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November 4, 2013

U.S. Army Engineer District, Nashville
ATTN: CELRN-EC-E (Ms. Paula Coleman)
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Subject: ***Submittal of the Final Remedial Investigation Report for The Red Water Pond Areas Former Plum Brook Ordnance Works, Sandusky, Ohio Contract No. W912P5-12-D-0001: Shaw Project Number 146394***

Dear Ms. Coleman:

In accordance with the requirements of Task Order No. DO-02 of Contract No. W912P5-12-D-0001 to Shaw Environmental & Infrastructure, Inc., a CB&I company, we are pleased to submit the final Remedial Investigation Report for the Red Water Pond Areas at the Former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio. This report represents the full compilation and summary for the Remedial Investigation for the Red Water Pond Areas (DERP-FUDS Project No. G05OH001820). This report was prepared consistent with the following: the focused remedial investigation report, risk assessment and direct push investigation, and the baseline ecological risk assessment that were prepared and finalized for the Red Water Pond Areas; the agreements among the PBOW project delivery team members; and communications with the U.S. Army Corps of Engineers regarding the scope of this report. This final document incorporates all responses to comment.

Enclosed for your records are four copies of this report and a complete electronic copy is attached to each hard copy on compact disk (CD). Copies have also been sent to those on the distribution list as indicated for their records.

Should you have any questions or require additional information regarding this submittal, please do not hesitate to contact me at (865) 694-7496.

Sincerely,

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Final

Red Water Pond Areas
Remedial Investigation Report

Former Plum Brook Ordnance Works
Sandusky, Ohio

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November 2013

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List of Acronyms

4-ADNT	4-amino-2,6-dinitrotoluene
amsl	above mean sea level
BERA	baseline ecological risk assessment
bgs	below ground surface
BHHRA	baseline human health risk assessment
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSEM	conceptual site exposure model
D&M	Dames & Moore, Inc.
DERP	Defense Environmental Restoration Program
DNB	dinitrobenzene
DNT	dinitrotoluene
DQO	data quality objective
EHI	ecological hazard index
EPA	U.S. Environmental Protection Agency
FS	feasibility study
FRI	focused remedial investigation
FUDS	Formerly Used Defense Sites
HI	hazard index
HQ	hazard quotient
ICI	International Consultants Incorporated
ILCR	incremental lifetime cancer risk
IT	IT Corporation
LRD	Great Lakes and Rivers Division
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MK	Morrison Knudsen Corporation
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	no-observed-adverse-effects level
NWI	National Wetland Inventory
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon

List of Acronyms *(Continued)*

PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl
PRRWP	Pentolite Road Red Water Pond
QAPP	quality assurance project plan
RADPI	risk assessment and direct-push investigation
RI	remedial investigation
RWP	Red Water Pond
Shaw	Shaw Environmental & Infrastructure, Inc.
SLERA	screening-level ecological risk assessment
SVOC	semivolatile organic compound
TAL	target analyte list
TNB	trinitrobenzene
TNT	trinitrotoluene
TNTA	TNT Area A
TNTB	TNT Area B
TNTC	TNT Area C
TOC	total organic carbon
TRV	toxicity reference value
USACE	U.S. Corps of Engineers
VOC	volatile organic compound
WARWP	West Area Red Water Pond

Executive Summary

A remedial investigation (RI) was conducted for the Red Water Pond Areas which include the Pentolite Road Red Water Pond Area (PRRWP) Area and West Area Red Water Pond (WARWP) Area. Results of the RI have been previously reported in the following three documents:

- Dames & Moore, Inc., 1997, ***Red Water Ponds Focused Remedial Investigation, Final Report***, Plum Brook Ordnance Works, Sandusky, Ohio, April.
- IT Corporation, 2000, ***Risk Assessment and Direct-Push Investigation of Red Water Pond Areas,*** Final, Former Plum Brook Ordnance Works, Sandusky, Ohio, August.
- IT Corporation, 2001, ***Red Water Pond Areas Baseline Ecological Risk Assessment, Final, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** November.

This RI report summarizes the findings of these three reports, which are appended, and presents recommendations based on their findings. No additional investigation results, evaluation, or information is presented in this RI, and the recommendations developed herein are based on the information previously presented in the finalized documents. The purposes of this RI report are to 1) place all RI-related reports under a single cover, and 2) document recommendations as to whether conditions for each site warrants the performance of a feasibility study (FS). This RI includes all environmental media except groundwater, which is addressed under a separate Formerly Used Defense Sites project.

Recommendations. Based on the RI results, including the baseline human health risk assessment and the screening-level ecological risk assessment, the U.S. Army Corps of Engineers recommends that an FS be performed for contamination associated with PRRWP Area soil. This recommendation is based on human health risks associated with soils that exceed the Plum Brook Ordnance Works cancer risk and noncancer hazard goals. An FS is not required with respect to other PRRWP Area media or the WARWP Area media addressed in this RI.

1.0 Introduction

The U.S. Army is conducting studies of environmental impacts attributable to releases associated with historical operations of a property previously owned by the U.S. Government and operated for the Department of Defense, the former Plum Brook Ordnance Works (PBOW) in Sandusky, Erie County, Ohio. PBOW is an Army Defense Environmental Restoration Program (DERP) project under the Great Lakes and Rivers Division (LRD) Formerly Used Defense Sites (FUDS) program. The Louisville District office of the U.S. Corps of Engineers (USACE) is the program management district for the LRD FUDS program. Management support for PBOW is provided by the USACE Huntington District office and technical oversight is provided by the USACE Nashville District office.

This remedial investigation (RI) has been performed to determine if there have been any environmental impacts associated with the two Red Water Pond (RWP) Areas that present an unacceptable risk to human health or the environment. The two RWP Areas are the Pentolite Road Red Water Pond (PRRWP) Area and the West Area Red Water Pond (WARWP) Area, which together comprise DERP-FUDS Project No. G05OH001820.

The RWP Areas RI report was prepared under Delivery Order No. DO-02 of Contract No. W912P5-12-D-0001 to Shaw Environmental & Infrastructure, Inc. (a CB&I company). This RI report addresses all environmental media (i.e., surface soil, subsurface soil, surface water, and sediment) associated with the two RWP Areas except groundwater, which is addressed under a separate FUDS project and a separate RI (Shaw, 2012). The RWP Areas RI report summarizes the pertinent information presented previously in the following reports:

- Dames & Moore, Inc. (D&M) 1997a, ***Red Water Ponds Focused Remedial Investigation, Final Report***, Plum Brook Ordnance Works, Sandusky, Ohio, April.
- IT Corporation (IT), 2000, ***Risk Assessment and Direct-Push Investigation of Red Water Pond Areas,*** Final, Former Plum Brook Ordnance Works, Sandusky, Ohio, August.
- IT Corporation (IT), 2001, ***Red Water Pond Areas Baseline Ecological Risk Assessment, Final, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** November.

It should be noted that this RI report generally presents and summarizes information directly as it was conveyed in these final approved reports. No new data are presented in this RI report.

1.1 Report Organization

As part of the RI effort, both RWP Areas were previously investigated and evaluated in the three separate reports listed in Section 1.0. The focused remedial investigation (FRI) report (D&M, 1997a) presents an initial RI investigation effort. The risk assessment and direct-push investigation (RADPI) (IT, 2000) presents the baseline human health risk assessment (BHHRA) and screening-level ecological risk assessment (SLERA). The third document is the baseline ecological risk assessment (BERA) (IT, 2001), which is a refinement of the SLERA. This RI report summarizes these three reports and presents recommendations based on their findings. Each of these reports is appended to this report in its entirety (Appendices A through C) in electronic format on compact disk.

The remainder of this chapter provides a description and history of the PBOW facility and PRRWP and WARWP Areas. The description of the RWPs discusses their relationship to the three 2,4,6-trinitrotoluene (TNT) manufacturing areas and their use at PBOW. It also describes the history and current conditions associated with each of the former disposal areas. More specific information on the PRRWP and WARWP Areas is included in Appendices A through C. Chapter 2.0 of this report summarizes the physical setting of PBOW and specifically addresses the two sites currently being evaluated. This discussion of physical setting includes the geography, topography, geology, hydrogeology, and surface water drainage.

Chapters 3.0 and 4.0 summarize the investigation reports, BHHRA, and ecological risk assessment results and conclusions for the PRRWP and WARWP Areas, respectively. Chapter 5.0 presents site-specific recommendations for site management decisions. These recommendations primarily discuss whether or not a remedial action is warranted. These recommendations do not identify a specific technological approach, but are provided to help site managers form a basis for determining whether a feasibility study (FS) is required or if proceeding to a no-action proposed plan is the appropriate course for a given site. References used in the RI are provided in Chapter 6.0.

1.2 Facility Location and Description

The former 9,000-acre PBOW facility was used for the manufacture of nitroaromatics during World War II. The National Aeronautics and Space Administration (NASA) operates and maintains the site as the Plum Brook Station, which is a satellite facility of the John H. Glenn Research Center, located at Lewis Field in Cleveland, Ohio. The site is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland. Although primarily in Perkins and Oxford Townships, the eastern edge of the site extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by Patten Tract Road, and on the east by U.S. Highway 250. The areas surrounding Plum Brook Station are mostly agricultural

and residential. Public access is restricted at PBOW, except during the annual deer hunting season. Figure 1-1 shows the geographical location of the former PBOW site. Figure 1-2 shows the locations of the two RWP Areas.

1.3 Facility History and Background

The PBOW facility was constructed on property comprising 9,009 acres in early 1941 as a manufacturing plant for TNT, 2,4-dinitrotoluene (DNT), and pentolite (International Consultants Incorporated [ICI], 1995). Production of explosives at PBOW began in December 1941 and continued until 1945. It is estimated that more than 1 billion pounds of nitroaromatic explosives were manufactured at PBOW during the 4-year operating period. The three explosive manufacturing areas were designated TNT Area A (TNTA), TNT Area B (TNTB), and TNT Area C (TNTC). Twelve process lines were used in the manufacture of 2,4,6-TNT: four lines at TNTA, three lines at TNTB, and five lines at TNTC.

After plant operations ceased in 1945, the Army conducted decontamination and decommissioning of many structures used in the manufacturing of TNT. Decontamination of the TNT manufacturing lines was continued by the Army through the end of 1945 (D&M, 1997b). After the property was certified as decontaminated, 3,230 acres of the property were initially transferred to the Ordnance Department, then to the War Assets Administration on September 6, 1946. In 1949, PBOW was transferred to the General Services Administration. This transfer did not include the 2,800-acre Plum Brook Depot area, also known as the Magazine Area. The Department of the Army reacquired the 3,230 acres in 1954. In 1955, the Army performed further decontamination of the manufacturing process lines. This effort included removal of contaminated surface and subsurface soil around the building and wooden and ceramic waste disposal lines containing TNT. Thousands of pounds of TNT were discovered in catch basins; this TNT was removed and burned at the burning grounds. The Army continued cleanup efforts until 1963.

Two property use agreements were entered into by the Army and the National Advisory Committee of Aeronautics, the predecessor of NASA, in 1956 and 1958, respectively. Accountability and custody for the entire portion of the former PBOW property (6,030 acres) that had been under the accountability and custody of the Department of the Army were transferred to NASA on March 15, 1963. NASA performed further decontamination efforts during 1964 (D&M, 1997b).

NASA has operated and maintained the former PBOW property as Plum Brook Station since 1963. Most of the aerospace testing and support facilities built in the 1960s and 1970s at PBOW

are currently inactive, are being demolished, or have been demolished. However, NASA has constructed newer research facilities on site since the 1970s. On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. This excess included approximately 1,500 acres outside of the PBOW fence line that were not formerly used by the Army except possibly as buffer, and therefore required no decontamination. The Perkins Township Board of Education acquired 46 acres of the excess acreage and uses this area as a bus transportation area. The General Services Administration has a use agreement with the Ohio National Guard for 604 acres of excessed property within the former PBOW fence. Additional PBOW property history is provided in the site management plan (ICI, 1995).

1.4 Red Water Ponds Description and History

The RWPs were present at PBOW and received waste water from former TNT manufacturing operations. The waste water that was transferred and received from TNT manufacturing areas consisted of spent sulfuric and nitric acids and red water from the TNT purification process. Chemicals in the waste streams included sodium salts of sulfite, sulfate, nitrite, nitrate, sulfonates of unwanted TNT isomers, trinitrobenzoic acid, trinitrobenzaldehyde, trinitrobenzyl alcohol, nitrotoluenes, and DNTs (D&M, 1997b).

The locations of the PRRWP and WARWP Areas are shown on Figure 1-2. Both RWP Areas are within the former PBOW property that is currently controlled by NASA. These areas are briefly described in the following paragraphs. More complete descriptions of the individual areas are included in Appendices A and B.

The PRRWP Area is located in the north-central portion of PBOW, approximately 1,000 feet north of Maintenance Road and approximately 300 feet south of Pentolite Road (Figure 1-2). The unlined pond in this area received waste process water from Waste Water Treatment Plant No. 1 from 1942 until 1945 via an elevated discharge pipe. This waste originated from the manufacture of TNT at TNTA and TNTB. The pond, which was apparently man-made, covered approximately 2 acres during plant operations. Construction details indicate that the PRRWP basin measured 200 feet in width, 400 feet in length, and 3 feet in depth, and was surrounded by a 1-foot-high levee (D&M, 1997a). Although the pond itself was approximately 2 acres in area, the study area of the PRRWP Area investigation is approximately 22 acres.

In 1977, retention dikes and sump pits were installed at the PRRWP Area in response to the observation of reddish-brown water in an adjacent surface ditch. In April and May 1977, approximately 60,000 gallons of the reddish-brown water were removed. The original basin was then backfilled and regraded so that the original pond area would be higher in elevation than the

surrounding area; this was done to prevent ponding in the area of the original PRRWP footprint (D&M, 1997a).

The WARWP Area is located in the far western part of the former PBOW facility, approximately 500 feet north-northwest of TNTC (Figure 1-2). The two unlined ponds in this area received TNTC process waste water from Waste Water Treatment Plant No. 2 from 1942 until 1945 via an elevated discharge pipe. The WARWP Area consisted of an “east pond” and a “west pond,” which were apparently man-made. Together, these ponds covered approximately 7 acres. The east pond contained water from the 1940s until the late 1970s, when the berm along its southeast perimeter was breached by NASA to drain the eastern pond. At present, the east pond is typically dry, with the exception of localized water near the location of the former berm. The west pond has existed since the 1940s. NASA disposed of some lime sludge in this pond in an attempt to fill it. This practice was discontinued in 1973 (Science Applications International Corporation, 1991).

The west pond, together with residual water in the east pond (near the former berm), currently comprises approximately 3.5 acres. The study area of the WARWP Area investigation is approximately 23 acres.

2.0 Physical Setting

2.1 Physiography and Topography

PBOW is located within the Eastern Lake section of the Central Lowland Province near the southwestern shore of Lake Erie. The region is characterized by lake plains, outwash plains, and till plains with occasional small hills produced during the retreat of the Wisconsin glaciation. The area of PBOW was originally a flat lake bottom that resulted from glacial melt waters. Across PBOW, the topography is relatively flat with a gentle north-northeast slope towards Lake Erie.

The land surface at the PRRWP Area is flat with soil hummocks and seasonally ponded areas. Elevations at the PRRWP Area range from 636 feet above mean sea level (amsl) on a mound in the western part of the site to a low elevation of 630 feet amsl near both the south-to-north-running tributary located on the eastern side and near the west-to-east-running tributary located on the northern side. Surface drainage is toward both these northern and eastern tributaries. There are no man-made features at the PRRWP Area other than remnants of the former dike.

The land surface at the WARWP is generally flat, with limited drainage eastward toward Pipe Creek. Elevations at the PRRWP Area range from 645 feet amsl in the northern part of the site to 625 feet amsl on near Pipe Creek. Aside from the dikes that surround the west pond, there are no man-made structures at the WARWP Area.

2.2 Geology

Dominant soil materials of Erie County are derived from glacial till, outwash (gravel and sand), and lacustrine (very fine sand, silt, and clay) deposits. Some soil types have been formed from more recent deposits of alluvium and weathering of parent rock. Within PBOW, the soil origins are listed as lacustrine. The glacial drift is less than 20 feet thick on average, with bedrock exposed in many places.

The bedrock formations in northern Ohio consist of Devonian and Silurian carbonates (limestone and dolomite) and clastics (shale, siltstone, and sandstone). At PBOW, four Devonian formations subcrop beneath glacial drift cover (Shaw, 2003). From oldest to youngest, these formations are Delaware Limestone, Plum Brook Shale, Prout Limestone, and the Huron Shale member of the Ohio Shale. Further details of PBOW-specific geology are presented in the FRI report (Appendix A). Site-specific geology is summarized in Section 3.2.2.2 for the PRRWP Area and Section 4.2.2.2 for the WARWP Area.

2.3 Hydrogeology

Groundwater is not addressed in this RI because groundwater underlying the RWP Areas is a separate FUDS project and was addressed as part of a separate RI (Shaw, 2012). However, this brief summary of PBOW hydrogeology is included to put other environmental media in context of the physical setting, which includes hydrogeology.

Groundwater at PBOW includes the shallow overburden/shale and the limestone bedrock aquifers. PBOW is located within a transition between the two aquifers; the shale is absent to the northwest. Both aquifers are overlain by a veneer of glacial drift, generally less than 20 feet thick, that is considered a poor source of groundwater. Flow in the overburden/shale is toward the local surface drainages, with a generally northerly trend. Groundwater flow in the Delaware Limestone is generally toward the north but is influenced by major fracture zones (Shaw, 2003).

Limestone bedrock groundwater quality in the vicinity of PBOW is generally poor because of naturally occurring petroleum hydrocarbons and hydrogen sulfide. Also, several PBOW limestone bedrock wells have been found to produce little or no groundwater. Yield from the overburden/shale groundwater unit is generally low and seasonally dependent throughout the vicinity of PBOW.

2.4 Surface Water

PBOW lies in the eastern region of the Pickeral Creek–Pipe Creek Basin, which in turn, lies within the St. Lawrence River drainage basin. The Huron River Basin lies approximately 3.5 miles east of PBOW. Sandusky Bay and Lake Erie are approximately 4.5 miles north of the site.

Eleven streams pass through or originate within PBOW and are a part of four drainage areas: 1) Sawmill Creek (southern PBOW); 2) Plum Brook (central (PBOW); 3) Pipe Creek (western PBOW); and 4) Storrs-Hemminger Ditch. All streams flow north or northeasterly into Sandusky Bay. Numerous ponds lie within and around PBOW.

The Erie County Health Department does not permit the use of surface water for private drinking water supply, and no surface water within PBOW is used as a drinking water supply.

PRRWP Area. The PRRWP Area is located in a flat, low-lying, marshy area. What little surface water drainage takes place occurs toward the north into the unnamed drainage ditch parallel to Pentolite Road and to the east into the unnamed adjacent drainage ditch which flows

north into the ditch parallel to Pentolite Road. The ditch parallel to Pentolite Road drains toward the east into Plum Brook.

WARWP Area. Surface water for the WARWP Area drains east into Pipe Creek.

3.0 Pentolite Road Red Water Pond Area

This chapter provides a summary of the sampling, analyses, results, and evaluation of the environmental media associated with PRRWP Area (i.e., soil, sediment, and surface water) that have been presented in the FRI (Appendix A), RADPI (Appendix B), and BERA (Appendix C). Section 3.1 briefly summarizes investigations prior to commencement of the RI. The PRRWP Area groundwater samples and analytical results for the pre-RI samples are also included in the Section 3.1 summary to provide an historical context of the investigation process implemented at the PRRWP Area. The site characterization presented in the FRI and the RADPI is summarized in Section 3.2. The BHHRA, presented in the RADPI, is summarized in Section 3.3. The PRRWP Area ecological risk assessment is summarized in Section 3.4, based on the SLERA (presented in the RADPI) and the BERA. Although the FRI and RADPI also include the investigation and evaluation of PRRWP Area groundwater, this information is not presented in the text of this RI because, as stated in Section 1.0, groundwater underlying the RWP Areas is addressed as a separate FUDS project in a separate RI report (Shaw, 2012).

3.1 Previous Investigations and Evaluations

In 1989, an evaluation was performed to determine whether residual chemical contamination was present. Soil borings IT-SB13 through IT-SB18 were drilled and six soil samples collected: four from depths of 0 to 2 feet and two from 4 to 6 feet below ground surface (bgs). An overburden monitoring well, IT-MW05, was installed on the northern edge of the PRRWP footprint in the suspected downgradient direction. Two geotechnical soil samples were collected from the monitoring well boring. Two surface water samples were collected: one from standing water within the former pond area and one from the downgradient drainage ditch. A groundwater sample was collected from the monitoring well following well development. Soil, surface water, and one groundwater sample were analyzed for nitroaromatics, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), unfiltered metals, total sulfates, pH, and nitrates. The nitroaromatics 2,4-DNT and 2,6-DNT were detected in the soil at concentrations of at least 0.740 milligrams per liter (mg/L) and sodium concentrations in samples from six of the borings exhibited concentrations significantly above measured background levels. Iron and manganese were detected in groundwater at concentrations above the secondary maximum contaminant levels. No analytes were detected at concentrations that exceed the associated maximum contaminant levels. Surface water did not show detectable concentrations of contamination (IT, 1991).

A site inspection was conducted from June through July 1993 to assess the threat posed to human health and the environment and to determine the need for any additional investigation (Morrison Knudsen Corporation [MK], 1994). MK collected and analyzed surface water and sediment samples from a drainage ditch along Pentolite Road north of the PRRWP Area. Samples were analyzed for VOCs, SVOCs, and nitroaromatic compounds. No samples from the Pentolite Road ditch showed detectable levels of contaminants (MK, 1994).

3.2 PRRWP Area Remedial Investigation Characterization and Evaluation

This section summarizes the RI sampling of environmental media at PRRWP Area, the analytical results, and an evaluation of these results as presented in the RWP FRI (D&M, 1997a) (Appendix A) and the RADPI (IT, 2000) (Appendix B).

3.2.1 PRRWP Area Samples and Analyses

3.2.1.1 Red Water Ponds FRI

From October to December of 1994, sampling was performed to delineate the horizontal and vertical extent of contamination at the PRRWP Area and to obtain preliminary soil and groundwater information for future use (D&M, 1997a). Soil sampling locations are shown on Figure 3-1.

Soil sampling locations in and around the former ponds were identified by a grid system established over a 1956 historical aerial photograph exhibiting the extent of the former ponds (Figure 3-1 includes the estimated 1956 extent of the ponds). A total of 20 borings were drilled at grid nodes; 12 drilled inside the pond perimeter and 8 drilled outside. The 20 borings included four 2-foot borings (soil samples collected 0 to 2 feet bgs), six 5-foot borings (soil samples typically collected 0 to 2 and 2 to 5 feet bgs), and fourteen 10-foot borings (soil samples typically collected 0 to 3, 3 to 5, and 5 to 10 feet bgs). In addition, one surface soil sample (0 to 0.5 foot bgs) and two subsurface soil samples were collected from the 10-foot borings in conjunction with two surface soil samples (0 to 0.5 foot bgs) from two 5-foot borings. In total, 63 soil samples were collected from the PRRWP Area (D&M, 1997a). The following list summarizes the samples and analyses collected for the FRI:

- ***Surface Soil*** – A total of 30 samples (0 to 0.5 foot bgs and between depths of 0 to 3 feet bgs), including 1 quality control sample, were analyzed for nitroaromatics and target analyte list (TAL) metals.

- ***Subsurface Soil*** – A total of 39 samples (2 to 5, 3 to 5, and 5 to 10 feet bgs), including 5 quality control samples, were analyzed for nitroaromatics and TAL metals.

All analytical data from these samples were reviewed for accuracy and completeness. All data analyzed were subjected to the data quality assessment following the guidelines in the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, 1993a), EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 1994a), and specific analytical method requirements. Data were evaluated against specific criteria to verify the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project data quality objectives (DQO). Additional information on data evaluation, data validation, and data quality are provided in the FRI (Appendix A).

3.2.1.2 Risk Assessment and Direct-Push Investigation

In June and November 1998, further investigation of the soil, groundwater, surface water, and sediment at the PRRWP Area was conducted to characterize potential contamination at the RWP Areas. This investigation is reported in the RADPI (IT, 2000). The analytical results from the RADPI and from the FRI (Section 3.2.1.1) were used to evaluate potential current and future risk/hazard to human health and ecological receptors from exposure to PRRWP Area environmental media including soil, sediment, and surface water (Sections 3.3 and 3.4). All samples were collected consistent with the site-specific work plan for the investigation (IT, 1998a) and the quality assurance project plan (QAPP) (IT, 1996). RADPI sampling locations at the PRRWP Area are shown on Figure 3-2.

Surface and subsurface soil samples were collected as part of the RADPI from 20 borings. In addition, five samples were collected for geotechnical purposes. Generally, surface soil is defined as samples collected from within the interval of 0 to 2 feet bgs, and subsurface soil is defined as samples collected from depths greater than 2 feet bgs per the work plan (IT, 1998a). Soil samples were collected using direct-push drilling and sampling procedures (IT, 2000).

As part of the RADPI, additional surface water and sediment samples would provide additional data needed in the risk assessments. Therefore, collocated surface water and sediment samples were collected from four surface water and sediment sample locations at the PRRWP Area; two within the east-west drainage ditch located adjacent to Pentolite Road and two from the ditch located on the east-southeast side of the PRRWP Area. Sample depths were 0 to 0.5 foot below the sediment. Figure 3-2 shows collocated sample collection locations (IT, 2000)

The following list summarizes the soil, sediment, and surface water samples and analyses collected for the RADPI:

- ***Surface Soil*** – A total of 20 samples were analyzed for VOCs, SVOCs, TAL metals, polychlorinated biphenyls (PCB), and nitroaromatics.
- ***Subsurface Soil*** – A total of 39 samples were collected from depths of 4 to 6 and 8 to 10 feet bgs and analyzed for VOCs, SVOCs, TAL metals, PCBs, and nitroaromatics. In addition, five samples were analyzed for geotechnical parameters including grain size, distribution, moisture content, and Atterberg limits.
- ***Sediment*** – Four samples were analyzed for VOCs, SVOCs, nitroaromatics, metals, PCBs, and total organic carbon (TOC).
- ***Surface Water*** – Four surface water samples were analyzed for VOCs, SVOCs, nitroaromatics, metals, PCBs, and hardness.

All analytical data from these samples were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the EPA document *Test Methods for Evaluating Solid Waste, Physical and Chemical Methods* (SW-846) (EPA, 1986), the QAPP (IT, 1996), and specific analytical method requirements. Data were evaluated against specific criteria to verify the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project DQOs. The criteria for blank evaluation were based on those detailed in Region 3 Modifications to National Functional Guidelines for Evaluating Organic Analyses (EPA, 1994b) and Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 1993b). Additional information on data evaluation, data validation, and data quality are provided in the RADPI (Appendix B).

3.2.2 PRRWP Area Characterization

3.2.2.1 Local Soils

Overburden thickness at PRRWP ranges from 19 to 27.5 feet and consists of brown sandy clay in the upper 7 to 12 feet of the overburden. Below this, the overburden predominantly consists of gray clay. The soil at PRRWP consists of Colwood loam, 0 to 1 percent slopes (CmA), Elnora loamy fine sand, 0 to 4 percent slopes (EnA), Oakville loamy fine sand, 0 to 6 percent slopes (OaB) and Udorthents loam, 0 to 6 percent slopes (UdB).

3.2.2.2 Local Geology

No bedrock wells were installed in the PRRWP Area. However, based on the regional geologic map for PBOW, the Olentangy Shale is interpreted to be present immediately below the overburden at PRRWP. It is estimated that the Olentangy Shale is approximately 10 feet thick at the PRRWP based on bedrock wells located southwest of the PRRWP. The Delaware Limestone is present below the Olentangy Shale.

3.2.2.3 Summary of Analytical Results

The analytical results of the RI samples, described in Section 3.2.1, are summarized in Section 3.2.2.3.1 for the FRI and in Section 3.2.2.3.2 for the RADPI. Analytical results from the RADPI were compared with risk-based screening concentrations as a point of comparison.

The evaluation of the analytical results of the samples and analyses (Section 3.2.1), as presented in the FRI and RADPI, are summarized in Sections 3.2.2.3.1 and 3.2.2.3.2 for each medium.

3.2.2.3.1 FRI – PRRWP Area

The summary of soil analytical results of samples from the FRI is provided below:

FRI Surface and Subsurface Soil Summary

- The sampling scheme was able to confirm the horizontal extent of nitroaromatic contamination as nitroaromatics were detected in only two areas outside the former pond footprint.
- Nitroaromatics were detected in the 0 to 0.5 foot bgs surface soil in four of the seven collected samples, and 2,4-DNT was detected in each of the four samples at concentrations ranging from 0.3 to 1.1 milligrams per kilogram (mg/kg).
- Nitroaromatics were detected in the 0 to 3 feet bgs surface soil in 5 of the 12 samples, and 1,3,5-trinitrobenzene (TNB), 2,4-DNT, and 1,3-dinitrobenzene (DNB) were detected in four of the borings.
- Eight nitroaromatics (2,4,6-TNT, 1,3,5-TNB, nitrobenzene, 2,4-DNT, 2,6-DNT, 3,4-DNT, 4-amino-2,6-dinitrotoluene [4-ADNT], and 1,3-DNT) were detected in the 3 to 5 feet bgs subsurface soil in 11 of the 12 borings.
- A high 2,4,6-TNT concentration of 12,000 mg/kg was detected in the 3 to 5 feet bgs sample (PR-S14), and 1,3,5-TNB was detected in nine out of the twelve samples.
- Nitroaromatics in the 5 to 10-feet bgs soil samples were detected in all 12 borings drilled within the former pond boundaries, with a total of nine compounds detected.

- Additional vertical delineation below 10 feet was suspected not to be warranted due to fluctuation in the water rising to 3 to 5 feet bgs and soil contamination typically limited to the unsaturated zone.

- All soil samples exceeding the risk-based screening levels were detected from depths below 3 feet.

3.2.2.3.2 RADPI – PRRWP Area

The summary of soil, surface water and sediment analytical results of the RADPI samples is provided below.

Surface and Subsurface Soil Summary. A total of 20 surface and 39 subsurface soil samples were collected from the PRRWP Area. The analytical results of these samples are summarized below.

- Nitroaromatics were detected in only 2 of the 20 surface soil samples and included 2,4-DNT in boring DP03 and 2,4-DNT, 2,4,6-TNT, and 4-ADNT in boring DP11.

- Nitroaromatics were detected in the subsurface soil samples (greater than 2 feet) and included 1,3,5-TNB (nine samples), 1,3-DNB (five samples), 2,4,6-TNT (one sample), 2,4-DNT (nine samples), and 2,6-DNT (five samples).

- A high 2,4-DNT concentration of 25 mg/kg was detected in the 4 to 5 feet bgs sample from boring DP03, and 1,3,5-TNB was detected at a concentration of 18 mg/kg in the 9 to 10 feet sample in boring DP10.

- Three VOCs (acetone, methylene chloride, and toluene) were detected in four soil samples. Acetone was detected in one subsurface sample (0.0082 mg/kg), methylene chloride was detected in one surface soil (0.0018 mg/kg) and one subsurface soil sample (0.0021 mg/kg), and toluene was detected in one subsurface soil sample (0.0017 mg/kg).

- Three SVOCs were detected in six samples and included 2,4-DNT (five samples), 2,6-DNT (three samples), and 3-NT (one sample).

- PCBs were not detected in any of the 20 samples.

- Twenty-one metals were detected in at least one soil sample.

- Cyanide was not detected in any of the surface or subsurface soil samples.

Surface Water Summary. Four surface water samples collocated with the sediment samples were collected at the PRRWP Area in November 1998. The findings are summarized below:

- Five VOCs were detected at low concentrations in the four surface water samples.
- Two SVOCs were detected in three of the four surface water samples.
- Nitroaromatic compounds were not detected in any of the surface water samples.
- PCBs were not detected in the surface water samples.
- Seven unfiltered metals and 12 filtered metals were detected in at least one of the four surface water samples.
- Results for hardness ranged from 284,000 to 488,000 micrograms per liter (µg/L) in the four samples.

Sediment Summary. Four sediment samples were collected at the PRRWP Area in November 1998: two within the east-west drainage ditch located adjacent to Pentolite Road and two from the ditch located on the east-southeast side. Analytical results for the sediment are as follows:

- Two VOCs (acetone and 2-butanone) were detected at low, estimated concentrations in two of the four sediment samples.
- Fifteen SVOCs were detected in SD-02 and/or SD-04, including acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.
- Nitroaromatic compounds were not detected in any of the sediment samples.
- PCBs were not detected in the sediment samples.
- Fourteen metals were detected in at least one of the four sediment samples.
- Results for TOC ranged from 5,450 to 33,000 mg/kg in the four samples.

3.3 Baseline Human Health Risk Assessment

This section provides a summary of the BHHRA for the PRRWP Area, which is included in the RADPI (IT, 2000) (Appendix B). It is important to note that this site-specific risk assessment, including the evaluation of hypothetical future land use, was performed to satisfy administrative requirements including those described by FUDS regulations (USACE, 2004). This chapter provides no data or other information that has not been previously presented in the FRI (Appendix A) or RADPI (Appendix B).

The BHHRA evaluates potential human health risks associated with exposure to soil, surface water, and sediment at the PRRWP Area in the former PBOW. Please note that groundwater analytical data were not evaluated for human health risks in the RADPI, as groundwater risks associated with the PRRWP Area was evaluated in a separate BHHRA (Shaw, 2006). Also, groundwater underlying the RWP areas is being administratively addressed as part of a separate DERP-FUDS project (Shaw, 2012).

The PRRWP Area and the WARWP Area were evaluated as separate sites. This summary identifies the chemicals of potential concern (COPC); summarizes the receptors, media, and exposure pathways evaluated; summarizes the risk characterization; and presents the BHHRA conclusions. The BHHRA was performed consistent with EPA guidance and the BHHRA work plan (IT, 1998b).

3.3.1 Identification of Chemicals of Potential Concern

A screening procedure was conducted on the FRI (D&M, 1997a) and RADPI (IT, 2000) analytical data from each PRRWP Area environmental medium. This screening process is used to identify COPCs, which are the detected chemical analytes carried through the full risk assessment process. The objectives of COPC screening are to focus the risk assessment on those chemicals that may contribute significantly to overall risk and to remove from quantification those chemicals whose contribution is clearly inconsequential. COPC screening includes a risk-based screen that also considers status as a human nutrient, a frequency-of-detection evaluation, and a background screen. The background screen for the PRRWP Area BHHRA separately identified COPCs that were associated with site-related conditions and those associated with background conditions (Appendix B).

The COPC screening process conducted during the BHHRA generated data summary tables for analytes detected in the respective environmental media. These summary tables, which identify the site-related COPCs, are included in this RI report as Tables 3-1 through 3-4 for surface soil, subsurface soil, surface water, and sediment, respectively. Additional details of this data summary are discussed in the BHHRA (Appendix B). The site-related COPCs for PRRWP Area environmental media are listed below.

- ***Surface Soil*** – 4-ADNT, 1,3-DNB, 2,4-DNT, 2,6-DNT, and 3,4-DNT.
- ***Subsurface Soil*** – 4-ADNT, 1,3-DNB, 2,4-DNT, 2,6-DNT, 3,4-DNT, and 2,4,6-TNT.

- ***Surface Water*** – None.
- ***Sediment*** – None.

3.3.2 Exposure Assessment

Exposure is the contact of a receptor with a chemical or physical agent. An exposure assessment estimates the type and magnitude of potential exposure of a receptor to COPCs found at or migrating from a site (EPA, 1989). The PRRWP Area BHHRA characterizes potential exposures to COPCs in site environmental media as portrayed by the conceptual site exposure model (CSEM).

The CSEM provides the basis for identifying and evaluating the potential risks to human health in the BHHRA. The CSEM, graphically depicted on Figure 3-3, includes the receptors appropriate to all plausible site-use scenarios and the potential exposure pathways. Although, as mentioned in Section 3.3, PRRWP Area groundwater is being addressed separately and was not evaluated in the PRRWP Area BHHRA, groundwater pathways were included on Figure 3-3 as potentially complete in the BHHRA. The receptors and pathways shown on Figure 3-3 reflect scenarios developed from information regarding site background and history, topography, climate, and demographics as presented in the TNT Areas site investigation report (D&M, 1997b) and the sitewide groundwater investigation (IT, 1997).

Exposure associated with the COPCs was evaluated for each of the receptors listed below. The media that were evaluated for each receptor are listed in parentheses. Total soil represents a mixture of surface and subsurface soil, assuming that the soil column may be disturbed in the future. Please note that the listed media include sediment and surface water, even though no site-related COPCs were detected in either medium.

- Current/future groundskeeper (surface soil)
- Future indoor worker (surface soil)
- Current/future construction worker (total soil, surface water, and sediment)
- Future resident (total soil, surface water, and sediment).

The resident was evaluated for noncancer hazards for the young child (ages 1 through 6 years), because the child is assumed to receive a greater exposure using the BHHRA protocol. Cancer risk results for the child and adult resident were evaluated separately but are combined in this report to present cancer risks associated with the 30-year residential child/adult exposure duration.

The equations for the calculations of intake values for each exposure pathway, exposure assumptions, and the calculation of exposure point concentrations of COPCs for modeled pathways (e.g., airborne concentrations) are presented in the BHHRA (Appendix B).

3.3.3 Risk Characterization

Risk characterization is the process of applying numerical methods and professional judgment to determine the potential for adverse human health effects to result from the presence of COPCs. Noncancer hazards and cancer risks are characterized separately, including COPCs that induce both types of effects. The equations and input values used to calculate cancer risks and noncancer hazards are included in Appendix B.

3.3.3.1 Cancer Risk

The risk from exposure to potential chemical carcinogens is estimated as the probability of an individual developing cancer over a lifetime and is called the incremental lifetime cancer risk (ILCR).

Total ILCRs in the range of 1E-6 to 1E-4 are regarded as acceptable; this range is referred to as the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) risk management range (EPA, 1990). Risks less than this range are regarded as negligible. A target cancer risk goal of 1E-5, the logarithmic midpoint of the NCP risk management range, was selected by the PBOW Project Delivery Team as a basis to consider remedial action. The 1E-5 ILCR level is also used by the Ohio Environmental Protection Agency (OEPA) as a policy goal (OEPA, 2009). Use of this 1E-5 goal represents a departure from the Army's practice of generally using a cancer risk exceeding a value of 1E-4 (the upper end of the NCP risk management range) to trigger remedial action considerations.

3.3.3.2 Noncancer Effects of Chemicals

The hazards associated with noncancer effects of chemicals are evaluated by comparing an exposure level or intake with a chemical-specific chronic reference dose as described in the BHHRA (Appendix B). A hazard quotient (HQ) of 1 indicates that the estimated intake equals the reference dose. If the HQ is greater than 1, there may be concern for potential adverse health effects. In the case of simultaneous exposure of a receptor to multiple chemicals, a hazard index (HI) is calculated as the sum of the HQs.

A total HI is calculated as the sum of all HI values, including all media and all COPCs, for a given receptor. Calculating a total HI as the sum of HQ values is based on the assumption that the potential for noncancer effects is additive. EPA (1989), however, acknowledges that the

assumption of additivity is probably appropriate only for chemicals that induce adverse effects by the same mechanism. Therefore, if the total HI for a receptor exceeds 1, individual HI values may be calculated for each target organ, as described in Appendix B.

3.3.3.3 Risk Characterization Results

Cancer and noncancer risk characterization results were evaluated in the BHHRA for each environmental medium and each receptor scenario using the methods summarized in Sections 3.3.1 and 3.3.2 and described in Appendix B. The cancer risks and noncancer hazards for each receptor potentially exposed to PRRWP Area environmental media are shown in Table 3-5.

The overall HI and ILCR values are summarized by receptor in the following bullets. Exceedances of the PBOW cancer risk goal (ILCR greater than 1E-5) are shown in bold type, and exceedances of the noncancer hazard criterion (HI greater than 1) or the NCP risk management range (1E-6 to 1E-4) are shown in bold italics:

- Current/future groundskeeper: ILCR = 6E-7; HI = 0.06
- Future indoor worker: ILCR = 3E-7; HI = 0.03
- Current/future construction worker: ILCR = 1E-5; ***HI = 104***
- Future resident***: ILCR = 9E-4; HI = 358***.

3.3.3.4 BHHRA Conclusions

The ILCR value for the future resident exceeds the NCP risk management range and the PBOW cancer risk goal. The ILCR values for the other three receptors are within or less than the NCP risk management range and do not exceed the PBOW cancer risk goal.

The HI values for the future resident and construction worker both exceed the target value of 1, indicating that adverse noncancer effects cannot be regarded as unlikely under these receptor exposure scenarios. The HI value for the groundskeeper and indoor worker are both less than the target HI of 1, indicating that adverse noncancer effects are unlikely for these receptors.

The ILCR exceedance (future resident) and HI exceedances (future resident and current/future construction worker) were associated with subsurface soil, and over 99 percent of both the ILCR and HI values for these receptors were associated with TNT in subsurface soil. If the contributions of TNT are excluded, the ILCR for the resident would be 8E-6, which is within the NCP risk management range and less than the PBOW target cancer risk goal. Likewise, excluding the contributions of TNT, the HI values for the resident and the construction worker would be less than or equal to the target HI level of 1.

A hot spot evaluation was performed as part of the BHHRA. A single sampling location, PR-S14, had much higher TNT concentrations than were found at any other PRRWP Area location; the PR-S14 sample at a depth interval of 3 to 5 feet bgs had a TNT concentration of 12,000 mg/kg and the PR-S14 sample collected from an interval of 5 to 10 feet bgs yielded a TNT concentration of 340 mg/kg. By contrast, the TNT concentrations of all other PRRWP Area RADPI and FRI samples were less than 1 mg/kg, which is less than even the highly conservative risk-based level used in the COPC screening process.

In summary, based on the BHHRA evaluation of the RADPI and FRI analytical results, TNT was clearly the main risk-driving COPC. Further, TNT was found at elevated concentrations in only one boring location. Risks and hazards associated with the other site-related COPCs did not collectively result in ILCR/HI values that would exceed the respective PBOW cancer risk goal or the target HI value.

3.4 PRRWP Area Ecological Risk Assessment

This section provides a summary of the ecological risk assessment which includes the SLERA (IT, 2000) and the BERA (IT, 2001), which are included as Appendices B and C, respectively. It is important to note that this ecological risk assessment was performed to satisfy administrative requirements, including those described by FUDS regulations (USACE, 2004). This section provides no data or other information that has not been previously presented in the SLERA and BERA.

The ecological risk assessment was performed to evaluate and provide an estimate of current and future ecological hazard associated with exposure to potential releases to soil, surface water, and sediment associated with the PRRWP Area. This summary provides an ecological site description, identifies chemicals of potential ecological concern (COPEC), identifies ecological receptors, characterizes exposure, characterizes ecological risks, and presents the conclusions of the ecological risk assessment. The results of the SLERA and BERA are integrated in this summary.

The ecological risk assessment was performed consistent with EPA guidance and with the RWP Areas ecological risk assessment work plan (IT, 1998b).

3.4.1 Ecological Site Description

This ecological site description includes a summary of site background and the area of concern, surface water resources, wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area

was based on a compilation of existing ecological information and site reconnaissance activities discussed in Section 3.4.1.2. Additional ecological site description is provided in Appendix B.

3.4.1.1 Site Background

PBOW is part of the Lake Plains region. Across PBOW, the land slopes gently to the north-northeast towards Lake Erie. The Lake Plains region itself is over 69 percent cropland, 2.7 percent pasture land, and 10.5 percent forest (Ohio Department of Natural Resources [ODNR], 1985). However, since the U.S. Army acquired the site in 1941 and removed the land from agricultural production, undeveloped portions of the former PBOW have become second-generation forest and open fields. This has resulted in PBOW becoming an island of forest and open fields within the greater context of primarily agricultural land in north-central Ohio.

The PRRWP Area ecological study area comprises approximately 22 acres. The ground surface is relatively flat, with minimal slope to the north. Ponded areas are present seasonally, dependent upon rainfall.

3.4.1.2 Site Reconnaissance

Ecologists performed site reconnaissance visits to the PRRWP Area in April 1998. This visit was used to compile lists of fauna and flora observed at the site. No federally or state-listed species were observed. A full species list is presented in Appendix B.

Prior to arrival at PBOW, site personnel obtained maps and other relevant site information and determined the locations of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visit to evaluate the site for more subtle clues of potential effects from contaminant release. Information obtained during the reconnaissance trip was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area.

3.4.1.3 Surface Water

An approximately 10-foot-deep, southwest-to-northeast ditch traverses the northern boundary of the study area (Figure 3-2). During reconnaissance, water in this ditch was approximately 3 feet wide, covered with algae, and only a few inches deep. The banks of this stream were steep, vegetated with grasses, and shaded by overhanging bushes, and exhibited little erosion. Crayfish

and water striders were observed, but no fish were present. Small areas within the study are seasonally ponded. It is estimated that the combined area of these ponds is less than 0.5 acre.

3.4.1.4 Wetlands

According to the National Wetland Inventory (NWI) maps for the area (U.S. Fish and Wildlife Service, 1997), the seasonally open water within the PRRWP Area is classified as a palustrine wetland with broad-leafed deciduous scrub-shrub and emergent wetland species present. It should be noted that the PRRWP Area was regraded in 1977 in an effort to remove standing water (D&M, 1997a); a more recent map may have resulted in a somewhat different NWI characterization. It should also be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes (such as PBOW), because minor depressions often contain isolated wetlands not easily identified through aerial photograph interpretation (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps).

3.4.1.5 Vegetative Communities

Vegetative communities at the site were classified during an April 1998 site reconnaissance trip. The most common vegetation communities were early old field, moderate forest, and palustrine scrub/shrub emergent wetlands; these wetlands are located primarily adjacent to the ditch (Figure 3-4). Possible vegetative stress was suggested by the presence of bare areas described in Appendix B.

3.4.1.6 Species Inventory

Based on information from ODNR (1995) and collected during the site reconnaissance, species lists were prepared for plants, mammals, birds, reptiles, amphibians, and fish. A total of 85 plant species were documented at the PRRWP Area during the April 1998 vegetation surveys. The following fauna were observed at the RWP Areas during the April 1998 reconnaissance: 4 mammal species (white-tailed deer, masked shrew, short-tailed shrew, and woodchuck), 13 bird species, 2 reptile species, and 4 amphibian species were observed. The SLERA does not document whether these animal species were observed at the PRRWP Area, at the WARWP Area, or both. No fish species were observed nor are expected to be present in the ponds because of the limited and seasonal nature of the surface water at the PRRWP Area, but fish were observed in the ditch.

3.4.2 Identification of Chemicals of Potential Ecological Concern

A screening process was performed on the analytical data from the FRI and RADPI to identify COPECs that may pose a threat to ecological receptors. These data include all soil samples collected to a depth of 6 feet, surface water samples, and sediment samples. Groundwater was

excluded because exposure to this PRRWP Area medium is considered to be an incomplete pathway for ecological receptors; also, note that RWP Area groundwater is being addressed administratively separately from other RWP Area media. Sample locations used in the SLERA are presented on Figures 3-1 and 3-2.

The COPEC selection process was performed to develop a subset of chemicals detected at the site that are not naturally occurring or are associated with non-site-related sources. This selection process and the screening values used for COPEC selection are described in the SLERA (Appendix B). The results of the COPEC screening as presented in the SLERA (Appendix B) are shown in Tables 3-6 through 3-9 for PRRWP Area surface soil, total soil, surface water, and sediment, respectively.

Chemicals identified as PRRWP Area COPECs were quantitatively evaluated in the SLERA predictive evaluation, which is summarized in Sections 3.4.3 through 3.4.6, where chemical-specific data were available.

3.4.3 Selection of Ecological Receptors

Ecological assessment receptors were selected in the SLERA to focus the exposure characterization on species, groups of species, or functional groups that are directly related to the following assessment endpoints: the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, and carnivorous birds.

As part of this receptor selection process, site biota were organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds.

Seven representative terrestrial receptor species that are expected or possible in the PRRWP Area were selected as indicator species for the potential effects of COPECs. These indicator species represent two classes of vertebrate wildlife (mammals and birds); include a range of both body size and food habits; and include herbivores, omnivores, and carnivores. The seven terrestrial species selected include the deer mouse (small omnivorous mammal), short-tailed shrew (small insectivorous mammal), Eastern cottontail rabbit (medium-sized terrestrial herbivorous mammal), marsh wren (small insectivorous bird), raccoon (medium-sized omnivorous mammal), white-tailed deer (large herbivorous mammal), and red-tailed hawk (large carnivorous bird).

Exposure to aquatic organisms is assumed to occur via direct exposure to contaminants in the water column and via prey exposed to contaminants in surface water and sediment. Potential uptake through the aquatic food chain is evaluated for the raccoon (also considered as a terrestrial receptor) and great blue heron (large avian aquatic piscivore).

A terrestrial food web is presented on Figure 3-5, and an aquatic food web is presented on Figure 3-6. Many of the species evaluated, particularly the deer mouse, cottontail rabbit, short-tailed shrew, and marsh wren, have limited home ranges that may make them particularly vulnerable to exposure from site contaminants. Further discussion of the selection of ecological receptors is provided in Appendix B.

3.4.4 Exposure Characterization

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Further discussion of exposure routes is provided in Appendix B.

Daily doses of COPECs for vertebrate receptors were calculated using standard exposure algorithms. These algorithms incorporate species-specific natural history parameters (e.g., feeding rates, water ingestion rates, and dietary composition) as well as site-specific area use factors. These algorithms are presented and described in the SLERA (Appendix B).

Exposure to soil, surface water, and sediment was evaluated for the pertinent representative terrestrial and aquatic assessment receptors, as described in Appendix B.

3.4.5 Risk Characterization

The risk characterization phase integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. Qualitative and semiquantitative approaches were used to estimate the likelihood of adverse effects occurring as a result of exposure of the selected site receptors to COPECs.

Food chain modeling was used to estimate exposure rates for the representative assessment receptors. These exposure rates were compared with toxicity reference values (TRV) to calculate ecological HQs (Wentsel et al., 1996). Only conservative TRVs based on a no-observed-adverse-effects level (NOAEL) were used in the food chain model. HQs are calculated by summing intake doses across all exposure pathways for each chemical for a given receptor and dividing by the TRV. HQs less than or equal to 1 represent no probable hazard. Although OEPA considers

all HQs above 1 to be potentially significant, the following uncertainties regarding ecological HQ interpretation are noted:

- HQs are not measures of risk.
- HQs are not population based.
- HQs are not linearly scaled.
- HQs are often produced that are unrealistically high and toxicologically impossible (e.g., estimated HQs greater than 1,000).
- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to HQ threshold exceedances.

The following interpretation of ecological HQ ranges from Wentsel et al. (1996) takes into consideration the uncertainties inherent in HQs and provides a basis for possible recommendations:

- HQs from 1 to less than 10 represent a low potential for environmental effects.
- HQs from 10 to less than 100 represent a significant potential that effects could result from greater exposure.
- HQs greater than 100 represent the highest potential for expected effects.

Therefore, it should be understood that HQs greater than 1 do not mean that adverse ecological effects are occurring at the site or may occur in the future.

The HQ values were summed together to provide a conservative estimate of the ecological hazard index (EHI), representing a measure of the potential for adverse ecological effects for all chemicals and exposure pathways for a given receptor.

Table 3-10 summarizes the NOAEL-based HIs for the seven terrestrial assessment receptors and Table 3-11 presents the NOAEL-based HIs for the two aquatic receptors evaluated for the PRRWP Area, as presented in Section 6.5.3 of Appendix B. Note that the raccoon includes exposure to both terrestrial and aquatic components.

Based on the PRRWP Area SLERA results, a BERA was conducted as a refinement. The BERA includes refined food-chain models for terrestrial and aquatic receptors that use site-specific bioconcentration factors and other site-specific information. The BERA also presents site-

specific aquatic and terrestrial toxicity test results and refines the SLERA food chain model by using more realistic (and, when possible, site-specific) exposure point concentrations, toxicity values, uptake factors, and toxicity values. The HI values from the BERA are summarized for the terrestrial receptors in Table 3-12. A predictive assessment for aquatic receptors was not performed in the BERA because all of the surface water and sediment COPECs were identified as not showing toxic effects and/or the concentrations of COPECs were determined to be background related.

3.4.6 Ecological Risk Assessment Conclusions

SLERA Conclusions. Each of the PRRWP Area terrestrial receptors had an HI less than 10 in the SLERA, indicating low potential for adverse ecological effects, except for the shrew (HI of 15) and marsh wren (HI of 451). The wren HI was attributed almost entirely to 4-ADNT (HQ of 448) in soil associated with the ingestion of invertebrates. The shrew HI was attributed mostly to 1,3-DNB (HQ of 4) and antimony (HQ of 6) in soil.

Both of the PRRWP Area aquatic receptors had HI values greater than 10. The great blue heron HI of 126 is mostly associated with iron in surface water (HQ of 101). The raccoon HI of 38 is mostly associated with carbazole in sediment via the ingestion of invertebrates (HQ of 12) and aluminum in surface water (HQ of 15) via fish ingestion.

It was concluded from the SLERA (Appendix B) that the performance of a BERA was appropriate for the PRRWP Area (Appendix C).

BERA Conclusions. All of the BERA HI values for terrestrial receptors, assuming reasonable maximum exposure, are less than 10 for the PRRWP Area. All of the central tendency exposure HI values are less than 1. These results indicate a low to negligible potential for adverse ecological effects with respect to terrestrial receptors.

As stated in Section 3.4.5, all of the surface water and sediment COPECs were identified as not showing toxic effects and/or the concentrations of COPECs were determined to be background related. For this reason, a refined predictive assessment was not necessary for PRRWP Area aquatic receptors. The potential for adverse ecological effects resulting from site-related chemicals is thus regarded as negligible.

3.5 PRRWP Area Recommendations

Soil remediation is recommended based on the RI efforts. Specifically, remedial action is recommended based on the results of the BHHRA to address a potential hot spot in the vicinity of sample PR-S14, where TNT was detected in subsurface soil at a concentration of 12,000 mg/kg at a depth interval of 3 to 5 feet bgs. TNT was also found at an elevated concentration (340 mg/kg) in the sample collected at this location in the 5 to 10 feet bgs depth interval. Inclusion of this hot spot area resulted in unacceptable cancer risks and/or noncancer hazards for the future resident and construction worker receptors at the PRRWP Area.

Because the results of the ecological risk assessment indicate a low to negligible potential for adverse ecological effects, no additional remedial action is recommended to address ecological or environmental concerns.

4.0 West Area Red Water Pond Area

This chapter provides a summary of the sampling, analyses, results, and evaluation of the environmental media associated with WARWP Area (i.e., soil, surface water, and sediment) that have been presented in the FRI (Appendix A), RADPI (Appendix B), and BERA (Appendix C). Section 4.1 briefly summarizes investigations prior to commencement of the RI. The WARWP Area groundwater samples and analytical results from the pre-RI samples are also summarized to provide an historical context of the investigation process implemented at the WARWP Area. The site characterization presented in the RFI and the RADPI is summarized in Section 4.2. The BHHRA, presented in Section 4.4, based on the SLERA (presented in the RADPI) and the BERA. Although the RFI and RADPI also include the investigation and evaluation of WARWP Area groundwater, this information is not presented in the text of this RI because, as stated in Section 1.0, groundwater underlying the RWP Areas is addressed as a separate FUDS project in a separate RI report (Shaw, 2012).

4.1 WARWP Area Previous Investigations and Evaluations

In 1984, Battelle Laboratories collected a surface soil sample from the spoils area at the WARWP Area. Concentrations of nitroaromatics were detected in the low mg/L range using a now obsolete analytical method (ICI, 1995).

Prior to 1985, a number of studies were conducted on the surface water and sediment from the WARWP Area. In the western pond at the WARWP Area, 34 bottom sediment samples were collected in a grid pattern by Ohio National Guard environmental health personnel and screened for TNT and DNT derivatives. The highest values of TNT and DNT found in the sediment were less than 1 mg/kg (IT, 2000).

In 1989, an investigation was performed to confirm or rule out the presence of residual chemical contamination from PBOW operations. Surface soil samples were collected from 0 to 2 feet bgs from borings IT-SB07, IT-SB09, IT-SB10, IT-SB11, and IT-SB12, located at the WARWP Area. Soil samples were analyzed for nitroaromatics, VOCs, SVOCs, unfiltered metals, total sulphates, nitrates, and pH. No VOCs or SVOCs were detected. Four nitroaromatic compounds (1,3-DNB, 1,3,5-TNB, 2,4-DNT, and 2,4,6-TNT) were detected with the highest concentrations (greater than 600 micrograms per kilogram) detected at IT-SB12. Manganese was also detected at a concentration exceeding that of the background sample. Monitoring well IT-MW02 was installed downgradient from the WARWP Area and two geotechnical soil samples were collected from the boring. A groundwater sample was collected for analysis of nitroaromatic compounds,

VOCs, SVOCs, nitrates, sulfates, metals, and pH. Analytical results indicated concentrations of some VOCs and SVOCs were detected in the low (less than 20 μg/L) range. Nitroaromatics as SVOCs, (up to 160 μg/L), chromium (0.12 μg/L), manganese (3.0 μg/L), and sulfate (950 μg/L) were also detected in the groundwater (IT, 1991).

In 1991, a preliminary assessment was conducted to evaluate past waste management and hazardous material handling processes. Based on this assessment, it was determined that hazardous substances had been released to the environment at the WARWP Area (Science Applications International Corporation, 1991).

In 1993, a site inspection was conducted to assess the threat posed by the site on human health and the environment and to determine the need for additional investigations (MK, 1994). Sediment and surface water from Pipe Creek near the WARWP Area were analyzed for VOCs, SVOCs, and nitroaromatics. The surface water had no detectable contaminants, but the sediment had a few VOCs and SVOCs in the low-parts per billion range. No nitroaromatics were detected (ICI, 1995). Four monitoring wells (MK-MW09, MK-MW10, MK-MW11, and MK-MW12) were installed in the vicinity of the WARWP Area (MK, 1994). Groundwater was collected from the four new wells and existing well IT-MW02 for analyses of nitroaromatic compounds, VOCs, SVOCs, nitrates, sulfates, and metals. VOCs, SVOCs, and nitroaromatics were not detected in any groundwater samples (ICI, 1995).

4.2 WARWP Area Remedial Investigation Characterization and Evaluation

This section summarizes the RI sampling of environmental media at the WARWP Area, the analytical results, and an evaluation of these results as presented in the RWP FRI by D&M (D&M, 1997b) (Appendix A) and RADPI by IT (IT, 2000) (Appendix B).

4.2.1 WARWP Area Samples and Analyses

4.2.1.1 Red Water Ponds FRI

From October to December 1994, an investigation was conducted to evaluate groundwater occurrence and flow conditions in the overburden and bedrock water-bearing zones; delineate the horizontal and vertical extent of contamination caused by use of the WARWP Area during PBOW operations; assess groundwater quality in the overburden water-bearing zone by collecting preliminary soil, groundwater, surface water, and sediment samples; and investigate the baseline groundwater quality of the bedrock water-bearing zone to evaluate the necessity of additional work at PBOW (D&M, 1997a). Sampling locations are shown on Figures 4-1 though 4-3.

Soil sampling locations in and around the former ponds were selected based on reviews of historical information documenting the areal extent of the ponds from their creation to the present. In addition, sampling locations were placed on the bank of Pipe Creek where red water had previously been observed seeping and at former breach locations of the east and west ponds. Further, the sampling scheme was designed to obtain preliminary information which may be useful during later stages of the project. A total of 20 borings were drilled around the perimeter of the west and east ponds, within the east pond, and on the west bank of Pipe Creek (Figure 4-1). The 20 borings included 14 soil samples collected 0 to 2 or 0 to 3 feet bgs, 15 soil samples collected between approximately 2 and 5 feet bgs, and four collected at 5 to 10 feet bgs. In addition, seven surface soil samples were collected from a depth of 0 to 0.5-foot bgs. In total, 40 soil samples were collected from the WARWP Area (D&M, 1997a).

As part of the FRI, an evaluation of surface water and sediment in the remaining west pond was conducted. The investigation included water depth measurements, the performance of penetrometer testing, collection of sediment and natural soil cores, and collection of surface water samples (D&M, 1997a). Surface water and sediment sampling locations are shown on Figure 4-2.

The following list summarizes the samples and analyses collected for the FRI:

- ***Surface Soil*** – A total of 21 samples (seven 0 to 0.5 foot bgs and fourteen 0 to 2 or 0 to 3 feet bgs) were collected and analyzed for nitroaromatics and metals.

- ***Subsurface Soil*** – A total of 19 samples (fifteen 2 to 4, 2 to 5, or 3 to 5 feet bgs and four 5 to 10 feet bgs) were analyzed for nitroaromatics and metals.

- ***Surface Water*** – Five samples were collected, four from the west pond and one from the east pond, and analyzed for nitroaromatics (filtered and unfiltered), metals (filtered and unfiltered), and total suspended solids. Also, one sample was analyzed for biological activity.

- ***Sediment*** – Twelve sediment samples, two from each of six cores, were selected for laboratory chemical analyses of nitroaromatics and metals. In addition, two of the six cores were also analyzed for biological activity and one of the sediment samples was analyzed for sulfate, pH, TOC, alkalinity, nitrate, total Kjeldahl nitrogen, phosphorous, potassium, cation exchange capacity, and moisture content.

All analytical data from these samples were reviewed for accuracy and completeness. All data analyzed were subjected to the data quality assessment following the guidelines in the EPA

Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, 1993a) and the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Date Review (EPA, 1994a), and specific analytical method requirements. Data were evaluated against specific criteria to verify the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project DQOs. Additional information on data evaluation, data validation, and data quality are provided in the FRI (Appendix A).

4.2.1.2 Red Water Pond Areas RADPI

In June and November 1998, further investigation of the soil, groundwater, surface water, and sediment at the WARWP Area was conducted to characterize potential contamination at the RWP Areas: this investigation is reported in the RADPI (IT, 2000). The analytical results from the RADPI and from the FRI (Section 4.2.1.1) were used to evaluate potential current and future risk/hazard to human health and ecological receptors from exposure to WARWP Area environmental media including soil, sediment, and surface water (Sections 4.3 and 4.4). All samples were collected in accordance with the site-specific work plan for the investigation (IT, 1998a) and the QAPP (IT, 1996). Soil sampling locations at the WARWP Area are shown on Figure 4-1.

Surface and subsurface soil samples were collected as part of the RADPI from 19 borings. In addition, four samples were collected for geotechnical purposes. Generally, surface soil is defined as samples collected from within the interval of 0 to 2 feet bgs, and subsurface soil is defined as samples collected from depths greater than 2 feet bgs per the work plan (IT, 1998a). Soil samples were collected using direct-push drilling and sampling procedures (IT, 2000).

As part of the RADPI, surface water and sediment samples were collected to provide additional data needed for risk assessment. Therefore, IT collected collocated surface water and sediment samples from six surface water and sediment sample locations at the WARWP Area; four locations were within Pipe Creek and two were within the west pond on the northern side. Sample depths were 0 to 0.5 foot below the sediment. Figure 4-3 shows collocated sample collection locations (IT, 2000)

The following list summarizes the soil, surface water, and sediment samples and analyses collected for the RADPI:

- ***Surface Soil*** – Nineteen samples were analyzed for VOCs, SVOCs, TAL metals, PCBs, and nitroaromatics.

- ***Subsurface Soil*** – A total of 37 samples were collected from depths of 4 to 6 and 8 to 10 feet bgs and analyzed for VOCs, SVOCs, TAL metals, PCBs, and nitroaromatics. In addition, four samples were analyzed for geotechnical parameters including grain size, distribution, moisture content, and Atterberg limits.

- ***Surface Water*** – Six surface water samples were analyzed for VOCs, SVOCs, nitroaromatics, metals, PCBs, and hardness.

- ***Sediment*** – Six samples were analyzed for VOCs, SVOCs, nitroaromatics, metals, PCBs, and TOC.

All analytical data from these samples were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in EPA (1986), the QAPP (IT, 1996), and specific analytical method requirements. Data were evaluated against specific criteria to verify the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project DQOs. The criteria for blank evaluation were based on those detailed in Region 3 Modifications to National Functional Guidelines for Evaluating Organic Analyses (EPA, 1994b) and Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 1993b). Additional information on data evaluation, data validation, and data quality are provided in the RADPI report and information attached therein (Appendix B).

4.2.2 WARWP Area Characterization

4.2.2.1 Local Soils

Overburden thickness at WARWP ranges from 18.5 to 24.5 feet and consists of low-plasiticity clay and silty clay with frequent discontinuous zones of silty sand and clayey sand with occasional peat in the upper 10 feet of the overburden. The lower 10 to 12 feet of overburden predominantly consists of gray clay. The soil at WARWP is approximately 50 percent Orrville silt loam, 0 to 2 percent slopes (OrA); with the remaining area consisting of Kibbie fine sandy loam, 0 to 2 percent slopes (KbA); Udorthents loam, 0 to 6 percent slopes (UdB); and Zurich silt loam, 6 to 12 percent slope.

4.2.2.2 Local Geology

The Delaware Limestone is the bedrock immediately below the overburden at WARWP. Depth to the Delaware Limestone is approximately 24.5 feet. The thickness of the limestone at the WARWP site is unknown because the only bedrock well at the site extended no farther than 25 feet below the top of the formation.

4.2.2.3 Summary of Analytical Results

The analytical results of the RI samples, described in Section 4.2.1, are summarized in Section 4.2.2.3.1 for the FRI and in Section 4.2.2.3.2 for the RADPI. Analytical results from the RADPI were compared with risk-based screening concentrations as a point of comparison.

4.2.2.3.1 FRI – WARWP Area

The soil, surface water, and sediment analytical results of the FRI samples collected are listed below:

FRI Surface and Subsurface Soil Summary

- Five nitroaromatics (1,3,5-TNB, 2,4-DNT, 1,3-DNB, 2,4,6-TNT, and 4A-DNT) were detected in the 21 surface soil samples 0 to 0.5, 0 to 2, and 0 to 3 feet bgs and each detection was less than 1 mg/kg.

- Nitroaromatic detections in surface soil samples were from samples located between the east pond and Pipe Creek.

- Seven nitroaromatics (2,4,6-TNT, 1,3,5-TNB, 2,4-DNT, 2,6-DNT, 3,4-DNT, 4A-DNT, and 1,3-DNB) were detected in the subsurface samples 2 to 5, 3 to 5, and 2 to 4 feet bgs.

- Maximum concentrations of 1,3,5-TNB (5.5 mg/kg), 2,4-DNT (5.1 mg/kg), and 1,3-DNT (2.4 mg/kg) were all detected in boring WA-S10 in the 2 to 5 feet bgs sample.

- Nitroaromatics 1,3,5-TNB (1.1 mg/kg), 3,4-DNT (0.3 mg/kg), and 1,3-DNB (0.5 mg/kg) were detected in the subsurface 5 to 10 feet bgs sample interval in boring WA-S10, later converted to well WA-MW02.

- Seven nitroaromatics were detected at low concentrations in the subsurface 5 to 10 feet bgs sample interval from borings drilled within the RWPs.

FRI Surface Water Summary

- One surface water sample collected from the east pond contained a nitroaromatic (3-nitrotoluene) above the practical quantitation limit.

- Elevated levels of nitroaromatics were not detected in any of the four surface water samples from the west pond.

FRI Sediment Summary

- Five nitroaromatics were detected at low concentrations in six sediment samples from four different cores (cores located in the northern section of the west pond).
- The nitroaromatic 2,4-DNT was detected in all six samples that exhibited nitroaromatic detections.
- No nitroaromatics were detected in four samples from two cores.
- A total of seven metals were detected in the 12 core samples.

4.2.2.3.2 RADPI – WARWP Area

The summary of RADPI soil, surface water, and sediment analytical results are listed below:

Surface and Subsurface Soil Summary. Nineteen surface and 37 subsurface soil samples were collected within the WARWP area from 19 direct-push locations.

- No nitroaromatics were detected in surface soil samples.
- Four nitroaromatics (1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, and 2,6-DNT) were detected in up to six subsurface soil samples.
- Three VOCs (acetone, methylene chloride, and toluene) were detected at low level concentrations in 5 of the 18 surface (0 to 2 feet bgs) soil samples.
- Two VOCs (methylene chloride and toluene) were detected at low concentrations in 6 of the 37 subsurface (4 to 6 and 8 to 10-feet bgs) soil samples.
- Thirteen SVOCs were detected in two surface soil samples at low concentrations. The nitroaromatic 2,4-DNT, detected as a SVOC, was in soil from boring DP11, and 12 other SVOCs were detected in the surface soil from boring DP13.
- Twelve SVOCs were detected in two subsurface soil samples at low concentrations. Two compounds were detected in the 4 to 6 feet bgs soil sample from boring DP09 and 12 SVOCs were detected in the 4 to 6 feet bgs soil sample from boring DP20.
- No PCBs were detected in any of the surface (0 to 2 feet bgs) or subsurface (4 to 6 and 8 to 10 feet bgs) soil samples.
- Twenty-one metals were detected in at least one soil sample at the WARWP Area.
- Cyanide was not detected in any of the surface or subsurface soil samples.

Surface Water Summary. Six surface water samples collocated with the sediment samples were collected at the WARWP Area in November 1998. The analytical results are summarized below:

- One VOC was detected at low, estimated concentrations in five of the six surface water samples. No VOCs were detected in SW-02.
- One SVOC was detected in one of the six surface water samples. That sample was collected from the west pond.
- Nitroaromatic compounds were not detected in any of the WARWP Area surface water samples.
- PCBs were not detected in the surface water samples.
- Twelve unfiltered metals and 11 filtered metals were detected in at least one of the six surface water samples and, excluding the nutritionally essential elements, filtered metals were limited to aluminum, arsenic, chromium, lead, manganese, and zinc.
- Results for hardness ranged from 372,000 to 592,000 μg/L calcium carbonate in the six samples.

Sediment Summary. Six sediment samples were collected at the WARWP Area in November 1998: four within Pipe Creek (SD-01 through SD-04) and two from the west pond (SD-05 and SD-06). Each was collected from a depth of 0.0 to 0.5 foot bgs. Analytical results for the sediment are as follows:

- Two VOCs (acetone and 2-butanone) were detected at low, estimated concentrations in three of the six sediment samples.
- Seven SVOCs were detected in sediment sample SD-01 at estimated concentrations: benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene. Sediment sample SD-04 exhibited only fluoranthene.
- Nitroaromatic compounds were not detected in any of the WARWP Area sediment samples.
- PCBs were not detected in the sediment samples.
- Results for TOC ranged from 3,960 to 93,400 mg/kg in the six samples.

4.3 Baseline Human Health Risk Assessment

This section provides a summary of the BHHRA for the WARWP Area, which is contained in the RADPI (IT, 2000). The RADPI, including the BHHRA, is provided as Appendix B. It is important to note that this site-specific risk assessment, including the evaluation of hypothetical future land use, was performed to satisfy administrative requirements, including those described by FUDS regulations (USACE, 2004). This chapter provides no data or other information that has not been previously presented in the FRI or RADPI (Appendices A and B, respectively).

The BHHRA evaluates potential human health risks associated with exposure to soil, surface water, and sediment at the WARWP Area in the former PBOW. Please note that groundwater analytical data were not evaluated for human health risks in the RADPI, as groundwater risks associated with the WARWP Area were later evaluated in a separate BHHRA (Shaw, 2006). Also, groundwater underlying the RWP areas is being administratively addressed as part of a separate DERP-FUDS project (Shaw, 2012).

This summary identifies the COPCs; summarizes the receptors, media, and exposure pathways evaluated; summarizes the risk characterization; and presents the BHHRA conclusions for the WARWP Area. The BHHRA was performed consistent with EPA guidance and the BHHRA work plan (IT, 1998b).

4.3.1 Identification of Chemicals of Potential Concern

A screening procedure was conducted on the FRI (D&M, 1997a) and RADPI (IT, 2000) analytical data from each WARWP Area environmental medium. This screening process is used to identify COPCs, which are the detected chemical analytes carried through the full risk assessment process. The objectives of COPC screening are to focus the risk assessment on those chemicals that may contribute significantly to overall risk and to remove from quantification those chemicals whose contribution is clearly inconsequential. COPC screening includes a risk-based screen that also considers status as a human nutrient, a frequency-of-detection evaluation, and a background screen. The background screen for the PRRWP Area BHHRA separately identified COPCs that were associated with site-related conditions and those associated with background conditions (Appendix B).

The COPC screening process conducted during the BHHRA generated data summary tables for the respective environmental media which are included in this RI report as Tables 4-1 through 4-4 for surface soil, subsurface soil, surface water, and sediment, respectively. Additional details of this data summary are discussed in the BHHRA (Appendix B). The site-related COPCs for WARWP Area environmental media are listed below.

- ***Surface Soil*** – Chromium, 2,4-DNT, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene.

- ***Subsurface Soil*** –2-Amino-4,6-dinitrotoluene, 4-ADNT, 1,3-DNB, 2,4-DNT, 2,6-DNT, 3,4-DNT, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene.

- ***Surface Water*** – Arsenic, lead, manganese, 2,4-DNT, 2,6-DNT, and 3,4-DNT.

- ***Sediment*** – Arsenic.

4.3.2 Exposure Assessment

Exposure is the contact of a receptor with a chemical or physical agent. An exposure assessment estimates the type and magnitude of potential exposure of a receptor to COPCs found at or migrating from a site (EPA, 1989). The BHHRA characterizes potential exposures to COPCs in WARWP Area environmental media as portrayed by the CSEM.

The CSEM provides the basis for identifying and evaluating the potential risks to human health in the BHHRA. The CSEM, graphically depicted on Figure 3-3, includes the receptors appropriate to all plausible site-use scenarios and the potential exposure pathways. Although as mentioned in Section 4.3, WARWP Area groundwater is being addressed separately and was not evaluated in the WARWP Area BHHRA, groundwater pathways were included on Figure 3-3 as potentially complete in the BHHRA. The receptors and pathways on Figure 3-3 reflect scenarios developed from information regarding site background and history, topography, climate, and demographics as presented in the TNT Areas site investigation report (D&M, 1997b) and the sitewide groundwater investigation (IT, 1997).

Exposure associated with the COPCs was evaluated for each of the receptors listed below. The media evaluated for each receptor are listed in parentheses. Total soil represents a mixture of surface and subsurface soil, assuming that the soil column may be disturbed in the future. Please note that the listed media include sediment and surface water, even though no site-related COPCs were detected in either of these.

- Current/future groundskeeper (surface soil)
- Future indoor worker (surface soil)
- Construction worker (total soil, surface water, sediment)
- Future resident (total soil, surface water, sediment).

The resident was evaluated for noncancer hazards for the young child (ages 1 through 6 years) because the child is assumed to receive a greater exposure using the BHHRA protocol. Cancer risk results for the child and adult resident were evaluated separately but are combined in this report to present cancer risks associated with the 30-year residential child/adult exposure duration.

The equations for the calculations of intake values for each exposure pathway, exposure assumptions, and the calculation of exposure point concentrations of COPCs for modeled pathways (e.g., airborne concentrations) are presented in the BHHRA (Appendix B).

4.3.3 Risk Characterization

Risk characterization is the process of applying numerical methods and professional judgment to determine the potential for adverse human health effects to result from the presence of COPCs. Noncancer hazards and cancer risks are characterized separately, including COPCs that induce both types of effects. The equations and input values used to calculate cancer risks and noncancer hazards are included in Appendix B.

4.3.3.1 Cancer Risk

The risk from exposure to potential chemical carcinogens is estimated as the probability of an individual developing cancer over a lifetime and is called the ILCR.

Total ILCRs in the range of 1E-6 to 1E-4 are regarded as acceptable (EPA, 1990); this range is referred to as the NCP risk management range. Risks less than this range are regarded as negligible. A target cancer risk goal of 1E-5, the logarithmic midpoint of the NCP risk management range, was selected by the PBOW Project Delivery Team as a basis to consider remedial action. The 1E-5 ILCR level is also used by OEPA as a policy goal (OEPA, 2009). Use of this 1E-5 goal represents a departure from the Army's practice of generally using a cancer risk exceeding a value of 1E-4 (the upper end of the NCP risk management range) to trigger remedial action considerations.

4.3.3.2 Noncancer Effects of Chemicals

The hazards associated with noncancer effects of chemicals are evaluated by comparing an exposure level or intake with a chemical-specific chronic reference dose as described in the BHHRA (Appendix B). An HQ of 1 indicates that the estimated intake equals the reference dose. If the HQ is greater than 1, there may be concern for potential adverse health effects. In the case of simultaneous exposure of a receptor to multiple chemicals, an HI is calculated an HI the sum of the HQs.

A total HI is calculated as the sum of all HI values, including all media and all COPCs, for a given receptor. Calculating a total HI as the sum of HQ values is based on the assumption that the potential for noncancer effects is additive. EPA (1989), however, acknowledges that the assumption of additivity is probably appropriate only for chemicals that induce adverse effects by the same mechanism. Therefore, if the total HI for a receptor exceeds 1, individual HI values may be calculated for each target organ, as described in Appendix B.

4.3.3.3 Risk Characterization Results

Cancer and noncancer risk characterization results were evaluated in the BHHRA for each WARWP Area environmental medium and each receptor scenario using the methods summarized in Sections 4.3.1 and 4.3.2 and described in Appendix B. The cancer risks and noncancer hazards for each receptor potentially exposed to PRRWP Area environmental media are shown in Table 4-5.

The overall HI and ILCR values are summarized by receptor in the following bullets. Exceedances of the PBOW cancer risk goal (ILCR greater than 1E-5) are shown in bold type and exceedances of the noncancer hazard criterion (HI greater than 1) are shown in bold italics. Note that none of the ILCR values exceed the NCP risk management range (1E-6 to 1E-4).

- Current/future groundskeeper: ILCR = 7E-6; HI = 0.01
- Future indoor worker: ILCR = 4E-8; HI = 0.003
- Current/future construction worker: ILCR = 8E-7; HI = 0.4
- Future resident: **ILCR = 2E-5**; HI = 0.7.

4.3.3.4 BHHRA Conclusions

The ILCR value for the future resident marginally exceeds the PBOW cancer risk goal but is well within the NCP risk management range. The ILCR values for the other three receptors are within or less than the NCP risk management range and do not exceed the PBOW cancer risk goal. Each of the HI values are less than the target value of 1, indicating that adverse noncancer effects are unlikely for each of these receptors.

The marginal ILCR exceedance for the future resident (1.6E-5, prior to rounding) is mostly attributable to the presence of the polycyclic aromatic hydrocarbons (PAH) benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene. These PAHs were detected in a single surface soil sample (DP-13) and a single subsurface soil sample (DP-20). In each case, the PAHs were detected at relatively low concentrations (less than 0.5 mg/kg) that were less than the reporting limits. The surface soil sample DP20 was collected within a site access

road. After submittal of the final BHHRA, USACE and OEPA agreed that the detection of these PAHs did not result from site-related conditions and that the PAHs should not be regarded as site-related contaminants (IT, 2002). The total ILCR for the WARWP Area assuming future residential exposure is 7E-6 when calculated without the contributions of PAHs. This value is within the NCP risk management range and less than the PBOW cancer risk goal.

In summary, based on the BHHRA evaluation of the RADPI and FRI analytical results, the ILCR of each receptor is less than or within the NCP risk management range and is less than the PBOW cancer risk goal. Each of the HI values is less than 1, indicating that adverse noncancer health effects are regarded as unlikely.

4.4 WARWP Area Ecological Risk Assessment

This section provides a summary of the ecological risk assessment which includes the SLERA (IT, 2000) and the BERA (IT, 2001), which are included as Appendices B and C, respectively. It is important to note that this ecological risk assessment was performed to satisfy administrative requirements including those described by FUDS regulations (USACE, 2004). This section provides no data or other information that has not been previously presented in the SLERA and BERA.

The ecological risk assessment was performed to evaluate and provide an estimate of current and future ecological hazard associated with exposure to potential releases to soil, surface water, and sediment associated with the WARWP Area. This summary provides an ecological site description, identifies COPECs, identifies ecological receptors, characterizes exposure, characterizes ecological risks, and presents the conclusions of the ecological risk assessment.

The ecological risk assessment was performed in accordance with EPA guidance and with the RWP Areas ecological risk assessment work plan (IT, 1998b).

4.4.1 Ecological Site Description

This ecological site description includes a summary of site background and the area of concern, surface water resources, wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area was based on a compilation of existing ecological information and site reconnaissance activities discussed in Sections 4.4.1.1 and 4.4.1.2. Additional ecological site description is provided in Appendix B.

4.4.1.1 Site Background

PBOW is part of the Lake Plains region. Across PBOW, the land slopes gently to the north-northeast towards Lake Erie. The Lake Plains region itself is over 69 percent cropland, 2.7 percent pasture land, and 10.5 percent forest (ODNR, 1985). However, since the U.S. Army acquired the site in 1941 and removed the land from agricultural production, undeveloped portions of the former PBOW have become second-generation forest and open fields. This has resulted in PBOW becoming an island of forest and open fields within the greater context of primarily agricultural land in north-central Ohio.

The WARWP Area ecological study area comprises approximately 23 acres. The ground surface is relatively flat, but slopes slightly south and east toward Pipe Creek. Formerly, two ponds were present, an “east pond” and a “west pond.” Currently, only the west pond exists. Although NASA drained the east pond in the 1970s, small ponded areas may exist in parts of the former east pond during periods of wet weather.

4.4.1.2 Site Reconnaissance

Ecologists performed site reconnaissance visits to the WARWP Area in April 1998. This visit was used to compile lists of fauna and flora observed at the site. No federally or state-listed species were observed. A full species list is presented in Appendix B.

Prior to arrival at PBOW, site personnel obtained maps and other relevant site information and determined the locations of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visit to evaluate the site for more subtle clues of potential effects from contaminant release. Information obtained during the reconnaissance trip was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area.

4.4.1.3 Surface Water

Surface water at the WARWP Area study area includes the west pond and Pipe Creek, which flows southwest to northeast in the vicinity of the site (Figures 1-2 and 4-1). The west pond has an average depth of 0.8 foot, with a maximum depth of 2.4 feet in its southwest corner (D&M, 1997a). The area of the pond is approximately 3.3 acres. It has been observed as largely covered with duckweed. As mentioned, ponded areas are sometimes present in areas of the former east pond. These areas are in the southwestern portion of the former east pond footprint adjacent to

the west pond and typically do not comprise more than 0.5 acre. Both the west pond and Pipe Creek are designated as “warm water habitat” and are likely to support forest fish throughout the year.

4.4.1.4 Wetlands

According to the NWI maps for the area (U.S. Fish and Wildlife Service, 1997), the open water within the WARWP Area is classified as a palustrine open water wetland and Pipe Creek is classified as riverine open water wetland. It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes (such as PBOW), because minor depressions often contain isolated wetlands not easily identified through aerial photograph interpretation (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps).

4.4.1.5 Vegetative Communities

Vegetative communities at the site were classified during a April 1998 site reconnaissance trip. The most common vegetation communities were moderate forest, late forest, and palustrine open water (Figure 4-4). Limited areas of possible vegetative stress within the WARWP Area were suggested by the presence of bare areas described in Appendix B.

4.4.1.6 Species Inventory

Based on information from ODNR (1995) and collected during the site reconnaissance, species lists were prepared for plants, mammals, birds, reptiles, amphibians, and fish. A total of 72 plant species were documented at the WARWP Area during the April 1998 vegetation surveys. The following fauna were observed at the RWP Areas during the April 1998 reconnaissance: 4 mammal species (white-tailed deer, masked shrew, short-tailed shrew, and woodchuck) 13 bird species, 2 reptile species, and 4 amphibian species were observed. Other than a white-tailed deer that was observed at the WARWP Area, the SLERA does not document whether these animal species were observed at the WARWP Area, at the PRRWP Area, or both. Foraging fish were observed in the west pond and are expected to be present in Pipe Creek.

4.4.2 Identification of Chemicals of Potential Ecological Concern

A screening process was performed on the analytical data from the FRI and RADPI to identify COPECs that may pose a threat to ecological receptors. These data include all soil samples collected to a depth of 6 feet, surface water samples, and sediment samples. Note that the soil includes both surface soil and subsurface soil and is thus referred to as “total soil” in the SLERA. Groundwater was excluded because exposure to this WARWP Area medium is considered to be an incomplete pathway for ecological receptors; also, note that RWP Area groundwater is being

addressed administratively separately from other RWP Area media. Locations of samples used in the ecological risk assessment are shown on Figures 4-1 through 4-3.

The COPEC selection process was performed to develop a subset of chemicals detected at the site that are not naturally occurring or are associated with non-site-related sources. This selection process and the screening values used for COPEC selection are described in the SLERA (Appendix B). The results of the WARWP Area COPEC screening as presented in the SLERA (Appendix B) are shown in Tables 4-6 (surface soil), 4-7 (subsurface soil), 4-8 (surface water) and 4-9 (sediment).

Chemicals identified as WARWP Area COPECs were quantitatively evaluated in the SLERA predictive evaluation, which is summarized in Sections 4.4.3 through 4.4.6, where chemical-specific data were available.

4.4.3 Selection of Ecological Receptors

Ecological assessment receptors were selected in the SLERA to focus the exposure characterization on species, groups of species, or functional groups that are directly related to the following assessment endpoints: the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, and carnivorous birds.

As part of this receptor selection process, site biota were organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds.

Seven representative terrestrial receptor species that are expected or possible in the area of the WARWP Area were selected as indicator species for the potential effects of COPECs. These indicator species represent two classes of vertebrate wildlife (mammals and birds); include a range of both body size and food habits; and include herbivores, omnivores, and carnivores. The seven terrestrial species selected include the deer mouse (small omnivorous mammal), short-tailed shrew (small insectivorous mammal), Eastern cottontail rabbit (medium-sized terrestrial herbivorous mammal), marsh wren (small insectivorous bird), raccoon (medium-sized omnivorous mammal), white-tailed deer (large herbivorous mammal), and red-tailed hawk (large carnivorous bird).

Exposure to aquatic organisms in the west pond and Pipe Creek is assumed to occur via direct exposure to contaminants in the water column and via prey exposed to contaminants in surface

water and sediment. Potential uptake through the aquatic food chain is evaluated for the raccoon (also considered as a terrestrial receptor) and great blue heron (large avian aquatic piscivore).

A terrestrial food web is presented on Figure 3-5 and an aquatic food web is presented on Figure 3-6. Many of the species evaluated, particularly the deer mouse, cottontail rabbit, short-tailed shrew, and marsh wren, have limited home ranges that may make them particularly vulnerable to exposure from site contaminants. Further discussion of the selection of ecological receptors is provided in Appendix B.

4.4.4 Exposure Characterization

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Further discussion of exposure routes is provided in Appendix B.

Daily doses of COPECs for vertebrate receptors were calculated using standard exposure algorithms. These algorithms incorporate species-specific natural history parameters (e.g., feeding rates, water ingestion rates, dietary composition) as well as site-specific area use factors. These algorithms are presented and described in the SLERA (Appendix B).

Exposure to soil, surface water, and sediment was evaluated for the pertinent representative terrestrial and aquatic assessment receptors, as described in Appendix B.

4.4.5 Risk Characterization

The risk characterization phase integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. Qualitative and semiquantitative approaches were used to estimate the likelihood of adverse effects occurring as a result of exposure of the selected site receptors to COPECs.

Food chain modeling was used to estimate exposure rates for the representative assessment receptors. These exposure rates were compared with TRVs to calculate ecological HQs (Wentsel et al., 1996). Only conservative TRVs based on a NOAEL were used in the food chain model. HQs are calculated by summing intake doses across all exposure pathways for each chemical for a given receptor and dividing by the TRV. HQs less than or equal to 1 represent no probable hazard. Although OEPA considers all HQs above 1 to be potentially significant, the following uncertainties regarding HQ interpretation are noted:

- HQs are not measures of risk.
- HQs are not population based.
- HQs are not linearly scaled.
- HQs are often produced that are unrealistically high and toxicologically impossible (e.g., estimated ecological HQs greater than 1,000).
- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to HQ threshold exceedances.

The following interpretation of HQ ranges from Wentsel et al. (1996) takes into consideration the uncertainties inherent in HQs and provides a basis for possible recommendations:

- HQs from 1 to less than 10 represent a low potential for environmental effects.
- HQs from 10 to less than 100 represent a significant potential that effects could result from greater exposure.
- HQs greater than 100 represent the highest potential for expected effects.

Therefore, it should be understood that HQs greater than 1 do not mean that adverse ecological effects are occurring at the site or may occur in the future.

Table 4-10 summarizes the NOAEL-based HIs for the seven evaluated terrestrial assessment receptors and Table 4-11 summarizes the NOAEL-based HI values for the two aquatic receptors, as presented in Section 6.5.3 of Appendix B. Note that the raccoon includes both terrestrial and aquatic components.

The HQ values were summed together to provide a conservative estimate of the EHI, representing a measure of the potential for adverse ecological effects for all chemicals and exposure pathways for a given receptor.

Based on the WARWP Area SLERA results, a BERA was conducted as a refinement. The BERA includes refined food-chain models for terrestrial and aquatic receptors that use site-specific bioconcentration factors and other site-specific information. The BERA also presents site-specific aquatic and terrestrial toxicity test results, and refines the SLERA food chain model by using more realistic (and, when possible, site-specific exposure point concentrations, toxicity values, uptake factors, and toxicity values). The HI values from the BERA are summarized for terrestrial receptors in Table 4-12 and for aquatic receptors in Table 4-13.

4.4.6 Ecological Risk Assessment Conclusions

SLERA Conclusions. The following WARWP Area terrestrial receptors had HI values greater than 10 in the SLERA: deer mouse (HI of 28), shrew (HI of 96), marsh wren (HI of 452), and raccoon (HI of 38). The wren HI was attributed almost entirely to 4-ADNT (HQ=448) in soil associated with ingestion of invertebrates living in the soil. Approximately 92 percent of the HI values for the mouse, shrew, and raccoon were attributed to PAHs in soil, via the ingestion of soil invertebrates.

Both of the aquatic receptors had HI values greater than 10. The great blue heron HI of 724 is mostly associated with inorganics (especially iron [HQ of 372] and magnesium [HQ of 148]) in surface water assuming ingestion of fish from this water (surface water HI of 618). The raccoon HI of 665 is mostly associated with inorganics in sediment via invertebrate uptake (sediment HI of 582), especially aluminum (HQ of 400).

It was concluded from the SLERA (Appendix B) that the performance of a BERA was appropriate for the WARWP (Appendix C).

BERA Conclusions. All of the BERA HI values for terrestrial receptors, assuming reasonable maximum exposure, are less than 10. All of the central tendency exposure HI values are less than 1. These results indicate a low to negligible potential for adverse ecological effects with respect to terrestrial receptors.

All of the surface water HI values for the heron and raccoon were found to be less than 1, indicating a negligible potential for adverse ecological effects. The reasonable maximum exposure-based sediment HI values for the heron and raccoon were 26 and 21, respectively. The central tendency sediment HI values were both less than 1, indicating negligible potential at the central tendency for adverse ecological effects. One hundred percent of the HI for each receptor was associated with iron in sediment. Additionally, the maximum WARWP Area iron concentration in sediment (24,300 mg/kg) is an order of magnitude less than the PBOW background screening concentration for iron in surface soil (358,000 mg/kg) shown on Table 4-6. Therefore, the iron concentrations present in WARWP Area sediment is likely associated with the parent soil materials native to PBOW.

The results of the earthworm toxicity study performed for WARWP Area soil suggest that PAHs in site soil may result in toxicity to terrestrial invertebrates and also have deleterious food chain

impacts to small insectivorous mammals, such as the shrew. However, this toxicity was not regarded as significant because the decrease in reproduction and survival did not exceed 30 percent compared to laboratory controls. Also, the food chain model only predicted potential adverse effects using the more conservative reasonable maximum effect exposure parameters; no adverse effects were predicted when the central tendency inputs were used. The extent of PAH contamination appears to be limited, as PAHs were detected in only 2 of 19 soil samples. After completion of the BERA, it was agreed by the PBOW Project Delivery Team that PAHs in WARWP Area soil are not site-related contaminants (IT, 2002).

4.5 WARWP Area Investigation and Evaluation Recommendations

No remedial actions or further investigation of WARWP Area media are recommended based on the results of the RI efforts, including the BHHRA, SLERA, and BERA.

Based on the BHHRA evaluation of the RADPI and FRI analytical results, the ILCR of each receptor is less than or within the NCP risk management range and less than the PBOW cancer risk goal. Each of the HI values is less than a value of 1, indicating that adverse noncancer health effects are regarded as unlikely. The ecological risk assessment results indicate that adverse ecological impacts from site-related contaminants appear to be unlikely.

5.0 DERP-FUDS Project No. G05OH001820 Recommendations

The purpose of the RI is to gather information concerning the site characteristics so that appropriate remedial alternatives may be developed in the FS. However, it is unnecessary to perform an FS if the HHRA indicates that the human health risk goals are met under baseline conditions and the ecological risk assessment indicates a lack of adverse ecological effects (U.S. Department of Defense, 2004; 2012).

The purpose of including recommendations in this RI is to clearly convey information to the Project Delivery Team that USACE regards as imperative to the total Comprehensive Environmental Response, Compensation, and Liability Act and DERP-FUDS project closure processes. Types of recommendations arising from the RI process may include one or more of the following:

- Proceed to FS
- No (further) action: no FS required; proceed to no (further) action proposed plan
- Perform additional evaluation (e.g., treatability study)
- Perform a time-critical or non-time-critical removal action.

5.1 PRRWP Area

Based on the findings of the RI, soil remediation is recommended. Specifically, remedial action is recommended to address a potential hot spot in the vicinity of sample PR-S14, where TNT was detected in subsurface soil at a concentration of 12,000 mg/kg at a depth interval of 3 to 5 feet bgs. TNT was also found at an elevated concentration (340 mg/kg) in the sample collected at this location in the 5 to 10 feet bgs depth interval.

5.2 WARWP Area

No remedial actions or further investigation of WARWP Area media are recommended based on the results of the WWTP3 RI efforts, including the BHHRA, SLERA, and BERA.

5.3 Overall Project Recommendation

Remediation is recommended to address elevated TNT concentrations in PRRWP Area soil as summarized in Section 5.1. No further action is recommended for any other PRRWP Area environmental media. Also, no further action is recommended for any WARWP Area environmental medium. Therefore, the FS for DERP-FUDS Project No. G05OH001820 will address only PRRWP Area soil contamination. The FS will present and discuss potential remedial alternatives for addressing elevated TNT in PRRWP Area soil.

6.0 References

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TABLES

Table 3-1

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in PRRWP Area Surface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]		COPC?[e,f]	Source Term Concentration
Inorganics											
ALUMINUM	20 / 20	2370 - 12700	21.3 - 24.8	N	7.05E+03	7.99E+03	2.69E+04	7.60E+03		N (c)	--
ARSENIC	36 / 50	2.3 - 22	1.1 - 3.8	NP	4.59E+00	5.80E+00	7.10E+01	3.90E-02		N (c)	--
BARIUM	13 / 20	24.3 - 84.3	21.3 - 24.8	NP	3.27E+01		1.30E+03	5.40E+02		N (a)	--
BERYLLIUM	3 / 50	0.68 - 0.69	0.53 - 1.3	NP	4.77E-01		1.17E+00	1.50E+01		N (a)	--
CALCIUM	19 / 20	817 - 54000	532 - 620	L	6.25E+03			Nutrient		N (b)	--
CHROMIUM	50 / 50	4.2 - 21	1 - 1.3	L	1.07E+01	1.15E+01	2.90E+01	2.10E+01	g	N (a)	--
COBALT	9 / 20	5.8 - 11.1	5.3 - 6.2	NP	4.74E+00		2.48E+02	4.70E+02		N (a)	--
COPPER	29 / 50	2.5 - 22.6	2.1 - 3.1	NP	4.77E+00		1.47E+02	2.90E+02		N (a)	--
IRON	20 / 20	8330 - 22900	10.6 - 12.4	N	1.43E+04			Nutrient		N (b)	--
LEAD	50 / 50	3.1 - 19	0.32 - 3.2	L	7.68E+00		5.13E+01	4.00E+02		N (a)	--
MAGNESIUM	20 / 20	791 - 11500	532 - 620	NP	2.32E+03			Nutrient		N (b)	--
MANGANESE	50 / 50	74.5 - 820	1.6 - 5.1	L	2.38E+02	2.74E+02	3.51E+03	1.80E+02		N (c)	--
MERCURY	2 / 50	0.04 - 0.043	0.035 - 0.31	NP	9.29E-02		5.60E-01	2.30E+00		N (a)	--
NICKEL	50 / 50	4.7 - 27.2	2.1 - 5	NP	9.62E+00		7.79E+01	1.60E+02		N (a)	--
POTASSIUM	5 / 20	684 - 1460	532 - 620	NP	4.41E+02			Nutrient		N (b)	--
SELENIUM	2 / 50	0.59 - 0.84	0.53 - 5	NP	1.48E+00		2.00E+00	3.90E+01		N (a)	--
SODIUM	2 / 20	741 - 1240	532 - 620	NP	3.57E+02			Nutrient		N (b)	--
VANADIUM	20 / 20	12.9 - 35.2	5.3 - 6.2	N	2.21E+01		8.31E+01	5.50E+01		N (a)	--
ZINC	50 / 50	17 - 78.5	2.1 - 2.5	NP	3.00E+01		3.22E+02	2.30E+03		N (a)	--
Nitroaromatics											
4-AMINO-2,6-DINITROTOLUENE	1 / 50	2.7 - 2.7	0.25 - 0.25	NP	1.77E-01	2.70E+00		3.70E-01		Y	2.70E+00
1,3-DINITROBENZENE	6 / 50	0.3 - 1.6	0.25 - 0.25	NP	1.98E-01	8.97E-01		6.10E-01		Y	8.97E-01
2,4-DINITROTOLUENE	12 / 50	0.3 - 2.4	0.25 - 0.25	NP	3.31E-01	1.57E+00		7.20E-02	h	Y	1.57E+00
2,6-DINITROTOLUENE	2 / 50	0.4 - 0.8	0.25 - 0.26	NP	1.47E-01	8.00E-01		7.20E-02	h	Y	8.00E-01
3,4-DINITROTOLUENE	1 / 30	0.3 - 0.3	0.25 - 0.25	NP	1.31E-01	3.00E-01		7.20E-02	h	Y	3.00E-01
1,3,5-TRINITROBENZENE	5 / 50	0.4 - 1.7	0.25 - 0.25	NP	2.01E-01			1.80E+02		N (a)	--
2,4,6-TRINITROTOLUENE	1 / 50	0.27 - 0.27	0.25 - 0.25	NP	1.28E-01			1.60E+00		N (a)	--
Volatile Organics											
METHYLENE CHLORIDE	1 / 10	0.0018 - 0.0018	0.0055 - 0.0062	NP	2.82E-03			8.90E-01		N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per killogram.
PRRWP - Pentolite Road Red Water Pond.

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the beginning depth of the sample.

[b] Method of estimation based on statistical distribution (please see Section 5.2.2).

[c] Based on upper tolerance limit of background data set.

[d] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3, 1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.

[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk-Based Screening concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.

[f] Y = Chemical is chosen as COPC.

[g] Based on PRG for total chromium.

[h] Based on PRG for mixed dinitrotoluene.

Table 3-2

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in PRRWP Area Subsurface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	39 / 39	3320 - 12300	22.1 - 26.7	N	8.65E+03	9.25E+03	2.69E+04	7.60E+03	N (c)	--
ANTIMONY	12 / 73	5.6 - 9.3	5.2 - 8	L*	4.00E+00	6.80E+00	9.30E+00	3.10E+00	N (c)	--
ARSENIC	69 / 73	2.6 - 42.8	1.1 - 3.8	L	8.80E+00	1.01E+01	7.10E+01	3.90E-02	N (c)	--
BARIUM	36 / 39	26.5 - 239	22.1 - 26.7	NP	6.81E+01		1.30E+03	5.40E+02	N (a)	--
BERYLLIUM	7 / 73	0.55 - 0.83	0.55 - 1.3	N	4.76E-01		1.17E+00	1.50E+01	N (a)	--
CADMIUM	1 / 73	0.63 - 0.63	0.55 - 1.3	N	4.43E-01			3.70E+00	N (a)	--
CALCIUM	39 / 39	1850 - 70400	552 - 667	NP	4.20E+04			Nutrient	N (b)	--
CHROMIUM	73 / 73	5.2 - 27	1 - 1.3	N	1.51E+01	1.58E+01	2.90E+01	2.10E+01	N (c)	--
COBALT	33 / 39	6.3 - 30.3	5.5 - 6.7	NP	1.03E+01		2.48E+02	4.70E+02	N (a)	--
COPPER	68 / 73	3 - 34.5	2.1 - 3.3	N	1.40E+01		1.47E+02	2.90E+02	N (a)	--
IRON	39 / 39	8940 - 43700	11 - 13.3	L	2.04E+04			Nutrient	N (b)	--
LEAD	73 / 73	2.9 - 18	0.33 - 3.2	N	9.89E+00		5.13E+01	4.00E+02	N (a)	--
MAGNESIUM	39 / 39	917 - 25300	552 - 667	NP	1.41E+04			Nutrient	N (b)	--
MANGANESE	73 / 73	140 - 2270	1.7 - 5.1	L	5.15E+02	5.63E+02	3.51E+03	1.80E+02	N (c)	--
MERCURY	1 / 73	0.045 - 0.045	0.036 - 0.32	N	8.08E-02		5.60E-01	2.30E+00	N (a)	--
NICKEL	73 / 73	6.4 - 57.2	2.1 - 5.3	L	2.24E+01		7.79E+01	1.60E+02	N (a)	--
POTASSIUM	37 / 40	713 - 2730	27 - 667	N	1.50E+03			Nutrient	N (b)	--
SELENIUM	6 / 73	0.64 - 1.1	0.55 - 5.1	L	1.33E+00		2.00E+00	3.90E+01	N (a)	--
SODIUM	10 / 39	1030 - 4280	552 - 667	NP	7.51E+02			Nutrient	N (b)	--
VANADIUM	39 / 39	15 - 38.4	5.5 - 6.7	L	2.51E+01		8.31E+01	5.50E+01	N (a)	--
ZINC	73 / 73	22.7 - 104	2.1 - 2.7	N	5.32E+01		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
4-AMINO-2-NITROTOLUENE	2 / 34	0.6 - 0.9	0.25 - 2.5	NP	1.95E-01			1.50E+00	N (a)	--
4-AMINO-2,6-DINITROTOLUENE	6 / 73	0.3 - 9.5	0.25 - 2.5	L*	3.35E-01	1.88E+00		3.70E-01	Y	1.88E+00
1,3-DINITROBENZENE	24 / 73	0.25 - 9.3	0.25 - 5	L*	1.12E+00	2.20E+00		6.10E-01	Y	2.20E+00
2,4-DINITROTOLUENE	29 / 73	0.28 - 25	0.25 - 2.5	L*	1.97E+00	5.34E+00		7.20E-02 h	Y	5.34E+00
2,6-DINITROTOLUENE	15 / 73	0.29 - 3.6	0.25 - 2.6	L*	3.42E-01	9.51E-01		7.20E-02 h	Y	9.51E-01
3,4-DINITROTOLUENE	5 / 34	0.5 - 4.5	0.25 - 2.5	NP	3.60E-01	3.68E+00		7.20E-02 h	Y	3.68E+00
NITROBENZENE	1 / 73	1.1 - 1.1	0.25 - 2.6	L	1.80E-01			2.00E+00	N (a)	--
2-NITROTOLUENE	1 / 73	0.9 - 0.9	0.25 - 2.5	L	1.75E-01			3.70E+01	N (a)	--
1,3,5-TRINITROBENZENE	31 / 73	0.4 - 58	0.25 - 5	L	4.01E+00			1.80E+02	N (a)	--
2,4,6-TRINITROTOLUENE	5 / 73	0.3 - 12000	0.25 - 2.5	L*	1.69E+02	1.20E+04		1.60E+00	Y	1.20E+04
Semivolatile Organics										
3-NITROANILINE	1 / 9	0.053 - 0.053	1.9 - 20	NP	1.89E+00			1.80E+00	N (a)	--
Volatile Organics										
ACETONE	1 / 8	0.0082 - 0.0082	0.024 - 0.027	NP	1.20E-02			1.60E+02	N (a)	--
METHYLENE CHLORIDE	1 / 9	0.0021 - 0.0021	0.006 - 0.0067	NP	3.00E-03			8.90E-01	N (a)	--
TOLUENE	1 / 9	0.0017 - 0.0017	0.006 - 0.0067	NP	2.96E-03			5.90E+01	N (a)	--

Table 3-2

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in PRRWP Area Subsurface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per killogram.
PRRWP - Pentolite Road Red Water Pond.
* Please see section 5.2.2.1.
[a] Subsurface soil is defined as the interval from 2 to 10 feet below the ground surface.
[b] Method of estimation based on statistical distribution.
[c] Based on upper tolerance limit of background data set.
[d] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3, 1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC.
(a) = maximum detection is less than the Risk Based Screening concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.
[f] Y = Chemical is chosen as COPC:
[g] Based on PRG for total chromium.
[h] Based on PRG for mixed dinitrotoluene.

Table 3-3

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in PRRWP Area Surface Water
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (μg/L)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL [a]	Background Screening Criterion [b]	Risk-Based Screening Criterion [c]	COPC?[d]
Inorganics (unfiltered)									
Aluminum	2 / 2	530 - 3040	200 - 200	NA	1.79E+03	NA	3.04E+03	3.60E+04	N (a)
Calcium	2 / 2	71700 - 118000	5000 - 5000	NA	9.49E+04	NA		Nutrient	N (b)
Iron	2 / 2	972 - 5790	100 - 100	NA	3.38E+03	NA		Nutrient	N (b)
Magnesium	2 / 2	15800 - 37300	5000 - 5000	NA	2.66E+04	NA		Nutrient	N (b)
Manganese	2 / 2	261 - 404	15 - 15	NA	3.33E+02	NA	8.90E+02	8.80E+02	N (a)
Sodium	2 / 2	13700 - 24700	5000 - 5000	NA	1.92E+04	NA		Nutrient	N (b)
Zinc	1 / 2	58 - 58	20 - 20	NA	3.90E+01	NA	5.80E+01	1.10E+04	N (a)
Volatile Organics									
Bromomethane	1 / 2	0.11 - 0.11	2 - 2	NA	1.06E+00	NA		8.70E+00	N (a)

μg/L - Microgram per liter.
COPC - Chemical of potential concern.
NA - Not available or not applicable.
PRRWP - Pentolite Road Red Water Pond.
UCL - Upper confidence limit.

[a] Insufficient number of samples (less than 5) to determine statistical distribution or calculate a UCL.
[b] Based on background data set.
[c] EPA, 1999, Region IX Preliminary Remediation Goals (PRGs), December 3, 1999, S. J. Smucker, Ph.D., unadjusted tap water PRGs.
[d] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk-Based Screening concentration (RBSC).
(b) = essential nutrient.

Table 3-4

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in PRRWP Area Sediment
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentration	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL mg/kg [a]	Background Screening Criterion [b]	Risk-Based Screening Criterion [c]	COPC? [d,e]	Source Term Concentration
Inorganics										
ALUMINUM	2 / 2	2830 - 5130	25.3 - 34.6	NA	3.98E+03	NA	6.02E+03	7.60E+04	N (a)	--
ARSENIC	2 / 2	4.3 - 5.1	1.3 - 1.7	NA	4.70E+00	NA	5.40E+00	3.90E-01	N (c)	--
BARIUM	1 / 2	48.1 - 48.1	25.3 - 34.6	NA	3.67E+01	NA	5.34E+01	5.40E+03	N (a)	--
CALCIUM	2 / 2	46300 - 62000	631 - 865	NA	5.42E+04	NA		Nutrient	N (b)	--
CHROMIUM	2 / 2	6.3 - 10.4	1.3 - 1.7	NA	8.35E+00	NA	1.15E+01	2.10E+02 [f]	N (a)	--
COPPER	2 / 2	7.6 - 14.5	3.2 - 4.3	NA	1.11E+01	NA	1.79E+01	2.90E+03	N (a)	--
IRON	2 / 2	9620 - 13700	12.6 - 17.3	NA	1.17E+04	NA		Nutrient	N (b)	--
LEAD	2 / 2	4.8 - 7.8	0.38 - 0.52	NA	6.30E+00	NA	1.28E+01	4.00E+02	N (a)	--
MAGNESIUM	2 / 2	13500 - 19300	631 - 865	NA	1.64E+04	NA		Nutrient	N (b)	--
MANGANESE	2 / 2	404 - 421	1.9 - 2.6	NA	4.13E+02	NA	8.65E+02	1.80E+03	N (a)	--
NICKEL	2 / 2	9.5 - 17.9	5.1 - 6.9	NA	1.37E+01	NA	2.30E+01	1.60E+03	N (a)	--
POTASSIUM	1 / 2	1040 - 1040	631 - 865	NA	8.36E+02	NA		Nutrient	N (b)	--
VANADIUM	2 / 2	12.9 - 14.2	6.3 - 8.7	NA	1.36E+01	NA	1.74E+01	5.50E+02	N (a)	--
ZINC	2 / 2	23.2 - 58.4	2.5 - 3.5	NA	4.08E+01	NA	7.33E+01	2.30E+04	N (a)	--
Semivolatile Organics										
ACENAPHTHENE	1 / 2	0.11 - 0.11	0.42 - 0.57	NA	3.40E-01	NA		3.70E+03	N (a)	--
ANTHRACENE	1 / 2	0.077 - 0.077	0.42 - 0.57	NA	3.24E-01	NA		2.20E+04	N (a)	--
CARBAZOLE	1 / 2	0.18 - 0.18	0.42 - 0.57	NA	3.75E-01	NA		2.40E+01	N (a)	--
DIBENZOFURAN	1 / 2	0.06 - 0.06	0.42 - 0.57	NA	3.15E-01	NA		2.90E+02	N (a)	--
FLUORANTHENE	1 / 2	0.14 - 0.14	0.42 - 0.57	NA	3.55E-01	NA		2.30E+03	N (a)	--
FLUORENE	1 / 2	0.11 - 0.11	0.42 - 0.57	NA	3.40E-01	NA		2.60E+03	N (a)	--
PHENANTHRENE	1 / 2	0.32 - 0.32	0.42 - 0.57	NA	4.45E-01	NA		2.30E+03	N (a)	--
PYRENE	1 / 2	0.11 - 0.11	0.42 - 0.57	NA	3.40E-01	NA		2.30E+03	N (a)	--
Volatile Organics										
ACETONE	1 / 1	0.049 - 0.049	0.035 - 0.035	NA	4.90E-02	NA		1.60E+03	N (a)	--
2-BUTANONE	1 / 2	0.01 - 0.01	0.025 - 0.035	NA	1.75E-02	NA		7.30E+03	N (a)	--

COPC - Chemical of potential concern.
mg/kg - Milligrams per kilogram.
NA - Not available or not applicable.
PRRWP - Pentolite Road Red Water Pond.
UCL - Upper confidence limit.

[a] Insufficient number of samples (less than 5), to determine statistical distribution or calculate a UCL.
[c] Based on background data set.
[c] EPA, 1999, Region IX Preliminary Remediation Goals (PRGs), December 3, 1999, S. J. Smucker, Ph.D., unadjusted residential soil PRG.
[d] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk-Based Screening Concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.
[e] Y = Chemical is chosen as a COPC.
[f] PRG based on total chromium.

Table 3-5

Summary of Total Hazard and Total Cancer Risk from Site-Related Chemicals of Potential Concern, PRRWP Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Groundskeeper		Indoor Worker		Construction Worker		On-Site Resident	
Contaminant Source	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR
Surface Soil	6.33E-02	6.21E-07	2.73E-02	2.82E-07	NA	NA	NA	NA
Total Soil	NA	NA	NA	NA	1.04E+02	1.12E-05	3.58E+02	8.50E-04
Surface Water	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	NA	NA	NA	NA	NA	NA	NA	NA
Total across all media	**6.33E-02**	**6.21E-07**	**2.73E-02**	**2.82E-07**	**1.04E+02**	**1.12E-05**	**3.58E+02**	**8.50E-04**

HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
NA - Not applicable.
PRRWP - Pentolite Road Red Water Pond.
Source: IT, 2000.

Table 3-6

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in PRRWP Area Surface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean (mg/kg)	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	20/20 (100)	7,053	2,370 - 12,700	NA	N	7,985	26,879	A	N	-
ARSENIC	36/50 (72)	4.6	2.3 - 22	3.1 - 3.6	L	5.4	71	A	N	-
BARIUM	13/20 (65)	33	24.3 - 84.3	21.3 - 23.8	L	48	431	A	N	-
BERYLLIUM	3/50 (6.0)	0.48	0.68 - 0.69	0.53 - 1.3	U	< 1.1	0.96	A	N	-
CALCIUM	19/20 (95)	6,246	817 - 54,000	556	L	11,864	218,208	A	N	-
CHROMIUM	50/50 (100)	11	4.2 - 21	NA	L	11.5	36	A	N	-
COBALT	9/20 (45)	4.7	5.8 - 11.1	5.3 - 6.2	U	6.2	66.1	A	N	-
COPPER	29/50 (58)	4.8	2.5 - 22.6	2.1 - 2.5	U	4.9	147	A	N	-
IRON	20/20 (100)	14,272	8,330 - 22,900	NA	N	15,600	358,040	A	N	-
LEAD	50/50 (100)	7.7	3.1 - 19	NA	L	8.7	51.2	A	N	-
MAGNESIUM	20/20 (100)	2,322	791 - 11,500	NA	U	2,310	30,765	A	N	-
MANGANESE	50/50 (100)	238	74.5 - 820	NA	L	274	3,494	A	N	-
MERCURY	2/50 (4.0)	0.093	0.04 - 0.043	0.035 - 0.31	U	< 0.28	0.149	A, B	N	-
NICKEL	50/50 (100)	9.6	4.7 - 27.2	NA	L	10.5	78	A	N	-
POTASSIUM	5/20 (25)	441	684 - 1,460	532 - 616	U	< 616	6,078	A	N	-
SELENIUM	2/50 (4.0)	1.5	0.59 - 0.84	0.53 - 5.0	U	< 4.4	2.39	A, B	N	-
SODIUM	2/20 (10)	357	741 - 1,240	532 - 620	U	< 594	319	-	Y	297
VANADIUM	20/20 (100)	22	12.9 - 35.2	NA	L	23.7	83	A	N	-
ZINC	50/50 (100)	30	17 - 78.5	NA	L	32	321	A	N	-
VOLATILE ORGANIC COMPOUNDS										
METHYLENE CHLORIDE	1/10 (10)	0.0028	0.0018	0.0055 - 0.0062	U	< 0.0062	NA	-	Y	0.0018
SEMIVOLATILE ORGANIC COMPOUNDS										
1,3-DINITROBENZENE	6/50 (12)	0.20	0.3 - 1.6	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	5/50 (10)	0.20	0.4 - 1.7	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	13/60 (22)	0.34	0.16 - 2.4	0.25 - 4.1	U	< 0.25	NA	-	Y	0.125
2,6-DINITROTOLUENE	3/60 (5.0)	0.18	0.05 - 0.8	0.25 - 4.1	U	< 0.26	NA	-	Y	0.13
2,4,6-TRINITROTOLUENE	1/50 (2.0)	0.13	0.27	0.25	U	< 0.25	NA	-	Y	0.125
3,4-DINITROTOLUENE	1/30 (3.3)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DINITROTOLUENE	1/50 (2.0)	0.18	2.7	0.25	U	< 0.25	NA	-	Y	0.125

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution. NA = distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background upper tolerance limit concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/kg - Milligrams per kilogram.
PRRWP - Pentolite Road Red Water Pond.
Source: IT, 2000a

Table 3-7

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in PRRWP Area Subsurface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean (mg/kg)	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	40/40 (100)	7,869	2,370 - 12,700	NA	N	8,494	26,879	A	N	-
ANTIMONY	11/90 (12)	3.5	3.6 - 9.3	5.2 - 7.7	U	< 6.8	7.8	-	Y	3.4
ARSENIC	74/90 (82)	6.9	2.3 - 42.8	3.1 - 3.6	L	8.0	71	A	N	-
BARIUM	31/40 (78)	54.4	24.3 - 239	21.3 - 24.9	L	73.5	431	A	N	-
BERYLLIUM	9/90 (10)	0.49	0.55 - 0.83	0.53 - 1.3	U	< 1.1	0.96	A	N	-
CALCIUM	39/40 (98)	18,927	817 - 63,200	566	U	10,300	218,208	A	N	-
CHROMIUM	90/90 (100)	12.3	4.2 - 21	NA	N	12.9	36	A	N	-
COBALT	26/40 (65)	8.1	5.8 - 30.3	5.3 - 6.4	L	10.1	66.1	A	N	-
COPPER	64/90 (71)	8.3	2.5 - 34.5	2.1 - 2.5	U	7.5	147	A	N	-
IRON	40/40 (100)	17,923	8,330 - 43,700	NA	L	19,837	358,040	A	N	-
LEAD	90/90 (100)	8.6	2.9 - 19	NA	N	9.2	51.2	A	N	-
MAGNESIUM	40/40 (100)	6,722	791 - 24,600	NA	U	5,150	30,765	A	N	-
MANGANESE	90/90 (100)	374	74.5 - 2,270	NA	L	414	3,494	A	N	-
MERCURY	3/90 (3.3)	0.089	0.04 - 0.045	0.035 - 0.31	U	< 0.28	0.149	A,B	N	-
NICKEL	90/90 (100)	14.9	4.7 - 57.2	NA	L	16.5	78	A	N	-
POTASSIUM	22/40 (55)	856	684 - 2,430	532 - 644	U	968	6,078	A	N	-
SELENIUM	5/90 (5.6)	1.4	0.59 - 0.84	0.53 - 5	U	< 4.5	2.39	A	N	-
SILVER	4/90 (4.4)	0.58	0.6 - 0.65	1.0 - 1.3	U	< 1.2	1.97	A	N	-
SODIUM	7/40 (18)	577	741 - 4,130	532 - 639	U	< 620	319	-	Y	310
THALLIUM	4/90 (4.4)	1.9	0.6 - 1.25	1.1 - 6.3	U	< 5.6	6.0	A	N	-
VANADIUM	40/40 (100)	23.9	12.9 - 38.4	NA	N	25.4	83	A	N	-
ZINC	90/90 (100)	39.2	17.0 - 104	NA	L	42.2	321	A	N	-
VOLATILE ORGANIC COMPOUNDS										
1,1,2,2-TETRACHLOROETHANE	1/14 (7.1)	0.0030	0.0031	0.0055 - 0.0063	U	< 0.0062	NA	-	Y	0.0031
ACETONE	1/10 (10)	0.011	0.0082	0.022 - 0.025	U	< 0.025	NA	-	Y	0.0125
METHYLENE CHLORIDE	1/14 (7.1)	0.0029	0.0018	0.0055 - 0.0063	U	< 0.0062	NA	-	Y	0.0031
TOLUENE	1/14 (7.1)	0.0029	0.0017	0.0055 - 0.0063	U	< 0.0062	NA	-	Y	0.0031
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	15/90 (17)	0.48	0.3 - 9.3	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	17/90 (19)	1.8	0.4 - 58	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	27/104 (26)	0.85	0.056 - 25	0.25 - 4.1	U	< 0.25	NA	-	Y	0.125
2,6-DINITROTOLUENE	10/104 (9.6)	0.23	0.05 - 3.6	0.25 - 4.1	U	< 0.26	NA	-	Y	0.13
2,4,6-TRINITROTOLUENE	3/90 (3.3)	133	0.27 - 12,000	0.25 - 2.5	U	< 0.25	NA	-	Y	0.125
3,4-DINITROTOLUENE	2/50 (4.0)	0.22	0.3 - 4.5	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DINITROTOLUENE	4/90 (4.4)	0.28	0.3 - 9.5	0.25 - 2.5	U	< 0.25	NA	-	Y	0.125
NITROBENZENE	1/104 (0.96)	0.20	1.1	0.25 - 4.2	U	< 0.26	NA	-	Y	0.13
MISCELLANEOUS										
TOTAL ORGANIC CARBON							NA			

[a] Total soil is defined as the interval from 0 to 6 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.

Table 3-7

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in PRRWP Area Subsurface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

NA = distribution not determined if sample size is less than 5.
[c] 95% Upper Confidence Limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background upper tolerance limit concentrations for inorganic constituents are based on site-specific data. Background PAH values from ATSDR (Agricultural).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/kg - Milligrams per kilogram.
PRRWP - Pentolite Road Red Water Pond.

Table 3-8

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in PRRWP Area Surface Water
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/L	Range of values, mg/L Detected	Range of values, mg/L Nondetected	Statistical Distribution [b]	95% UCL mg/L [c]	Background mg/L [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/L [g]
INORGANICS										
ALUMINUM	2/2 (100)	1.8	0.53 - 3.04	NA	NA	NA	<0.20 - 0.778	-	Y	3.04
CALCIUM	2/2 (100)	95	71.7 - 118	NA	NA	NA	74.2 - 98.1	A	N	-
IRON	2/2 (100)	3.4	0.972 - 5.79	NA	NA	NA	0.948 - 1.42	-	Y	5.79
LEAD	1/2 (50)	0.0051	0.0087	0.003	NA	NA	<0.003	-	Y	0.0087
MAGNESIUM	2/2 (100)	27	15.8 - 37.3	NA	NA	NA	16.0 - 36.9	A	N	-
MANGANESE	2/2 (100)	0.33	0.261 - 0.404	NA	NA	NA	0.0671 - 0.245	-	Y	0.404
SODIUM	2/2 (100)	19	13.7 - 24.7	NA	NA	NA	14.8 - 25.7	A	N	-
ZINC	1/2 (50)	0.034	0.058	0.02	NA	NA	<0.020 - 0.0202	-	Y	0.058
VOLATILE ORGANIC COMPOUNDS										
BROMOMETHANE	1/2 (50)	0.00056	0.00011	0.002	NA	NA	NA	-	Y	0.00011
MISCELLANEOUS										
HARDNESS	2/2 (100)	386	284 - 488	NA	NA	NA	328 - 432	--	--	--

[a] Surface water results from totals. Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/L - Milligrams per liter.
PRRWP - Pentolite Road Red Water Pond.

Table 3-9

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in PRRWP Area Sediment
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	2/2 (100)	3,980	2,830 - 5,130	NA	NA	NA	3,400 - 6,020	A	N	-
ARSENIC	2/2 (100)	4.7	4.3 - 5.1	NA	NA	NA	4.4 - 4.6	A	N	-
BARIUM	1/2 (50)	30.4	48.1	25.3	NA	NA	28.5 - 53.4	A	N	-
CALCIUM	2/2 (100)	54,150	46,300 - 62,000	NA	NA	NA	8,110 - 96,000	A	N	-
CHROMIUM	2/2 (100)	8.4	6.3 - 10.4	NA	NA	NA	6.8 - 11.5	A	N	-
COPPER	2/2 (100)	11.1	7.6 - 14.5	NA	NA	NA	7.4 - 17.9	A	N	-
IRON	2/2 (100)	11,660	9,620 - 13,700	NA	NA	NA	9,330 - 16,200	A	N	-
LEAD	2/2 (100)	6.3	4.8 - 7.8	NA	NA	NA	5.6 - 12.8	A	N	-
MAGNESIUM	2/2 (100)	16,400	13,500 - 19,300	NA	NA	NA	2,710 - 10,700	-	Y	19,300
MANGANESE	2/2 (100)	413	404 - 421	NA	NA	NA	104 - 865	A	N	-
NICKEL	2/2 (100)	13.7	9.5 - 17.9	NA	NA	NA	10.4 - 18.6	A	N	-
POTASSIUM	1/2 (50)	678	1,040	631	NA	NA	<663 - <1,310	-	Y	1,040
VANADIUM	2/2 (100)	13.6	12.9 - 14.2	NA	NA	NA	7.9 - 17.4	A	N	-
ZINC	2/2 (100)	40.8	23.2 - 58.4	NA	NA	NA	36.1 - 73.3	A	N	-
VOLATILE ORGANIC COMPOUNDS										
ACETONE	1/2 (50)	0.041	0.069	0.025	NA	NA	NA	-	Y	0.069
2-BUTANONE	1/2 (50)	0.014	0.015	0.025	NA	NA	NA	-	Y	0.015
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
ACENAPHTHENE	1/2 (50)	0.20	0.11	0.57	NA	NA	NA	-	Y	0.11
ANTHRACENE	1/2 (50)	0.18	0.077	0.57	NA	NA	NA	-	Y	0.077
CARBAZOLE	1/2 (50)	0.23	0.18	0.57	NA	NA	NA	-	Y	0.18
DIBENZOFURAN	1/2 (50)	0.17	0.06	0.57	NA	NA	NA	-	Y	0.06
FLUORANTHENE	1/2 (50)	0.21	0.14	0.57	NA	NA	NA	-	Y	0.14
FLUORENE	1/2 (50)	0.20	0.11	0.57	NA	NA	NA	-	Y	0.11
PHENANTHRENE	1/2 (50)	0.30	0.32	0.57	NA	NA	NA	-	Y	0.32
PYRENE	1/2 (50)	0.20	0.11	0.57	NA	NA	NA	-	Y	0.11
MISCELLANEOUS										
TOTAL ORGANIC CARBON	2/2 (100)	11,225	5,450 - 17,000	NA	NA	NA	12,000 - 33,000	--	--	--

[a] Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/kg - Milligrams per kilogram.
PRRWP - Pentolite Road Red Water Pond.

Table 3-10

Terrestrial Receptors Hazard Index Summary for Pentolite Road Area
Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Terrestrial Receptor						
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer	Hawk
Soil [a] HI	2.5	0.96	14	451	2.1	0.026	0.0011
Risk Drivers:	32% 1,3-DNB (invertebrate intake)	59% 1,3-DNB (plant intake)	45% Antimony (soil intake)	99% 4-ADNT (invertebrate intake)	33% 1,3-DNB (invertebrate intake)	63% Nitrobenzene (plant intake)	60% 4-ADNT (soil intake)
	19% 1,3-DNB (plant intake)	19% 1,3,5-TNB (plant intake)	26% 1,3-DNB (invertebrate intake)		18% 1,3-DNB (plant intake)		
Surface Water HI	1.6	1.7	1.1	0.32	4.0	1.8	0.0007
Risk Drivers:	96% Aluminum (water intake)	98% Aluminum (water intake)	96% Aluminum (water intake)	79% Iron (water intake)	96% Aluminum (water intake)	96% Aluminum (water intake)	79% Iron (water intake)
Total Receptor HI	4.1	2.7	15	451	6.1	1.8	0.0018

DNB - dinitrobenzene; 4-ADNT – 4-amino-2,6-dinitrotoluene
HI – Hazard index.

[a] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated COPEC via deep feeder roots.

Sources: IT, 2000.

Table 3-11

Aquatic Receptor Hazard Index Summary for Pentolite Road Area
Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Aquatic Receptor	
	Great Blue Heron	Raccoon
Sediment HI	9.0	20
Risk Drivers:	48% Potassium (invertebrate intake)	57% Carbazole (invertebrate intake)
	41% Magnesium (sediment intake)	21% Potassium (invertebrate intake)
Surface Water HI	117	18
Risk Drivers:	86% Iron (fish intake)	92% Aluminum (fish intake)
	10% Aluminum (fish intake)	11% Aluminum (water intake)
Total Receptor HI	126	38

HI – Hazard index.
Sources: IT, 2000.

Table 3-12

Terrestrial Receptors Hazard Index Summary for Pentolite Road Area[a]
Central Tendency and Reasonable Maximum Exposure
Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Terrestrial Receptor					
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer
Soil [b] HI	0.06 - 2.7[c]	0.07 - 3.2	0.01 - 0.3	0.01 - 0.5	0.05 - 2.2	0.002 - 0.03
Risk Drivers:	94% 1,3-DNB (plant intake for RME)	94% 1,3-DNB (plant intake for RME)	—	—	94% 1,3-DNB(plant intake for RME)	—
Surface Water HI	—[d]	—	—	—	—	—
Risk Drivers:	—	—	—	—	—	—
Total Receptor HI	0.06 - 2.7	0.07 - 3.2	0.01 - 0.3	0.01 - 0.5	0.05 - 2.2	0.002 - 0.03

DNB – Dinitrobenzene.
HI – Hazard index.

[a] Details presented in ecological risk assessment spreadsheets in Appendix H. Only risk drivers shown.
[b] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated chemicals of potential ecological concern (COPEC) via deep feeder roots.
[c] The lower value is the central tendency (CT) value and the higher value is the reasonable maximum exposure (RME) value.
[d] A "—" indicates no hazard estimate was performed due to COPEC(s) screened out due to background or low frequency of detection, or COPEC(s) toxicity values not available.

Notes :
(1) CT and RME approach assumptions include differences in exposure point concentrations; toxicity values; interclass toxicity uncertainty factor; and method of calculation of site-specific soil- to-invertebrate biological accumulation factor (see text for details).

(2) Red-tailed hawk not presented because screening-level ecological risk assessment HI values were all acceptable.

(3) Risk driver percentage based on intake pathway indicated.

Source: IT, 2001.

Table 4-1

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in WARWP Area Surface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	19 / 19	4720 - 20600	22.4 - 27.7	N	1.12E+04	1.30E+04	2.69E+04	7.60E+03	N (c)	--
ANTIMONY	2 / 40	7.4 - 7.4	5.4 - 8.3	NP	3.44E+00		9.30E+00	3.10E+01	N (a)	--
ARSENIC	36 / 40	2 - 11.5	1.1 - 4.3	NP	5.21E+00	6.08E+00	7.10E+01	3.90E-02	N (c)	--
BARIUM	16 / 19	24.8 - 130	22.4 - 27.7	N	6.45E+01		1.30E+03	5.40E+02	N (a)	--
BERYLLIUM	10 / 40	0.59 - 1.2	0.56 - 1.4	NP	5.72E-01		1.17E+00	1.50E+01	N (a)	--
CADMIUM	1 / 40	0.59 - 0.59	0.56 - 1.4	NP	4.60E-01			3.70E+00	N (a)	--
CALCIUM	19 / 19	757 - 58600	559 - 693	NP	9.64E+03			Nutrient	N (b)	--
CHROMIUM	40 / 40	5.4 - 35	1.1 - 1.4	L	1.67E+01	1.87E+01	2.90E+01	2.10E+01 [g]	Y	1.87E+01
COBALT	13 / 19	8.5 - 17.9	5.6 - 6.9	NP	9.83E+00		2.48E+02	4.70E+02	N (a)	--
COPPER	36 / 40	2.4 - 30.9	2.2 - 3.5	L	9.62E+00		1.47E+02	2.90E+02	N (a)	--
IRON	19 / 19	7190 - 36000	11.2 - 13.9	N	1.91E+04			Nutrient	N (b)	--
LEAD	40 / 40	2.2 - 23	0.34 - 3.6	N	1.20E+01		5.13E+01	4.00E+02	N (a)	--
MAGNESIUM	18 / 19	684 - 12200	559 - 693	L	3.89E+03			Nutrient	N (b)	--
MANGANESE	40 / 40	89.6 - 1340	1.7 - 5.8	L	4.69E+02	6.02E+02	3.51E+03	1.80E+02	N (c)	--
MERCURY	4 / 40	0.04 - 0.1	0.037 - 0.36	NP	9.18E-02		5.60E-01	2.30E+00	N (a)	--
NICKEL	40 / 40	7.1 - 46.9	2.2 - 5.5	L	2.14E+01		7.79E+01	1.60E+02	N (a)	--
POTASSIUM	14 / 19	742 - 2970	559 - 693	N	1.43E+03			Nutrient	N (b)	--
SELENIUM	1 / 40	0.65 - 0.65	0.56 - 5.8	NP	1.41E+00		2.00E+00	3.90E+01	N (a)	--
SODIUM	1 / 19	681 - 681	559 - 693	NP	3.13E+02			Nutrient	N (b)	--
VANADIUM	19 / 19	10.1 - 40.5	5.6 - 6.9	L	2.53E+01		8.31E+01	5.50E+01	N (a)	--
ZINC	39 / 40	15.9 - 111	2.2 - 2.9	N	5.87E+01		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1 / 40	0.3 - 0.3	0.25 - 0.25	NP	1.29E-01			3.70E-01 [h]	N (a)	--
1,3-DINITROBENZENE	1 / 40	0.3 - 0.3	0.25 - 0.25	NP	1.29E-01			6.10E-01	N (a)	--
2,4-DINITROTOLUENE	4 / 40	0.3 - 0.4	0.25 - 0.25	NP	1.43E-01	4.00E-01		7.20E-02	Y	4.00E-01
1,3,5-TRINITROBENZENE	3 / 40	0.3 - 0.7	0.25 - 0.25	NP	1.56E-01			1.80E+02	N (a)	--
2,4,6-TRINITROTOLUENE	1 / 40	0.3 - 0.3	0.25 - 0.25	NP	1.29E-01			1.60E+00	N (a)	--
Semivolatile Organics										--
ACENAPHTHYLENE	1 / 10	0.041 - 0.041	0.37 - 0.4	NP	1.77E-01			3.70E+02 [h]	N (a)	--
ANTHRACENE	1 / 10	0.23 - 0.23	0.37 - 0.4	NP	1.96E-01			2.20E+03	N (a)	--
BENZO(A)ANTHRACENE	1 / 10	0.4 - 0.4	0.37 - 0.4	NP	2.13E-01	4.00E-01		6.20E-02	Y	4.00E-01
BENZO(A)PYRENE	1 / 10	0.39 - 0.39	0.37 - 0.4	NP	2.12E-01	3.90E-01		6.20E-03	Y	3.90E-01
BENZO(B)FLUORANTHENE	1 / 10	0.3 - 0.3	0.37 - 0.4	NP	2.03E-01	3.00E-01		6.20E-02	Y	3.00E-01
BENZO(GHI)PERYLENE	1 / 10	0.22 - 0.22	0.37 - 0.4	NP	1.95E-01			2.30E+02 [h]	N (a)	--
BENZO(K)FLUORANTHENE	1 / 10	0.35 - 0.35	0.37 - 0.4	NP	2.08E-01			6.20E-01	N (a)	--
CHRYSENE	1 / 10	0.42 - 0.42	0.37 - 0.4	NP	2.15E-01			6.20E+00	N (a)	--
FLUORANTHENE	1 / 10	0.76 - 0.76	0.37 - 0.4	NP	2.49E-01			2.30E+02	N (a)	--
INDENO(1,2,3-CD)PYRENE	1 / 10	0.23 - 0.23	0.37 - 0.4	NP	1.96E-01	2.30E-01		6.20E-02	Y	2.30E-01

Table 4-1

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in WARWP Area Surface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
PHENANTHRENE	1 / 10	0.36 - 0.36	0.37 - 0.4	NP	2.09E-01			2.30E+02 [h]	N (a)	--
PYRENE	1 / 10	0.55 - 0.55	0.37 - 0.4	NP	2.28E-01			2.30E+02	N (a)	--
Volatile Organics										
ACETONE	1 / 10	0.035 - 0.035	0.022 - 0.024	NP	1.40E-02			1.60E+02	N (a)	--
METHYLENE CHLORIDE	3 / 10	0.00185 - 0.0023	0.0056 0.006	L	1.50E-03			8.90E-01	N (a)	--
TOLUENE	3 / 10	0.0018 - 0.0032	0.0056 - 0.006	NP	2.76E-03			5.20E+01	N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per kilogram.
WARWP - West Area Red Water Ponds.

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the beginning depth of the sample.
[b] Method of estimation based on statistical distribution.
[c] Based on upper tolerance limit of background data set.
[d] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3, 1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk-Based Screening concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.
[f] Y = Chemical is chosen as COPC.
[g] Based on PRG for total chromium.
[h] Based on PRG for mixed dinitrotoluene.

Table 4-2

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in WARWP Area Subsurface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	37 / 37	5080 - 21000	22.5 - 27.1	L	1.07E+04	1.19E+04	2.69E+04	7.60E+03	N (c)	--
ANTIMONY	1 / 56	7.7 - 7.7	5.3 - 8.1	L*	3.49E+00	3.51E+00	9.30E+00	3.10E+00	N (c)	--
ARSENIC	52 / 56	2.2 - 23.6	1.1 - 4	L	6.89E+00	8.03E+00	7.10E+01	3.90E-02	N (c)	--
BARIUM	36 / 37	27.9 - 165	22.5 - 27.1	L	6.24E+01		1.30E+03	5.40E+02	N (a)	--
BERYLLIUM	12 / 56	0.59 - 1	0.56 - 1.3	N	4.97E-01		1.17E+00	1.50E+01	N (a)	--
CADMIUM	2 / 56	0.68 - 1.4	0.56 - 1.3	L	4.24E-01			3.70E+00	N (a)	--
CALCIUM	37 / 37	1220 - 67600	562 - 678	NP	2.04E+04			Nutrient	N (b)	--
CHROMIUM	56 / 56	7.5 - 29	1.1 - 1.4	L	1.65E+01	1.78E+01	2.90E+01	2.10E+01 [g]	Y	1.78E+01
COBALT	34 / 37	6 - 21	5.6 - 6.8	N	1.04E+01		2.48E+02	4.70E+02	N (a)	--
COPPER	52 / 56	2.4 - 34.7	2.1 - 3.4	N	1.46E+01		1.47E+02	2.90E+02	N (a)	--
IRON	37 / 37	8490 - 34000	11.2 - 13.6	N	2.10E+04	2.29E+04		Nutrient	N (b)	--
LEAD	56 / 56	4.4 - 20	0.34 - 3.3	L	9.99E+00		5.13E+01	4.00E+02	N (a)	--
MAGNESIUM	37 / 37	832 - 23400	562 - 678	NP	7.39E+03			Nutrient	N (b)	--
MANGANESE	56 / 56	83.4 - 1900	1.7 - 5.3	L	4.34E+02	5.06E+02	3.51E+03	1.80E+02	N (c)	--
NICKEL	56 / 56	7.4 - 45	2.1 - 5.4	N	2.45E+01		7.79E+01	1.60E+02	N (a)	--
POTASSIUM	34 / 37	643 - 5630	562 - 678	L	1.82E+03			Nutrient	N (b)	--
SODIUM	6 / 37	619 - 1270	562 - 678	NP	4.01E+02			Nutrient	N (b)	--
VANADIUM	37 / 37	13.9 - 40.3	5.6 - 6.8	L	2.57E+01		8.31E+01	5.50E+01	N (a)	--
ZINC	56 / 56	26.5 - 94.6	2.1 - 2.7	N	5.77E+01		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
2-AMINO-4,6-DINITROTOLUENE	1 / 19	0.5 - 0.5	0.25 - 0.25	NP	1.45E-01	5.00E-01		3.70E-01	Y	5.00E-01
4-AMINO-2,6-DINITROTOLUENE	5 / 56	0.3 - 0.7	0.25 - 1.2	L*	1.63E-01	6.00E-01		3.70E-01	Y	6.00E-01
1,3-DINITROBENZENE	6 / 56	0.3 - 2.4	0.25 - 1.2	L*	2.65E-01	2.12E+00		6.10E-01	Y	2.12E+00
2,4-DINITROTOLUENE	11 / 56	0.3 - 6.3	0.25 - 1.2	L*	5.07E-01	3.09E+00		7.20E-02 [h]	Y	3.09E+00
2,6-DINITROTOLUENE	3 / 56	0.3 - 1.5	0.25 - 1.2	L*	1.66E-01	1.50E+00		7.20E-02 [h]	Y	1.50E+00
3,4-DINITROTOLUENE	2 / 19	0.3 - 0.5	0.25 - 0.25	NP	1.54E-01	5.00E-01		7.20E-02 [h]	Y	5.00E-01
1,3,5-TRINITROBENZENE	19 / 56	0.28 - 5.5	0.25 - 1.2	L	7.06E-01			1.80E+02	N (a)	--
2,4,6-TRINITROTOLUENE	5 / 56	0.3 - 2.1	0.25 - 1.2	L	1.84E-01			1.60E+01	N (a)	--
Semivolatile Organics										
ACENAPHTHYLENE	1 / 9	0.04 - 0.04	0.38 - 0.42	NP	1.83E-01			3.70E+02	N (a)	--
ANTHRACENE	1 / 9	0.12 - 0.12	0.38 - 0.42	NP	1.92E-01			2.20E+03	N (a)	--
BENZO(A)ANTHRACENE	1 / 9	0.17 - 0.17	0.38 - 0.42	NP	1.97E-01	2.05E-01		6.20E-02	Y	1.70E-01
BENZO(A)PYRENE	1 / 9	0.14 - 0.14	0.38 - 0.42	NP	1.94E-01	1.96E-01		6.20E-03	Y	1.40E-01
BENZO(B)FLUORANTHENE	1 / 9	0.14 - 0.14	0.38 - 0.42	NP	1.94E-01	1.96E-01		6.20E-02	Y	1.40E-01
BENZO(GHI)PERYLENE	1 / 9	0.076 - 0.076	0.38 - 0.42	NP	1.87E-01			2.30E+02	N (a)	--
BENZO(K)FLUORANTHENE	1 / 9	0.11 - 0.11	0.38 - 0.42	NP	1.91E-01			6.20E-01	N (a)	--

Table 4-2

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in WARWP Area Subsurface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
CHRYSENE	1 / 9	0.17 - 0.17	0.38 - 0.42	NP	1.97E-01			6.20E+00	N (a)	--
FLUORANTHENE	2 / 9	0.058 - 0.38	0.38 - 0.42	NP	2.05E-01			2.30E+02	N (a)	--
INDENO(1,2,3-CD)PYRENE	1 / 9	0.076 - 0.076	0.38 - 0.42	NP	1.87E-01	1.96E-01		6.20E-02	Y	7.60E-02
PHENANTHRENE	1 / 9	0.25 - 0.25	0.38 - 0.42	NP	2.06E-01			2.30E+02	N (a)	--
PYRENE	2 / 9	0.043 - 0.28	0.38 - 0.42	NP	1.93E-01			2.30E+02	N (a)	--
Volatile Organics										
METHYLENE CHLORIDE	1 / 9	0.002 - 0.002	0.0057 - 0.0064	NP	2.91E-03			8.90E-01	N (a)	--
TOLUENE	5 / 9	0.0015 - 0.0025	0.0057 - 0.0064	N	2.51E-03			5.20E+01	N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per killogram.
WARWP - West Area Red Water Pond.

[a] Subsurface soil is defined as the interval from 2 to 10 feet below the ground surface.
[b] Method of estimation based on statistical distribution.
[c] Based on upper tolerance limit of background data set.
[d] Residential Soil PRGs from EPA, 1999, "Region 9 Preliminary Remediation Goals (PRGs), December 3, 1999," adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk-Based Screening concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.
[f] Y = Chemical is chosen as COPC.
[g] Based on PRG for total chromium.
[h] Based on PRG for mixed dinitrotoluene.

Table 4-3

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in WARWP Area Surface Water
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (μg/L)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL[b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]		COPC? [e,f]	Source Term Concentration
Inorganics											
ALUMINUM	3 / 4	300 - 13800	200 - 200	NA	6.65E+03		3.04E+03	3.60E+04		N (a)	--
ARSENIC	2 / 9	20.2 - 21.8	10 - 30	NP	1.41E+01	1.50E+01		4.50E-02		Y	1.50E+01
CALCIUM	4 / 4	31100 - 115000	5000 - 5000	NA	8.93E+04			Nutrient		N (b)	--
CHROMIUM	3 / 9	10 - 23.3	10 - 10	NP	8.97E+00			1.10E+02	g	N (a)	--
IRON	4 / 4	646 - 21100	100 - 100	NA	1.04E+04			Nutrient		N (b)	--
LEAD	3 / 9	25 - 77	3 - 25	NP	2.09E+01	7.70E+01		1.50E+01	h	Y	7.70E+01
MAGNESIUM	4 / 4	25800 - 50700	5000 - 5000	NA	3.73E+04			Nutrient		N (b)	--
MANGANESE	9 / 9	126 - 1600	15 - 40	NP	6.25E+02	1.60E+03	8.90E+02	8.80E+02		Y	1.60E+03
NICKEL	1 / 9	20 - 20	20 - 40	NP	1.56E+01			7.30E+02		N (a)	--
POTASSIUM	4 / 4	5180 - 9910	5000 - 5000	NA	7.61E+03			Nutrient		N (b)	--
SODIUM	4 / 4	38300 - 107000	5000 - 5000	NA	7.21E+04			Nutrient		N (b)	--
VANADIUM	1 / 4	52.2 - 52.2	50 - 50	NA	3.18E+01			2.60E+02		N (a)	--
ZINC	7 / 9	20 - 92.5	20 - 20	NP	4.44E+01		5.80E+01	1.10E+04		N (a)	--
Nitroaromatics											
4-AMINO-2-NITROTOLUENE	1 / 5	0.6 - 0.6	0.55 - 0.55	NP	3.40E-01			2.00E+00		N (a)	--
1,3-DINITROBENZENE	1 / 9	0.3 - 0.3	0.15 - 0.2	NP	1.11E-01			3.60E+00		N (a)	--
2,4-DINITROTOLUENE	1 / 9	0.5 - 0.5	0.1 - 0.2	NP	1.22E-01	5.00E-01		9.90E-02	i	Y	5.00E-01
2,6-DINITROTOLUENE	1 / 9	0.8 - 0.8	0.1 - 0.2	NP	1.56E-01	8.00E-01		9.90E-02	i	Y	8.00E-01
3,4-DINITROTOLUENE	4 / 5	0.5 - 0.6	0.21 - 0.21	NP	4.81E-01	6.00E-01		9.90E-02	i	Y	6.00E-01
3-NITROTOLUENE	4 / 9	2.3 - 54	0.2 - 1.4	L	6.92E+00			6.10E+01		N (a)	--
Semivolatile Organics											
DI-n-OCYLPHTHALATE	1 / 4	7.8 - 7.8	10 - 10	NA	5.70E+00			7.30E+02		N (a)	--
Volatile Organics											
BROMOMETHANE	4 / 4	0.16 - 0.21	2 - 2	NA	1.85E-01			8.70E+00		N (a)	--

UCL - Upper confidence limit.
COPC - Chemical of potential concern.
NA - Not applicable.
μg/L - Micrograms per liter.
WARWP - West Area Red Water Pond.

[a] Statistical Distribution: L = Lognormal distribution; NP = Nonparametric distribution; NA = sample size is less than 5 and distribution is not characterized.
[b] Method of estimation based on statistical distribution.
[c] Based on background data set.
[d] EPA, 1999, Region IX Preliminary Remediation Goals (PRGs), December 3, 1999, S. J. Smucker, Ph.D., unadjusted tap water PRGs.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk Based Screening concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.
[f] Y = Chemical is chosen as COPC.
[g] RBSC based on the PRG for chromium VI.
[h] EPA, 1996, ***Drinking Water Regulations and Health Advisories***, Office of Water, Washington, DC, October.
[i] Based on PRG for mixed dinitrotoluene.

Table 4-4

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Concern in WARWP Area Sediment
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentration	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	4 / 4	3230 - 9600	24.2 - 98.5	NA	5.99E+03		6.02E+03	7.60E+04	N (a)	--
ARSENIC	9 / 17	4 - 11.3	1.2 - 4.9	NP	4.58E+00	8.38E+00	5.40E+00	3.90E-01	Y	8.38E+00
BARIUM	3 / 4	34.8 - 65	24.2 - 98.5	NA	4.63E+01		5.34E+01	5.40E+03	N (a)	--
CALCIUM	4 / 4	6710 - 74700	606 - 2460	NA	2.74E+04			Nutrient	N (b)	--
CHROMIUM	17 / 17	7.4 - 28.7	1.2 - 4.9	L	1.51E+01		1.15E+01	2.10E+02 [g]	N (a)	--
COBALT	2 / 4	10.6 - 10.8	6.1 - 24.6	NA	1.01E+01		1.09E+01	4.70E+03	N (a)	--
COPPER	7 / 17	3.2 - 24.5	2.4 - 12.3	NP	5.24E+00		1.79E+01	2.90E+03	N (a)	--
IRON	4 / 4	16000 - 24300	12.1 - 49.3	NA	1.87E+04			Nutrient	N (b)	--
LEAD	17 / 17	8.1 - 32.1	0.36 - 4	L	1.60E+01		1.28E+01	4.00E+02	N (a)	--
MAGNESIUM	4 / 4	2520 - 6770	606 - 2460	NA	3.84E+03			Nutrient	N (b)	--
MANGANESE	17 / 17	149 - 726	1.8 - 7.4	NP	2.49E+02		8.65E+02	1.80E+03	N (a)	--
NICKEL	17 / 17	8.8 - 24.5	2.4 - 19.7	N	1.77E+01		2.30E+01	1.60E+03	N (a)	--
POTASSIUM	2 / 5	821 - 1500	27 - 2460	N	9.04E+02			Nutrient	N (b)	--
VANADIUM	1 / 4	25 - 25	6.1 - 24.6	NA	9.54E+00		1.74E+01	5.50E+02	N (a)	--
ZINC	17 / 17	36 - 94	2.4 - 9.9	L	6.09E+01		7.33E+01	2.30E+04	N (a)	--
Nitroaromatics										
2-AMINO-4,6-DINITROTOLUENE	1 / 17	0.3 - 0.3	0.25 - 0.25	NP	1.35E-01			3.70E+00	N (a)	--
1,3-DINITROBENZENE	4 / 17	0.3 - 0.7	0.25 - 0.25	NP	2.37E-01			6.10E+00	N (a)	--
2,4-DINITROTOLUENE	6 / 17	0.3 - 0.7	0.25 - 0.25	NP	2.57E-01			7.20E-01 [h]	N (a)	--
2,6-DINITROTOLUENE	1 / 17	0.4 - 0.4	0.25 - 0.26	NP	1.45E-01			7.20E-01 [h]	N (a)	--
1,3,5-TRINITROBENZENE	3 / 17	0.6 - 0.8	0.25 - 0.25	NP	2.21E-01			1.80E+03	N (a)	--
Semivolatile Organics										
FLUORANTHENE	1 / 4	0.047 - 0.047	0.4 - 1.6	NA	3.79E-01			2.30E+03	N (a)	--
Volatile Organics										
2-BUTANONE	2 / 4	0.021 - 0.029	0.024 - 0.099	NA	2.79E-02			7.30E+03	N (a)	--
ACETONE	2 / 2	0.071 - 0.11	0.053 - 0.099	NA	9.05E-02			1.60E+03	N (a)	--

COPC - Chemical of potential concern.
UCL - Upper confidence limit.
mg/kg - Milligrams per kilogram.
WARWP - West Area Red Water Pond.

[a] Statistical Distribution: L = Lognormal distribution; NP = Nonparametric distribution; NA = sample size is less than 5 and distribution is not characterized.
[b] Method of estimation based on statistical distribution.
[c] Based on background data set.
[c] EPA, 1999, Region IX Preliminary Remediation Goals (PRGs), December 3, 1999, S. J. Smucker, Ph.D., unadjusted residential soil PRG.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the Risk-Based Screening concentration (RBSC).
(b) = essential nutrient.
(c) = maximum concentration is less than background screening criterion.
[f] Y = Chemical is chosen as COPC.
[g] RBSC based on the PRG for total chromium.

Table 4-5

Summary of Total Hazard and Total Cancer Risk from Site-Related Chemicals of Potential Concern, WARWP Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Groundskeeper		Indoor Worker		Construction Worker		On-Site Resident	
Contaminant Source	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR
Surface Soil	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA
Total Soil	NA	NA	NA	NA	2.19E-01	5.84E-07	6.15E-01	1.51E-05
Surface Water	NA	NA	NA	NA	8.92E-02	2.28E-08	4.41E-02	4.36E-07
Sediment	NA	NA	NA	NA	6.65E-02	2.14E-07	5.41E-03	3.05E-07
Total across all media	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**3.74E-01**	**8.21E-07**	**6.65E-01**	**1.58E-05**

HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
NA - Not applicable.
WARWP - West Area Red Water Pond.

Source: IT, 2000.

Table 4-6

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in WARWP Area Surface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
INORGANICS										
ALUMINUM	19/19 (100)	11,194	4,720 - 20,600	NA	N	13,033	26,879	A	N	-
ANTIMONY	2/40 (5.0)	3.4	7.4	5.4 - 8.3	U	< 6.8	7.88	A, B	N	-
ARSENIC	36/40 (90)	5.2	2 - 11.5	3.4 - 3.7	N	5.9	70.80	A	N	-
BARIUM	16/19 (84)	64.5	24.8 - 130	22.4 - 23.2	N	79	431.00	A	N	-
BERYLLIUM	10/40 (25)	0.57	0.59 - 1.2	0.56 - 1.4	U	< 1.2	0.96	-	Y	0.6
CADMIUM	1/40 (2.5)	0.46	0.59	0.56 - 1.4	U	< 1.2	1.2	A, B	N	-
CALCIUM	19/19 (100)	9,642	757 - 58,600	NA	L	20,541	218,208	A	N	-
CHROMIUM	40/40 (100)	16.7	5.4 - 35	NA	L	18.7	36.00	A	N	-
COBALT	13/19 (68)	9.8	8.5 - 17.9	5.6 - 6.9	N	12	66.10	A	N	-
COPPER	36/40 (90)	9.6	2.4 - 30.9	2.3 - 2.5	L	14.4	147.00	A	N	-
IRON	19/19 (100)	19,061	7,190 - 36,000	NA	N	22,187	358,040	A	N	-
LEAD	40/40 (100)	12.0	2.2 -23	NA	N	13.3	51.20	A	N	-
MAGNESIUM	18/19 (95)	3,888	684 - 12,200	579	L	7,419	30,765	A	N	-
MANGANESE	40/40 (100)	469	89.6 - 1,340	NA	L	602	3,494	A	N	-
MERCURY	4/40 (10)	0.092	0.04 - 0.1	0.037 - 0.36	U	< 0.3	0.15	A	N	-
NICKEL	40/40 (100)	21.4	7.1 - 46.9	NA	L	25.1	78.21	A	N	-
POTASSIUM	14/19 (74)	1,431	742 - 2,970	559 - 693	N	1,803	6,078	A	N	-
SELENIUM	1/40 (2.5)	1.4	0.65	0.56 - 5.8	U	< 4.7	2.39	A	N	-
SODIUM	1/19 (5.3)	313	681	559 - 693	U	< 597	319	-	Y	298.5
VANADIUM	19/19 (100)	25.3	10.1 - 40.5	NA	L	29.8	83.10	A	N	-
ZINC	39/40 (98)	58.7	15.9 - 111	2.5	N	65.4	321.00	A	N	-
VOLATILE ORGANIC COMPOUNDS										
ACETONE	1/10 (10)	0.014	0.035	0.022 - 0.024	U	< 0.024	NA	-	Y	0.012
METHYLENE CHLORIDE	10/10 (100)	0.0015	0.0009 - 0.0023	NA	L	0.0019	NA	-	Y	0.0019
TOLUENE	3/10 (30)	0.0028	0.0018 - 0.0032	0.0056 - 0.006	U	0.0023	NA	-	Y	0.0023
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	1/40 (2.5)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	3/40 (7.5)	0.16	0.3 - 0.7	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	4/50 (8.0)	0.15	0.043 - 0.4	0.25 - 0.4	U	< 0.25	NA	-	Y	0.125
2,4,6-TRINITROTOLUENE	1/42 (2.4)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DITROTOLUENE	1/40 (2.5)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
ACENAPHTHYLENE	1/10 (10)	0.18	0.041	0.37 - 0.4	U	< 0.4	0.005	-	Y	0.041
ANTHRACENE	1/10 (10)	0.20	0.23	0.37 - 0.4	U	< 0.4	0.011 - 0.013	-	Y	0.2
BENZO(A)ANTHRACENE	1/10 (10)	0.21	0.40	0.37 - 0.4	U	< 0.4	0.056 - 0.11	-	Y	0.2
BENZO(A)PYRENE	1/10 (10)	0.21	0.39	0.37 - 0.4	U	< 0.4	0.0046 - 0.9	-	N	-
BENZO(B)FLUORANTHENE	1/10 (10)	0.20	0.3	0.37 - 0.4	U	< 0.4	0.058 - 0.22	-	Y	0.2
BENZO(GHI)PERYLENE	1/10 (10)	0.19	0.22	0.37 - 0.4	U	< 0.4	0.066	-	Y	0.2
BENZO(K)FLUORANTHENE	1/10 (10)	0.21	0.35	0.37 - 0.4	U	< 0.4	0.058 - 0.25	-	Y	0.2
CHRYSENE	1/10 (10)	0.21	0.42	0.37 - 0.4	U	< 0.4	0.078 - 0.12	-	Y	0.2
FLUORANTHENE	1/10 (10)	0.25	0.76	0.37 - 0.4	U	< 0.4	0.12 - 0.21	-	Y	0.2

Table 4-6

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in WARWP Area Surface Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
INDENO(1,2,3-CD)PYRENE	1/10 (10)	0.20	0.23	0.37 - 0.4	U	< 0.4	0.063 - 0.1	-	Y	0.2
PHENANTHRENE	1/10 (10)	0.21	0.36	0.37 - 0.4	U	< 0.4	0.048 - 0.14	-	Y	0.2
PYRENE	1/10 (10)	0.23	0.55	0.37 - 0.4	U	< 0.4	0.099 - 0.15	-	Y	0.2

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = Distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background upper tolerance limit concentration for inorganic constituents are based on site data. Polycyclic aromatic hydrocarbons from Agency for Toxic Substances and Disease Registry (agricultural soil).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/kg - Milligrams per kilogram.
WARWP - West Area Red Water Pond.
Source: IT, 2000a.

Table 4-7
Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in WARWP Area Total Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
INORGANICS										
ALUMINUM	38/38 (100)	10,168	4,720 - 20,600	NA	L	11,423	26,879	A	N	-
ANTIMONY	2/74 (2.7)	3.4	7.4 - 7.4	5.3 - 8.3	U	< 6.9	7.88	A,B	N	-
ARSENIC	68/74 (92)	5.7	2.0 - 23.6	3.4 - 3.7	L	6.4	70.8	A	N	-
BARIUM	35/38 (92)	59.4	24.8 - 130	22.4 - 23.2	N	67.7	431	A	N	-
BERYLLIUM	12/74 (16)	0.52	0.59 - 1.2	0.56 - 1.4	U	< 1.2	0.96	-	Y	0.6
CADMIUM	2/74 (2.7)	0.46	0.59 - 1.4	0.56 - 1.4	U	< 1.1	1.2	-	Y	0.55
CALCIUM	38/38 (100)	10,080	757 - 58,600	NA	U	3,760	218,208	A	N	-
CHROMIUM	74/74 (100)	16	5.4 - 35.0	NA	L	17.2	36.0	A	N	-
COBALT	30/38 (79)	9.6	6.0 - 21.0	5.6 - 6.9	N	11.0	66.1	A	N	-
COPPER	68/74 (92)	10.4	2.4 - 30.9	2.3 - 2.9	L	13.7	147	A	N	-
IRON	38/38 (100)	18,917	7,190 - 36,000	NA	N	20,859	358,040	A	N	-
LEAD	74/74 (100)	10.9	2.2 - 23.0	NA	N	11.8	51.2	A	N	-
MAGNESIUM	37/38 (97)	4,470	684 - 23,400	579	L	6,171	30,765	A	N	-
MANGANESE	74/74 (100)	425	83.4 - 1,340	NA	L	498	3,494	A	N	-
MERCURY	4/74 (5.4)	0.084	0.04 - 0.1	0.037 - 0.36	U	< 0.29	0.15	A	N	-
NICKEL	74/74 (100)	21.4	7.1 - 46.9	NA	L	23.7	78.21	A	N	-
POTASSIUM	31/38 (82)	1,326	643 - 2,970	559 - 693	N	1,536	6,078	A	N	-
SELENIUM	1/74 (1.4)	1.3	0.65	0.56 - 5.8	U	< 4.5	2.39	A,B	N	-
SODIUM	3/38 (7.9)	345	681 - 1,270	559 - 693	U	< 598	319	-	Y	299
VANADIUM	38/38 (100)	24.2	10.1 - 40.5	NA	L	26.6	83.1	A	N	-
ZINC	73/74 (99)	56.1	15.9 - 111	2.5	N	60.2	321	A	N	-
VOLATILE ORGANIC COMPOUNDS										
ACETONE	1/18 (5.6)	0.013	0.035	0.022 - 0.025	U	< 0.024	NA	-	Y	0.012
METHYLENE CHLORIDE	11/18 (61)	0.0021	0.0009 - 0.0023	0.0057 - 0.0063	N	0.0024	NA	-	Y	0.0024
TOLUENE	7/18 (39)	0.0026	0.0015 - 0.0032	0.0056 - 0.0062	U	0.0018	NA	-	Y	0.0018
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	5/74 (6.8)	0.20	0.3 - 2.4	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	13/74 (18)	0.42	0.3 - 5.5	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	11/92 (12)	0.27	0.043 - 5.1	0.25 - 0.41	U	< 0.25	NA	-	Y	0.125
2,6-DINITROTOLUENE	2/92 (2.2)	0.16	0.3 - 1.5	0.25 - 0.41	U	< 0.26	NA	-	Y	0.13
2,4,6-TRINITROTOLUENE	5/74 (6.8)	0.14	0.3 - 0.4	0.25	U	< 0.25	NA	-	Y	0.125
3,4-DINITROTOLUENE	1/36 (2.8)	0.14	0.5	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DITROTOLUENE	6/74 (8.1)	0.15	0.3 - 0.7	0.25	U	< 0.25	NA	-	Y	0.125
ACENAPHTHYLENE	2/18 (11)	0.18	0.04 - 0.041	0.37 - 0.41	U	< 0.4	0.005	-	Y	0.2
ANTHRACENE	2/18 (11)	0.19	0.12 - 0.23	0.37 - 0.41	U	< 0.4	0.011 - 0.013	-	Y	0.2
BENZO(A)ANTHRACENE	2/18 (11)	0.21	0.17 - 0.4	0.37 - 0.41	U	< 0.4	0.056 - 0.11	-	Y	0.2
BENZO(A)PYRENE	2/18 (11)	0.20	0.14 - 0.39	0.37 - 0.41	U	< 0.4	0.0046 - 0.9	A	N	-
BENZO(B)FLUORANTHENE	2/18 (11)	0.20	0.14 - 0.3	0.37 - 0.41	U	< 0.4	0.058 - 0.22	-	Y	0.2
BENZO(GHI)PERYLENE	2/18 (11)	0.19	0.076 - 0.22	0.37 - 0.41	U	< 0.4	0.066	-	Y	0.2
BENZO(K)FLUORANTHENE	2/18 (11)	0.20	0.11 - 0.35	0.37 - 0.41	U	< 0.4	0.058 - 0.25	-	Y	0.2
CHRYSENE	2/18 (11)	0.21	0.17 - 0.42	0.37 - 0.41	U	< 0.4	0.078 - 0.12	-	Y	0.2
FLUORANTHENE	3/18 (17)	0.23	0.058 - 0.76	0.37 - 0.41	U	< 0.4	0.12 - 0.21	-	Y	0.2
INDENO(1,2,3-CD)PYRENE	2/18 (11)	0.19	0.076 - 0.23	0.37 - 0.41	U	< 0.4	0.063 - 0.1	-	Y	0.2

Table 4-7
Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in WARWP Area Total Soil[a]
Former Plum Brook Ordnance Works, Sandusky, Ohio

PHENANTHRENE	2/18 (11)	0.21	0.25 - 0.36	0.37 - 0.41	U	< 0.4	0.048 - 0.14	-	Y	0.2
PYRENE	3/18 (17)	0.21	0.043 - 0.55	0.37 - 0.41	U	< 0.4	0.099 - 0.15	-	Y	0.2

mg/kg - Milligrams per kilogram; WARWP - West Area Red Water Pond.

[a] Total soil is defined as the interval from 0 to 6 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = Distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background UTL concentration for inorganic constituents are based on site data. Background PAHs from ATSDR (agricultural soil).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 4-8

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in WARWP Area Surface Water
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/L	Range of values, mg/L Detected	Range of values, mg/L Nondetected	Statistical Distribution [b]	95% UCL mg/L [c]	Background mg/L [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/L [g]
INORGANICS										
ALUMINUM	3/4 (75)	6.6	0.3 - 13.8	0.20	L	1.4E+12	<0.20 - 0.631	-	Y	13.8
ARSENIC	2/9 (22)	0.014	0.0202 - 0.0218	0.010 - 0.030	N	0.0177	<0.010	-	Y	0.0177
CALCIUM	4/4 (100)	89	31.1 - 115	NA	N	135	106 - 107	A	N	-
CHROMIUM	3/9 (33)	0.009	0.010 - 0.0233	0.01	U	0.0233	<0.010	-	Y	0.0233
IRON	4/4 (100)	10.4	0.646 - 21.1	NA	N	23.6	0.126 - 1.3	-	Y	21.1
LEAD	3/9 (33)	0.021	0.025 - 0.077	0.003 - 0.025	L	0.168	<0.003	-	Y	0.077
MAGNESIUM	4/4 (100)	37	25.8 - 50.7	NA	N	52.8	26 - 26.5	-	Y	50.7
MANGANESE	9/9 (100)	0.63	0.126 - 1.60	NA	L	1.95	0.0306 - 0.89	-	Y	1.6
NICKEL	1/9 (11)	0.016	0.02	0.020 - 0.040	U	0.02	<0.040	A	N	-
POTASSIUM	4/4 (100)	7.6	5.18 - 9.91	NA	L	14.1	9.4 - 9.73	A	N	-
SODIUM	4/4 (100)	72	38.3 - 107	NA	N	117.5	38.2 - 39.3	-	Y	107
VANADIUM	1/4 (25)	0.032	0.0522	0.05	U	0.0522	<0.050	-	Y	0.0522
ZINC	5/9 (56)	0.042	0.043 - 0.0925	0.02	N	0.0629	<0.020 - 0.027	-	Y	0.0629
VOLATILE ORGANIC COMPOUNDS										
BROMOMETHANE	4/4 (100)	0.00018	0.00016 - 0.00021	NA	L	0.00023	NA	-	Y	0.00021
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	1/9 (11)	0.00011	0.0003	0.00015 - 0.0002	U	0.0003	NA	-	Y	0.0003
2,4-DINITROTOLUENE	1/9 (11)	0.00012	0.0005	0.0001 - 0.0002	U	0.0005	NA	-	Y	0.0005
2,6-DINITROTOLUENE	1/9 (11)	0.00016	0.0008	0.0001 - 0.0002	U	0.0008	NA	-	Y	0.0008
3,4-DINITROTOLUENE	4/5 (80)	0.00048	0.0005 - 0.0006	0.00021	U	0.0006	NA	-	Y	0.0006
3-NITROTOLUENE	4/9 (44)	0.0069	0.0023 - 0.054	0.0002 - 0.0014	L	1.007	NA	-	Y	0.054
4-AMINO-2-NITROTOLUENE	1/5 (20)	0.00034	0.0006	0.00055	U	0.0006	NA	-	Y	0.0006
DI-n-OCTYLPHTHALATE	1/4 (25)	0.0057	0.0078	0.01	U	0.0078	NA	-	Y	0.0078
MISCELLANEOUS										
HARDNESS	4/4 (100)	446	372 - 592	NA	NA	NA	360 - 408	--	--	--

[a] Surface water results from totals. Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NP = Nonparametric distribution for data sets with greater than 50% nondetects.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/L - Milligrams per liter.
WARWP - West Area Red Water Pond.

Table 4-9

Summary Statistics of Detected Analytes and Identification of Chemicals of Potential Ecological Concern in WARWP Area Sediment
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	4/4 (100)	5,993	3,230 - 9,600	NA	L	16,929	2,450 - 3,170	-	Y	9,600
ARSENIC	9/17 (53)	4.6	4.0 - 11.3	3.8 - 4.8	L	6.5	3.5 - 5.4	-	Y	6.5
BARIUM	3/4 (75)	46	34.8 - 65	98.5	L	74.6	<24.1 -26.6	-	Y	65
CALCIUM	4/4 (100)	27,428	6,710 - 74,700	NA	L	1,716,875	10,800 - 13,900	-	Y	74,700
CHROMIUM	17/17 (100)	15	7.4 - 28.7	NA	L	18.1	5.3 - 6.7	-	Y	18.1
COBALT	2/4 (50)	10	10.6 - 10.8	13.3 - 24.6	N	12.9	6.4 - 10.9	A	N	-
COPPER	7/17 (41)	5.2	3.2 - 24.5	2.4 - 3.2	U	24.5	8.8 - 13.7	-	Y	24.5
IRON	4/4 (100)	18,700	16,000 - 24,300	NA	L	24,565	9,900 - 14,900	-	Y	24,300
LEAD	17/17 (100)	16	8.1 - 32.1	NA	L	18.8	6.5 - 9.7	-	Y	18.8
MAGNESIUM	4/4 (100)	3,843	2,520 - 6,770	NA	L	9,227	2,110 - 2,720	-	Y	6,770
MANGANESE	17/17 (100)	249	149 - 726	NA	L	299	231 - 305	-	Y	299
NICKEL	17/17 (100)	18	8.8 - 24.5	NA	N	19.8	13.7 - 23	A	N	-
POTASSIUM	2/5 (40)	904	821 - 1,500	606 - 2,460	N	1,353	<603 - <623	-	Y	1,353
VANADIUM	1/4 (25)	9.5	25	6.1 - 13.3	L	372	<6.0 - <6.2	-	Y	25
ZINC	17/17 (100)	61	36 - 94	NA	L	68	35.1 - 48	-	Y	68
VOLATILE ORGANIC COMPOUNDS										
ACETONE	2/4 (50)	0.052	0.071 - 0.11	0.024 - 0.028	N	0.11	NA	-	Y	0.11
2-BUTANONE	2/4 (50)	0.028	0.021 - 0.029	0.024 - 0.099	L	0.12	NA	-	Y	0.029
METHYLENE CHLORIDE	1/4 (25)	0.0083	0.02	0.0061 - 0.013	L	0.16	NA	-	Y	0.02
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROARMOMATICS										
1,3-DINITROBENZENE	4/17 (24)	0.24	0.3 - 0.7	0.25	U	0.7	NA	-	Y	0.7
1,3,5-TRINITROBENZENE	3/17 (18)	0.22	0.6 - 0.8	0.25	U	0.8	NA	-	Y	0.8
2-AMINO-4,6-DINITROTOLUENE	1/13 (8)	0.14	0.3	0.25	U	0.3	NA	-	Y	0.3
2,4-DINITROTOLUENE	6/17 (35)	0.26	0.3 - 0.7	0.25	U	0.7	NA	-	Y	0.7
2,6-DINITROTOLUENE	1/17 (6)	0.14	0.4	0.25 - 0.26	U	0.4	NA	-	Y	0.4
FLUORANTHENE	1/4 (25)	0.40	0.047	0.46 - 1.6	N	0.76	NA	-	Y	0.047
MISCELLANEOUS										
TOTAL ORGANIC CARBON (pond)	2/2 (100)	66,800	40,200 - 93,400	NA	NA	NA	3,960 - 5430	-	-	-
PHOSPHORUS	1/1 (100)	3.1	3.1	NA	NA	NA	NA	-	Y	3.1

[a] Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
mg/kg - Milligrams per kilogram.
WARWP - West Area Red Water Pond.

Table 4-10

Terrestrial Receptors Hazard Index Summary for West Area
Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Terrestrial Receptor						
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer	Hawk
Soil [a] HI	21	1.1	91	450	19	0.010	0.0013
Risk Drivers:	92% PAHs (invertebrate intake)	60% 1,3-Dinitrobenzene (plant intake)	92% PAHs (invertebrate intake)	99% 4-ADNT (invertebrate intake)	92% PAHs (invertebrate intake)	55% 1,3-DNB (plant intake)	93% 4-ADNT (soil intake)
Surface Water HI	7.7	8.0	5.0	2.2	19	8.3	0.0049
Risk Drivers:	93% Aluminum (water intake)	95% Aluminum (water intake)	93% Aluminum (water intake)	41% Iron (water intake)	93% Aluminum (water intake)	93% Aluminum (water intake)	41% Iron (water intake)
Total Receptor HI	28	9.1	96	452	38	8.3	0.0062

DNB – dintrobenzene; 4-ADNT – 4-amino-2,6-dinitrotoluene; PAH – polycyclic aromatic hydrocarbon.
HI – Hazard index.

[a] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated COPEC via deep feeder roots.

Sources: IT, 2000.

Table 4-11

Aquatic Receptor Hazard Index Summary for West Area Red Water Ponds Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Aquatic Receptor	
	Great Blue Heron	Raccoon
Sediment HI	106	582
Risk Drivers:	33% 2-ADNT (invertebrate intake)	58% Aluminum (sediment intake)
	24% Phosphorus (invertebrate intake)	11% Aluminum (invertebrate intake)
	13% Iron (sediment intake)	7.9% Calcium (invertebrate intake)
	10% Calcium (invertebrate intake)	5.3% Phosphorus (invertebrate intake)
Surface Water HI	618	83
Risk Drivers:	60% Iron (fish intake)	79% Aluminum (fish intake)
	24% Magnesium (fish intake)	10% Aluminum (water intake)
	8.8% Aluminum (fish intake)	5.4% Iron (water intake)
	4.2% Lead (fish intake)	
Total Receptor HI	724	665

2-ADNT – 2-Amino-4,6-dinitrotoluene.
HI – Hazard index.

Sources: IT, 2000.

Table 4-12

Terrestrial Receptors Hazard Index Summary for West Area[a]
Central Tendency and Reasonable Maximum Exposure
Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Terrestrial Receptor					
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer
Soil [b] HI	0.006 - 0.5[c]	0.002 - 0.15	0.03 - 2.5	—[d]	0.006 - 0.5	0.0006 - 0.03
Risk Drivers	—	—	100% - PAHs (invertebrate intake)	—	—	—
Surface Water HI	0.003 - 0.3	0.003 - 0.15	0.002 - 0.2	0.01 - 1.0	0.008 - 0.6	0.003 - 0.3
Risk Drivers	—	—	—	—	—	—
Total Receptor HI	0.009 - 0.8	0.005 - 0.3	0.03 - 2.7	0.01 - 1.0	0.01 - 1.2	0.004 - 0.3

[a] Details presented in eco risk assessment spreadsheets in Appendix H. Only risk drivers considered
[b] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated chemicals of potential ecological concern (COPEC) via deep feeder roots.
[C] No hazard estimated. COPEC(s) screened out due to background or low frequency of detection, or COPEC(s) toxicity values not available.
[d] A "—" indicates no hazard estimate was performed due to COPEC(s) screened out due to background or low frequency of detection, or COPEC(s) toxicity values not available.
HI – Hazard index.

Notes :

(1) CT and RME approach assumptions include differences in exposure point concentrations; toxicity values; interclass toxicity uncertainty factor; and method of calculation of site-specific soil-to-invertebrate biological accumulation factor (see text for details).

(2) Red-tailed hawk not presented because screening-level ecological risk assessment HI values were all acceptable.

(3) Risk drivers percentage is based on intake pathway indicated.

Source: IT, 2001.

Table 4-13

Aquatic Receptor Hazard Index Summary for West Area [a]
Central Tendency and Reasonable Maximum Exposure
Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio

Media	Aquatic Receptor	
	Great Blue Heron	Raccoon
Sediment HI	0.4 – 26[b]	0.37 - 20
Risk Drivers	100% Iron[c] (Sediment intake, for RME)	100% Iron (Sediment intake, for RME)
Surface Water HI	0.002 - 0.2	0.004 - 0.3
Risk Drivers	—	—
Total Receptor HI	0.4 – 26	0.4 - 21

[a] Only the risk drivers are shown.
[b] The lower value is central tendency (CT) value and the higher value is the reasonable maximum exposure (RME) value. CT and RME approach assumptions include differences in exposure point concentrations; toxicity values; interclass toxicity uncertainty factors; and method of calculation of site-specific surface water-to-fish and sediment-to-invertebrate biological accumulation factors.
[c] Risk driver percentage is based on intake pathway indicated.
[d] A "—" indicates no hazard estimate was performed because chemical was screened out due to background or low frequency of detection, or toxicity value was not available.
HI – Hazard index.

Source: IT, 2001.

FIGURES

FIGURE 1-1
PBOW VICINITY MAP

RED WATER POND AREAS
REMEDIAL INVESTIGATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Shaw Environmental & Infrastructure, Inc.
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NOTES:

1. SNAKE ROAD BURNING GROUND AREA WAS ALSO REFERRED TO AS "SNAKE ROAD BURN PIT", "SCHEID ROAD BURNING GROUNDS", AND "DISPOSAL AREA THREE".
2. FORMER REACTOR FACILITY CONSTRUCTED BY NASA POST WWII AND IS IDENTIFIED FOR LOCATION PURPOSES ONLY. DEMOLITION OF THE REACTOR WAS COMPLETED BY NASA IN 2012.

LEGEND:

- AREA OF CONCERN
- APPROXIMATE LOCATION OF SEWER LINES
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FENCE
- FACILITY BOUNDARY

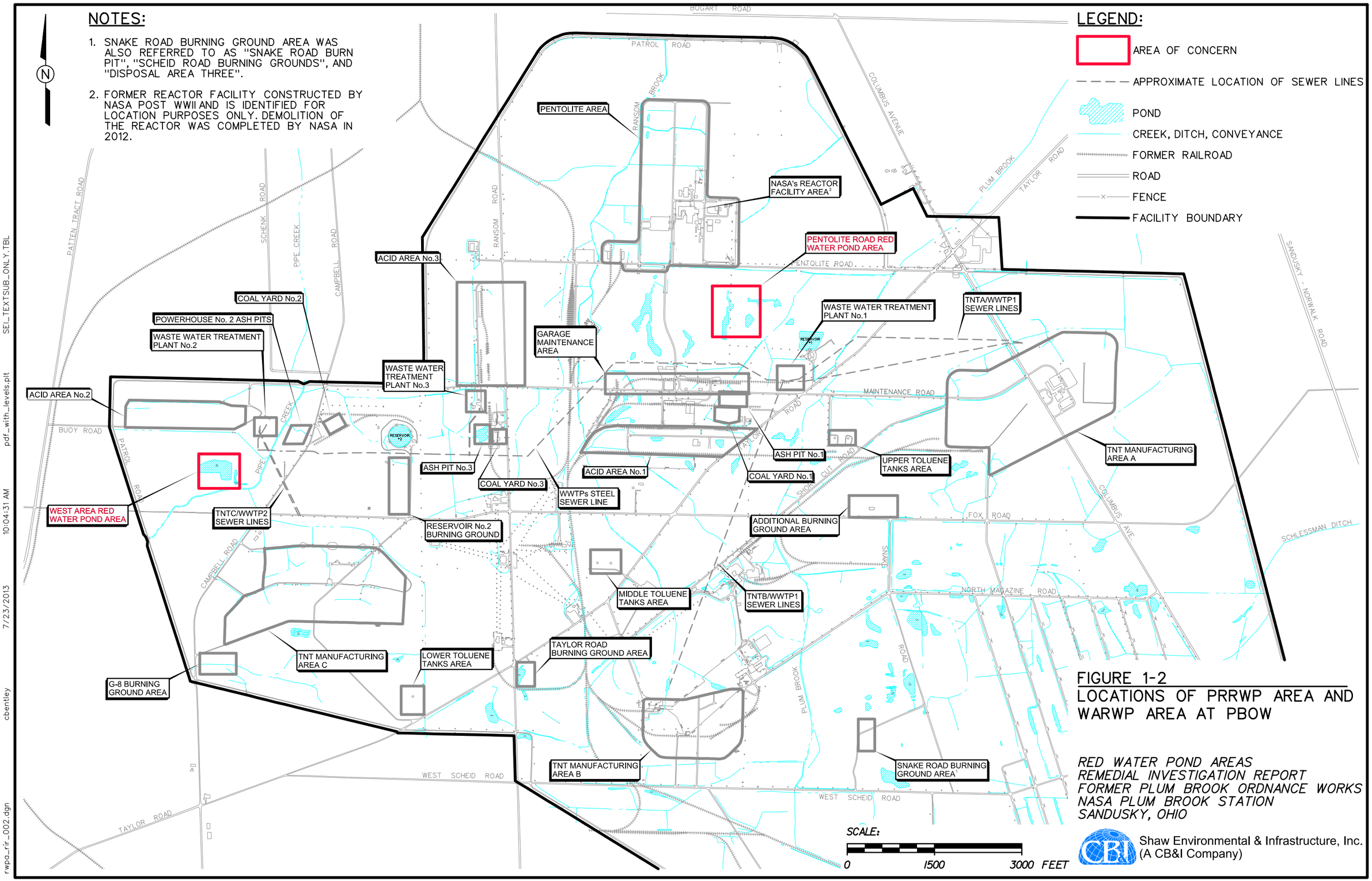

FIGURE 1-2
LOCATIONS OF PRRWP AREA AND WARWP AREA AT PBOW

RED WATER POND AREAS
REMEDIAL INVESTIGATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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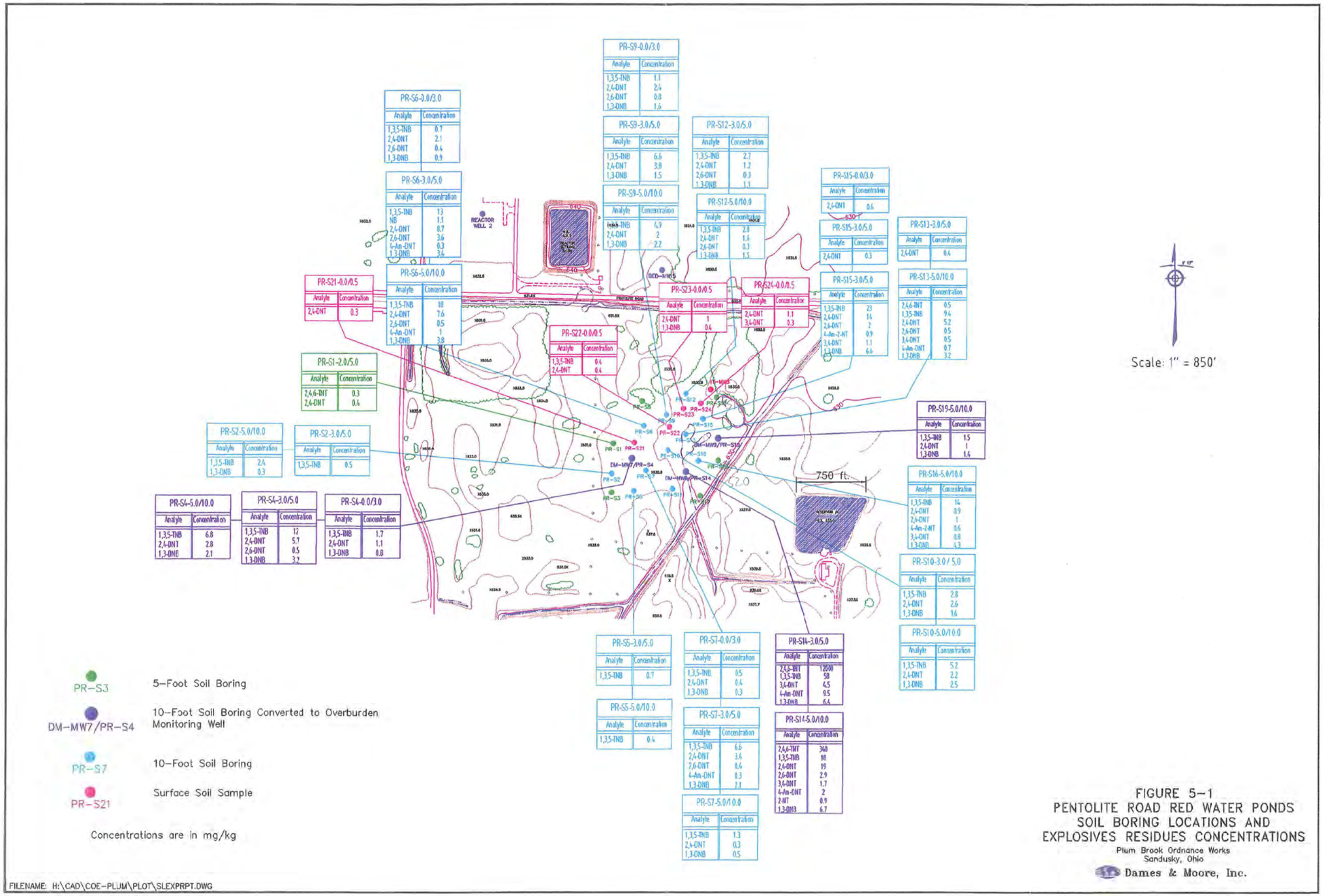


FIGURE 5-1
PENTOLITE ROAD RED WATER PONDS
SOIL BORING LOCATIONS AND
EXPLOSIVES RESIDUES CONCENTRATIONS
Plum Brook Ordnance Works
Sandusky, Ohio
Dames & Moore, Inc.

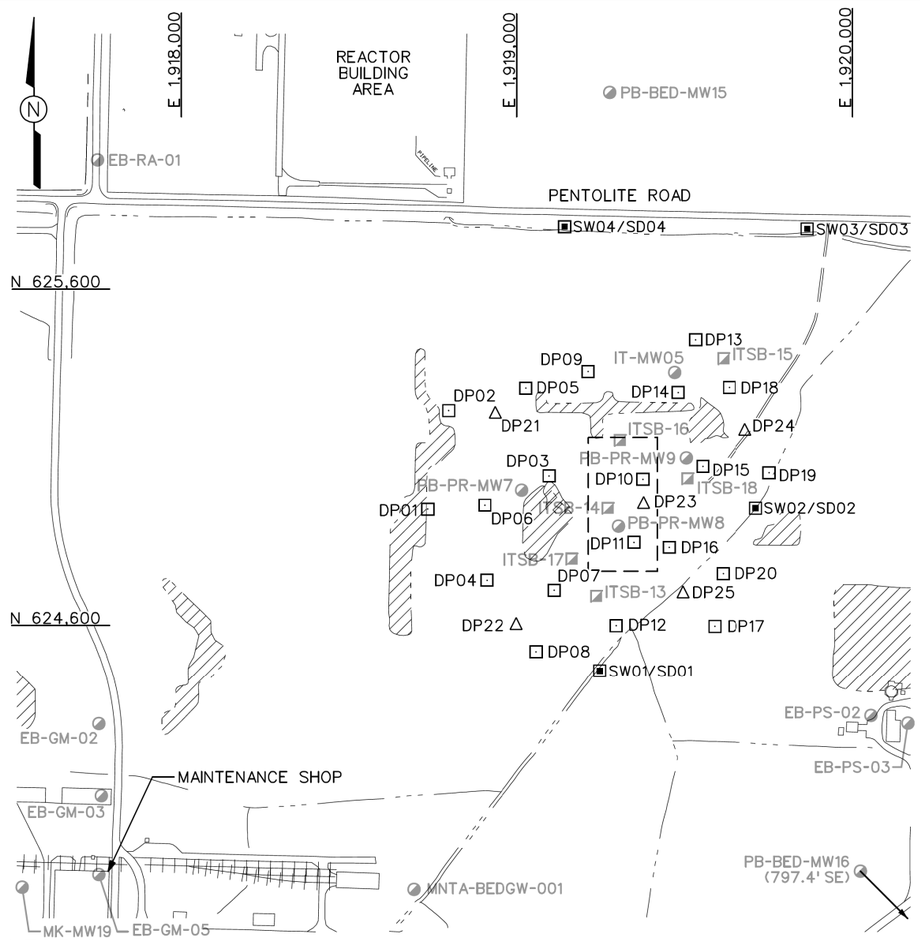
SOURCE: DAMES & MOORE, 1997, RED WATER PONDS FOCUSED REMEDIAL INVESTIGATION, VOLUME I, APRIL.

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

FOCUSED REMEDIAL INVESTIGATION REPORT
SOIL SAMPLE LOCATION MAP AT THE PRRWP AREA
RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 3-1

rwpa_rir_003.dgn cbentley 7/23/2013 10:41:57 AM pdf_with_levels.plt SEL_TEXTSUB_ONLY.TBL



LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE WATER DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- FENCE (PBOW BOUNDARY)
- IT-MW02 — EXISTING MONITORING WELL LOCATION
- ITSB-13 — EXISTING SOIL BORING LOCAITON
- DP01 — DIRECT PUSH SAMPLE LOCATIONS
- DP21 — DIRECT PUSH GEOTECHNICAL LOCATIONS
- SW01/SD01 — SURFACE WATER/SEDIMENT SAMPLES

SCALE

0 400 800 FEET

FIGURE 2-2
PENTOLITE ROAD RED WATER PONDS SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

SOURCE: IT CORPORATION (IT), 2000, FINAL, RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION OF REDWATER POND AREAS, FORMER PBOW, SANDUSKY, OH, REV2, AUGUST.

STARTING DATE: 12/16/97 | DATE LAST REV.: | DRAFT. CHCK. BY: C. TUMLIN | INITIATOR: D. KESSLER | DWG. NO.: \773701ES.012
DRAWN BY: D. BILLINGSLEY | DRAWN BY: | ENGR. CHCK. BY: R. ELLIS | PROJ. MGR.: SPANGBERG | PROJ. NO.: 773701

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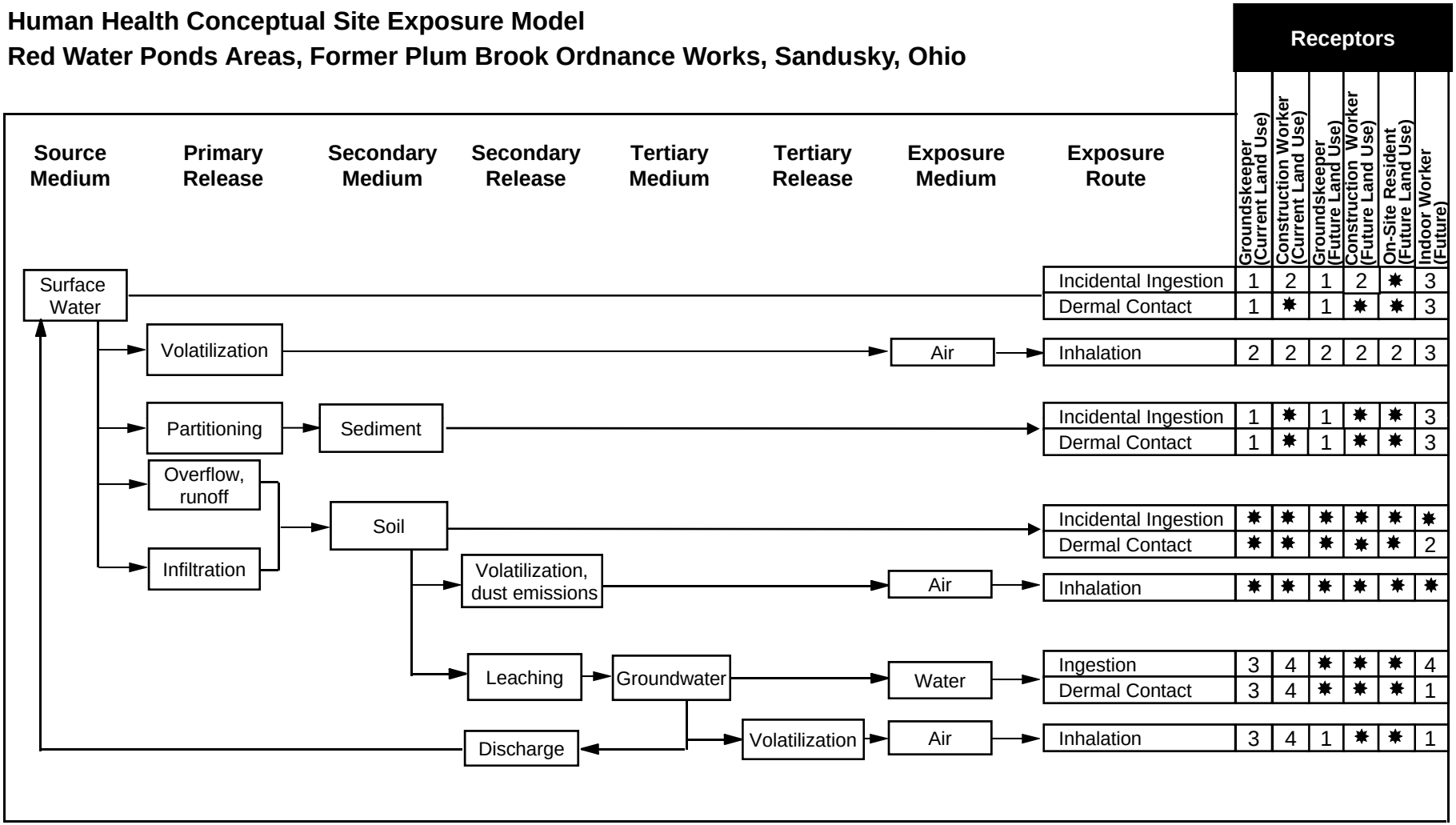
RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION
SAMPLE LOCATION MAP AT THE PRRWP AREA
RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 3-2

Figure 3-3
Human Health Conceptual Site Exposure Model
Red Water Ponds Areas, Former Plum Brook Ordnance Works, Sandusky, Ohio



✸ = Complete exposure pathway evaluated in the risk assessment.
1 = Contact with this medium, although possible, is not part of this receptor's normal or expected activities; therefore, contact would be sporadic and is not quantified.
2 = Although theoretically complete, this pathway is not quantified as explained in text.
3 = There is no plausible pathway for exposure to this medium.
4 = Although a complete pathway, groundwater data are not available. Future groundwater exposures will be assessed when data become available.

Source: IT, 2000.

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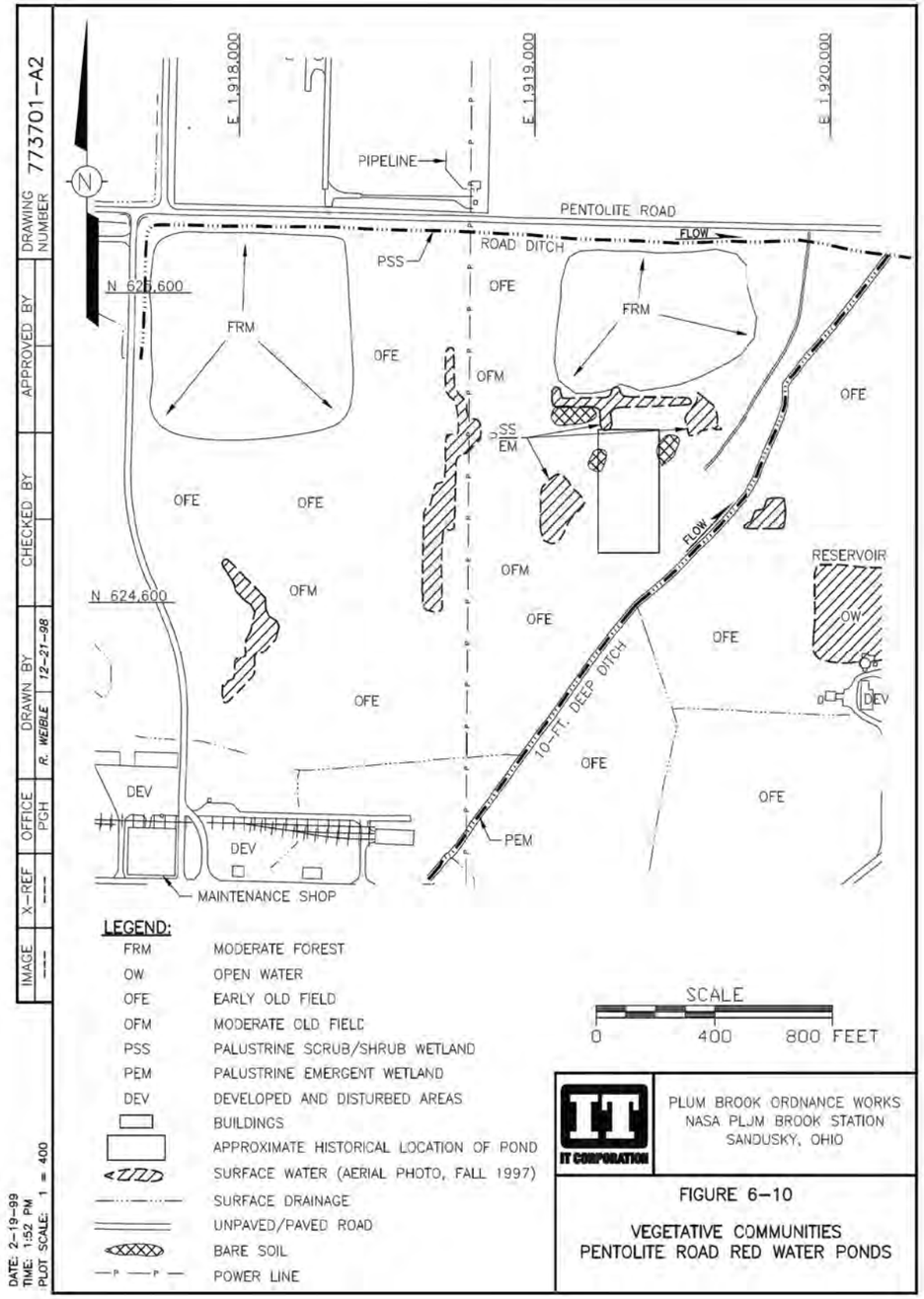

SOURCE: IT CORPORATION (IT), 2000, FINAL, RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION OF REDWATER POND AREAS, FORMER PBOW, SANDUSKY, OH, REV2, AUGUST.

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VEGETATIVE COMMUNITIES AT THE PRRWP AREA

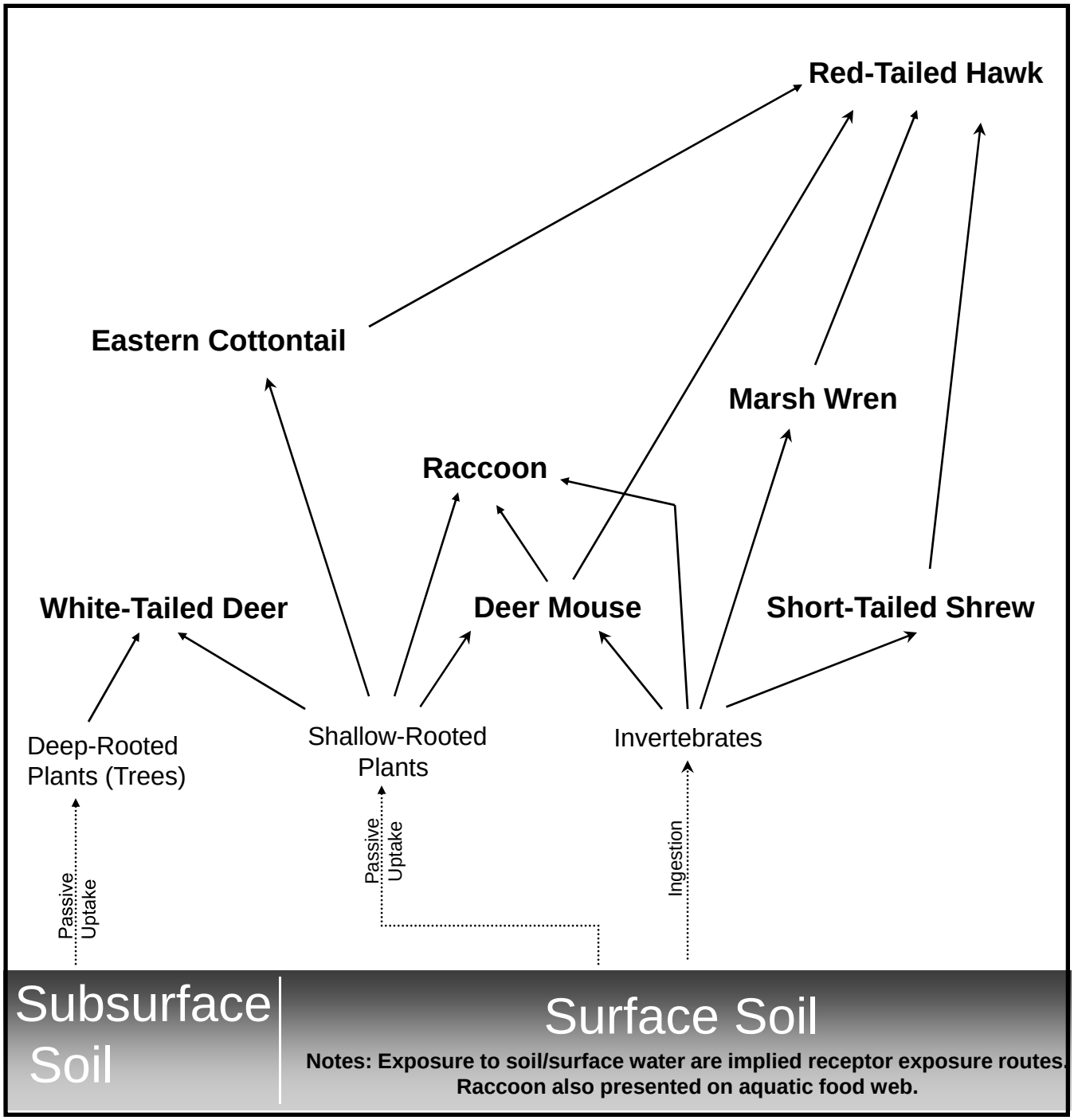
RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 3-4

RWPA_RIR_006.dgn cbentley 7/25/2013 2:08:16 PM pdf_with_levels.plt SEL_TEXTSUB_ONLY.TBL

Figure 3-5

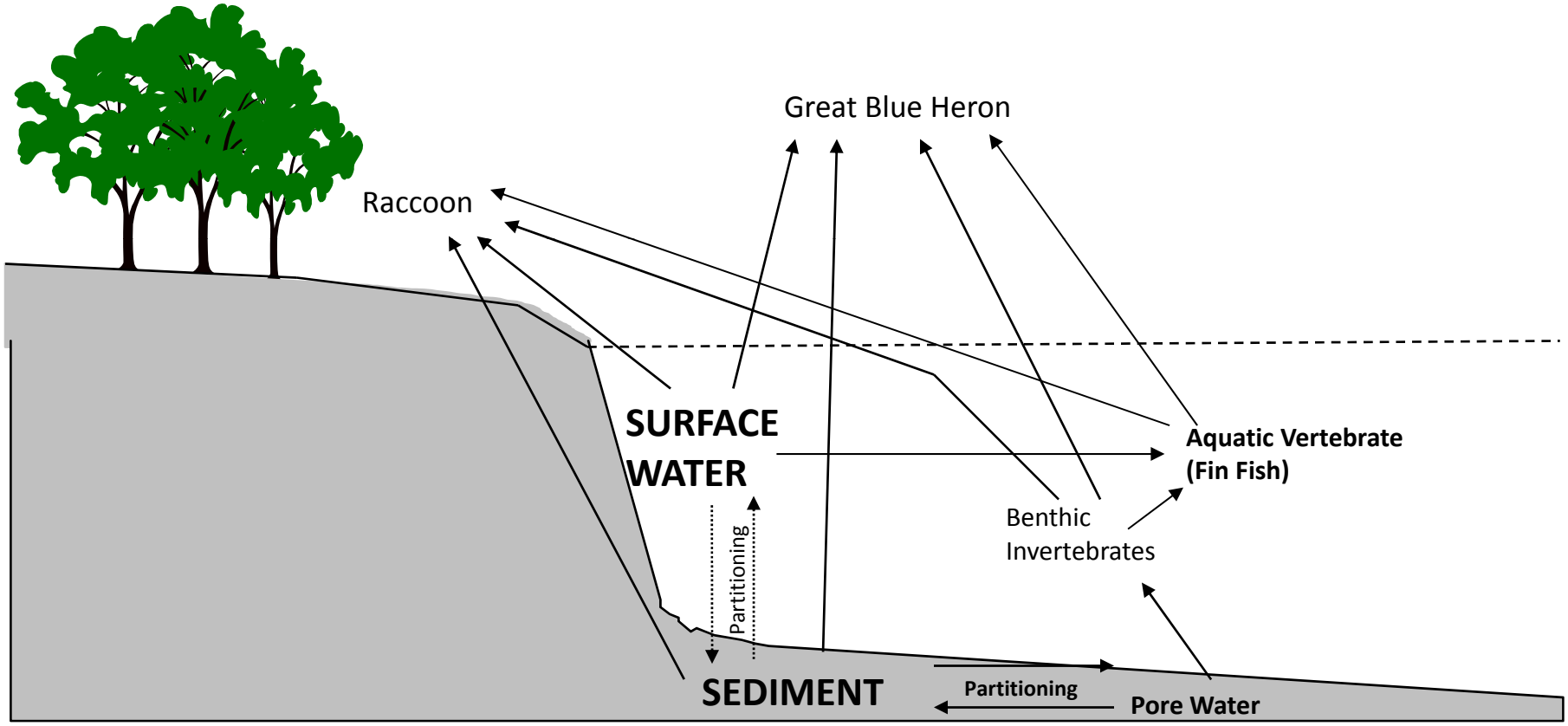
Simplified Terrestrial Food Web Conceptual Site Model
Red Water Pond Areas
Former Plum Brook Ordnance Works, Sandusky, Ohio



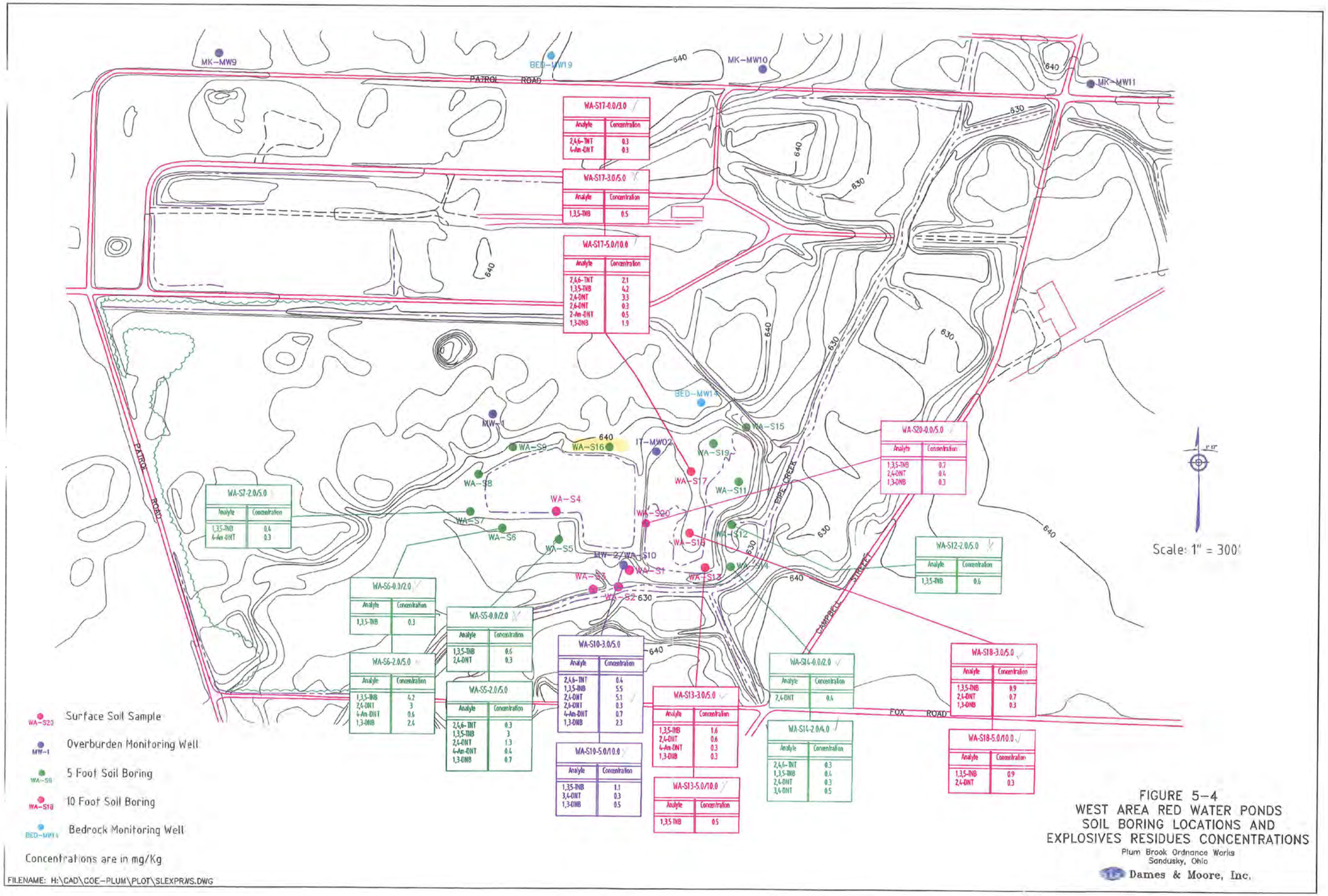
Source: IT, 2000.

Figure 3-6

Simplified Aquatic Food Web Conceptual Site Model
Red Water Pond Areas
Former Plum Brook Ordnance Works, Sandusky, Ohio



Note: Raccoon also presented on terrestrial food web.
Source: IT, 2000.



SOURCE: DAMES & MOORE, 1997, RED WATER PONDS FOCUSED REMEDIAL INVESTIGATION, VOLUME I, APRIL.

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(A CB&I Company)

FOCUSED REMEDIAL INVESTIGATION REPORT
SOIL SAMPLE LOCATION MAP AT THE WARWP AREA
RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 4-1

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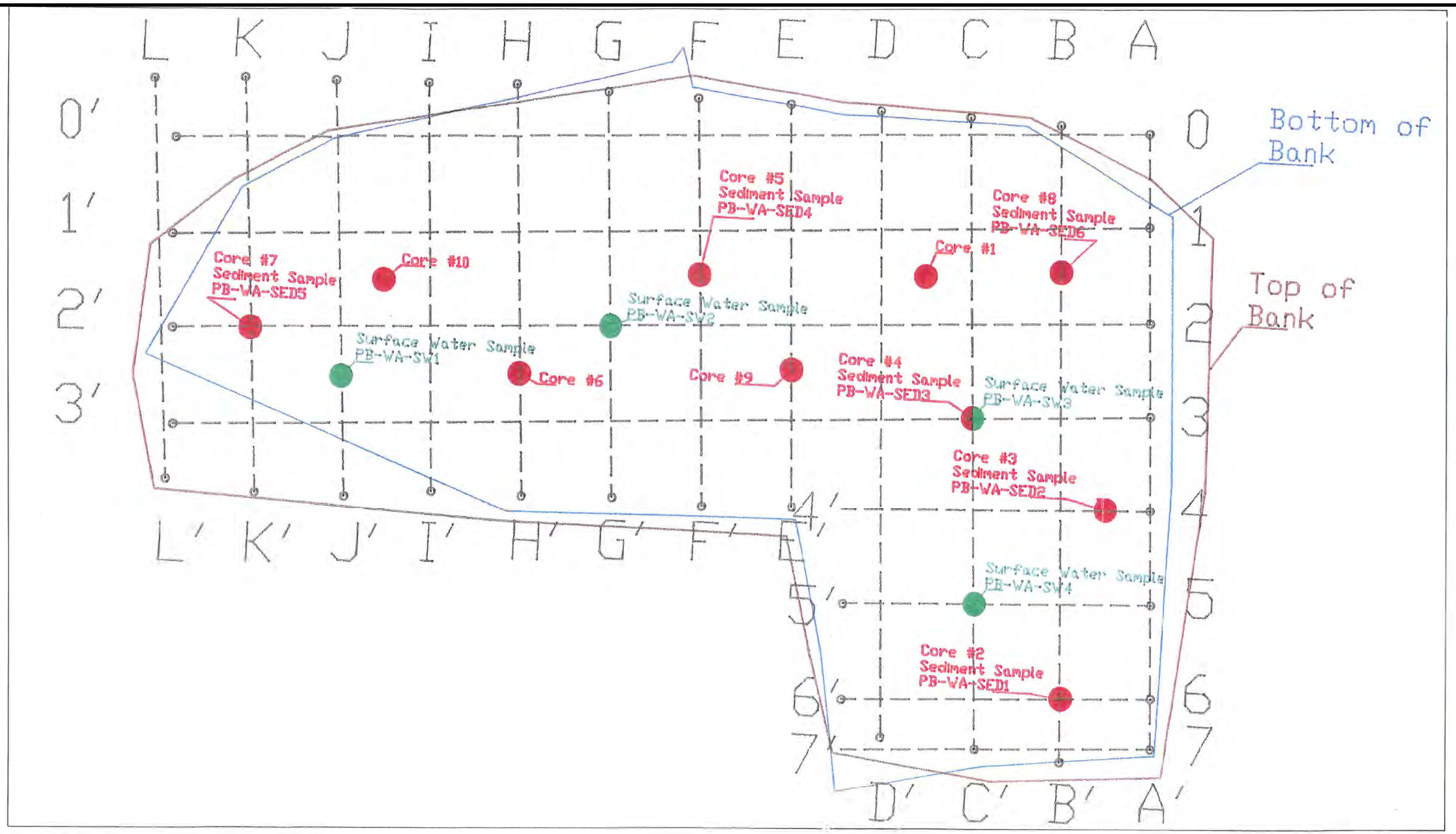

50 25 0 50 100 FEET

LEGEND:

- Core Samples
- Surface Water Samples

N

Figure 7-1

CORE SEDIMENT AND NATURAL SOIL AND SURFACE WATER SAMPLING LOCATIONS

Plum Brook Ordnance Works

Sandusky, Ohio

DAMES & MOORE

SOURCE: DAMES & MOORE, 1997, RED WATER PONDS FOCUSED REMEDIAL INVESTIGATION, VOLUME I, APRIL.

Shaw Environmental & Infrastructure, Inc.
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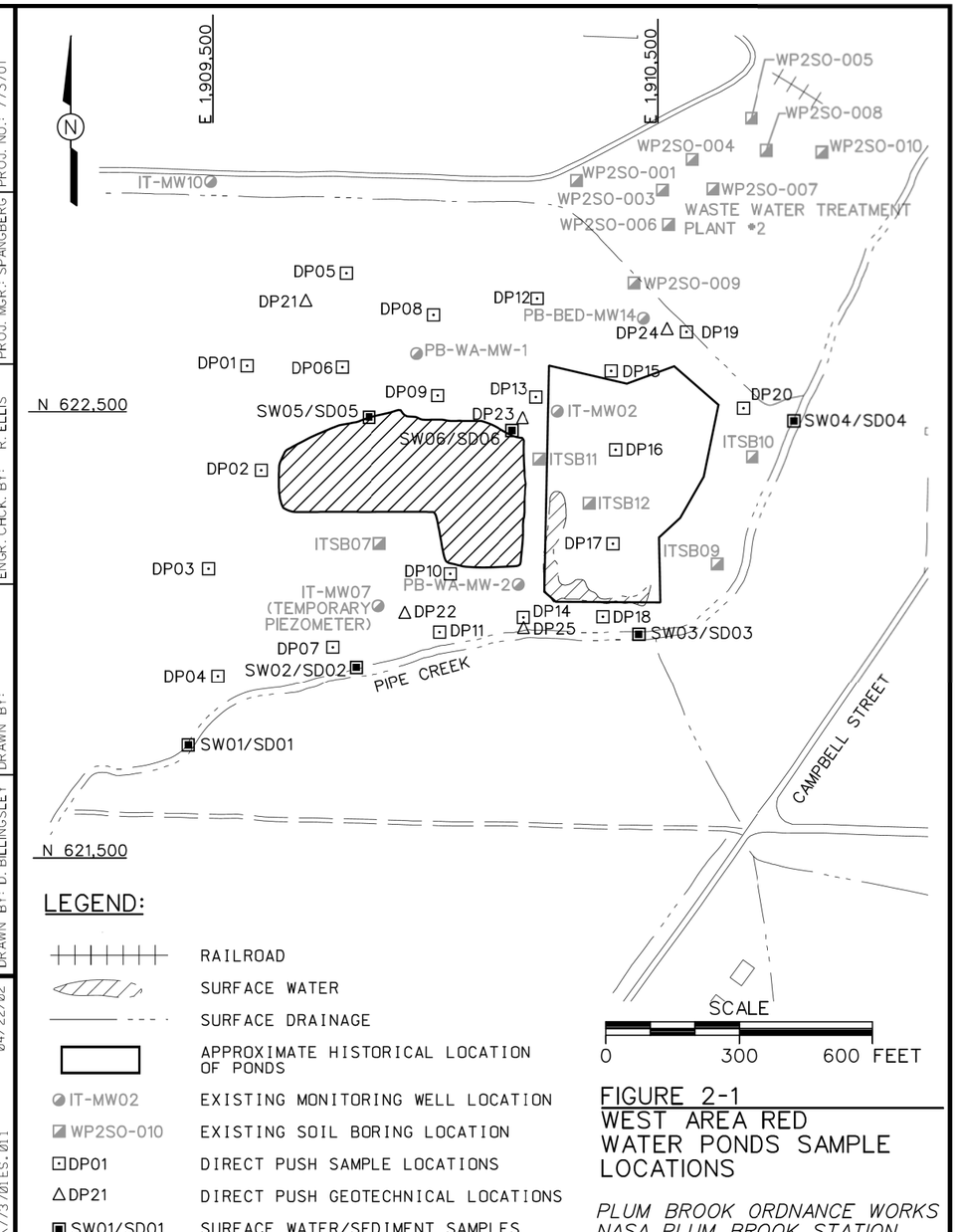
FOCUSED REMEDIAL INVESTIGATION REPORT
SURFACE WATER AND SEDIMENT SAMPLE LOCATION MAP AT THE WARWP AREA
RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 4-2

rwpa_rir_011.dgn cbentley 7/23/2013 10:25:17 AM pdf_with_levels.plt SEL_TEXTSUB_ONLY.TBL



SOURCE: IT CORPORATION (IT), 2000, FINAL, RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION OF REDWATER POND AREAS, FORMER PBOW, SANDUSKY, OH, REV2, AUGUST.

STARTING DATE: 12/16/97 | DATE LAST REV.: | DRAFT. CHCK. BY: C. TUMLIN | INITIATOR: D. KESSLER | DWG. NO.: \773701ES.011
DRAWN BY: D. BILLINGSLEY | DRAWN BY: | ENGR. CHCK. BY: R. ELLIS | PROJ. MGR.: SPANGBERG | PROJ. NO.: 773701

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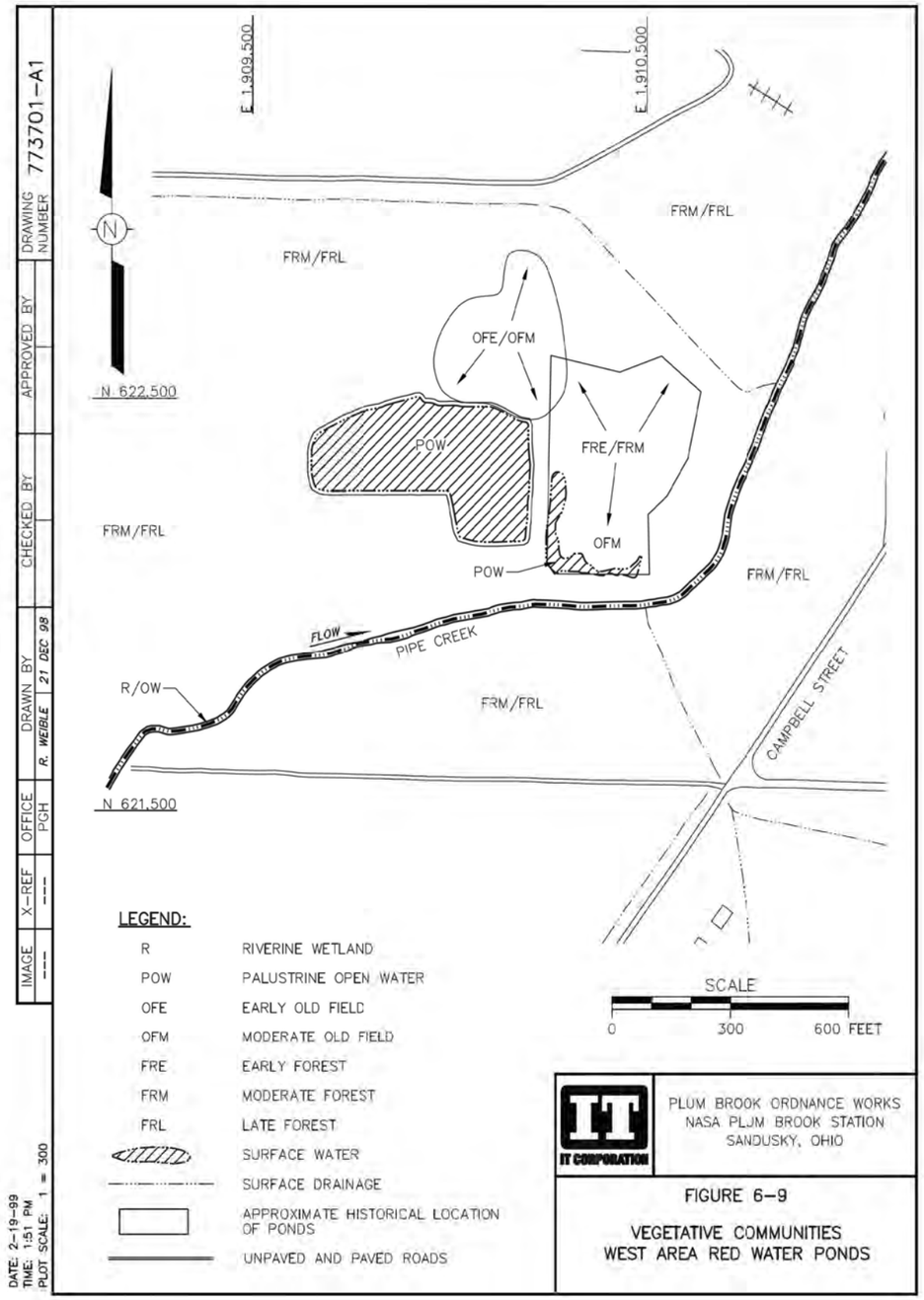
RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION
SAMPLE LOCATION MAP AT THE WARWP AREA
RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 4-3



SOURCE: IT CORPORATION (IT), 2000, FINAL, RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION OF REDWATER POND AREAS, FORMER PBOW, SANDUSKY, OH, REV2, AUGUST.

Shaw Environmental & Infrastructure, Inc.
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VEGETATIVE COMMUNITIES AT THE WARWP AREA

RED WATER POND AREAS REMEDIAL INVESTIGATION REPORT

FIGURE 4-4

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APPENDIX A

RED WATER PONDS FOCUSED REMEDIAL INVESTIGATION, DAMES AND MOORE, INC., APRIL 1997 (ELECTRONIC DELIVERABLE ONLY)

RED WATER PONDS

FOCUSED REMEDIAL INVESTIGATION

FINAL REPORT

FOR

PLUM BROOK ORDNANCE WORKS

PLUM BROOK STATION/NASA

SANDUSKY, OHIO

Prepared for:

U.S. Army Corps of Engineers

Nashville District/Huntington District

Prepared by:

Dames & Moore, Inc.
Atlanta, Georgia

APRIL 1997

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EXECUTIVE SUMMARY

The former Plum Brook Ordnance Works (PBOW), an approximately 9,000 acre site located in Sandusky, Ohio, was used as an explosives manufacturing facility during World War II. The site is now owned by the National Aeronautics and Space Administration (NASA) and is operated as the NASA Lewis Research Center, Plum Brook Station (PBS). Under provisions of the Department of Defense (DoD) Defense Environmental Restoration Program - Formerly Used Defense Sites, the U.S. Army Corps of Engineers (USACE), Nashville District (CEORN) conducted a Focused Remedial Investigation of the two former Red Water Ponds areas, the Pentolite Road Red Water Ponds and the West Area Red Water Ponds, at the former PBOW.

The objective of the Focused Remedial Investigation was to attempt to identify and evaluate the source, nature, and extent of contamination resulting from past DoD-related uses of the red water ponds. To accomplish this objective, the Focused Remedial Investigation was designed to assess the extent of contamination in the soil and groundwater at the two Red Water Ponds Areas; to evaluate whether contamination is present in the surface water and sediment of the remaining west pond at the West Area Red Water Ponds; to evaluate, based on information developed during the investigation the potential nature of risk associated with the contamination; and to establish whether additional investigation is warranted.

The results of the Focused Remedial Investigation confirm that nitroaromatics are present in the soils and the groundwater in both former red water ponds areas. High levels of explosives residues were detected in both media at the Pentolite Road Red Water Ponds. Lower levels of explosives residues were detected in the soils and the overburden groundwater monitoring wells at the West Area Red Water Ponds. However, a groundwater sample from a pit excavated immediately north of the west pond contained very high levels of explosives residues indicating that higher levels of contamination may be present in portions of the aquifer where wells are not currently installed. Dames & Moore believes that the horizontal extent of contamination has been adequately delineated in the soils. The vertical extent of soil contamination has not been delineated; however additional investigation of the vertical extent of soil

contamination is probably not necessary because of the shallow depth to groundwater in the overburden materials.

Soils Investigation

The soils investigation was designed to try to delineate the horizontal and vertical extent of contamination in and around the former red water ponds. Therefore, samples were collected around the perimeters of both pond areas and inside the footprints of the ponds that had been filled in (both ponds at the Pentolite Road Red Water Ponds) or drained (the east pond at the West Area Red Water Ponds).

One hundred and three samples were collected from the two red water ponds areas. Available historical information indicates that the former ponds were shallow, generally not more than a few feet deep. Borings installed inside the ponds to assess vertical extent of contamination were drilled to a depth of 10 feet. Outside the ponds, the source of contamination was expected to be releases/spillage over the berms surrounding the ponds. Contamination, if present, would generally be limited to the upper few feet of soils. Boring depths around the ponds were generally limited to 5 feet. Samples were analyzed for 14 nitroaromatic compounds representative of TNT, its intermediate products, and degradation products, and for concentrations of 14 metals, the 13 priority pollutant metals and manganese.

The investigation indicates that explosives residues are present in soils in both former red water ponds areas although much higher concentrations of nitroaromatics were detected at the Pentolite Road Red Water Ponds than at the West Area Red Water Ponds. Significant findings are as follows:

- 1,3,5-TNB and 2,4-DNT were the most commonly detected explosives residues. Both compounds are major constituents of red water disposed of in the ponds. 1,3,5-TNB was present in 43 of the 103 samples and 2,4-DNT was present in 40 samples.
- At the Pentolite Road Red Water Ponds, the horizontal extent of contamination appears to have successfully delineated. Low levels of

contamination were detected outside the apparent pond footprint in only two areas.

- Nitroaromatics were detected in all of the borings installed inside the pond footprint at the Pentolite Road Red Water Ponds. Explosives residues were present in each boring in the sample collected from 5 to 10 feet. However, further delineation of the vertical extent of contamination is probably not necessary because of the shallow groundwater table in the overburden materials in this area.

- 2,4,6-TNT and 1,3,5-TNB were present in several samples at the Pentolite Road Red Water Ponds at concentrations well in excess of the risk-based industrial scenario screening levels developed by Region III of the U.S. Environmental Protection Agency (EPA). However, all of the samples exceeding the risk-based screening levels were collected from depths of 3 feet or deeper.

- At the West Area Red Water Ponds, very low levels of nitroaromatics were detected outside the former pond perimeter on the south and southeast sides between the ponds and Pipe Creek. However, in general, the horizontal extent of contamination at the West Area Red Water Ponds has been satisfactorily delineated.

- Low levels of explosives residues were also detected in the borings installed inside the east pond. Concentrations were much lower than those detected at the Pentolite Road Red Water Ponds.

- Explosives residues were detected in the deepest samples collected in borings installed both inside the east pond and also around the perimeter of the West Area Red Water Ponds. Therefore, the vertical extent of contamination has apparently not been delineated in either area. Further delineation of the vertical extent of contamination is probably not warranted because of the shallow groundwater at the site.

- All nitroaromatics concentrations detected in the samples collected from the West Area Red Water Ponds were below 6 mg/Kg. None exceeded the risk-based industrial scenario screening levels. 1,3,5-TNB exceeded the risk-based residential scenario screening criteria of 3.9 mg/Kg in three samples.

Fourteen background soil samples were collected from eight borings installed in areas of the site least likely to have been impacted by former DoD activities. These samples were analyzed for the same explosives residues and metals as the soils from the two red water ponds areas. In addition, in order to demonstrate that the background locations were, in fact, not impacted by former DoD activities, background soil samples were also analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) to establish baseline soil quality. No explosives residues

were detected in the background soils. However, four VOCs and one SVOC were detected. These four VOCs and one SVOC were detected in soils from many areas of the site during previous investigations.

Nine metals, antimony, arsenic, cadmium, chromium, cooper, lead, manganese, nickel, and zinc, were detected in the soil samples collected from the red water ponds areas. A statistical analysis comparing metals concentrations in background soil samples to concentrations in samples collected from the two former red water ponds areas indicated that manganese levels in these areas are above background. Concentrations of all other metals are consistent with levels detected in the background soils.

Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Cadmium was detected in only one soil sample, collected from the West Area Red Water Ponds.

A comparison of elevated metals levels to concentrations of explosives residues did not indicate a correlation between the two.

Groundwater Investigation

Groundwater at the site occurs in two basic hydrostratigraphic units: the unconsolidated overburden and the bedrock. The overburden is composed of glacial outwash materials, and varies in thickness from a few feet to over 40 feet. The bedrock consists of both limestone and shale.

The results of the groundwater investigation indicate that generally groundwater flow in both the overburden and the bedrock is to the north, eventually toward Lake Erie, as would be expected for this site. However, it is likely that because of the shallow bedrock and thin veneer of overburden materials overlying the bedrock, the vertical flow of groundwater downward from the overburden into the bedrock predominates over horizontal flow in the overburden. This flow pattern, if accurate, would facilitate migration of contaminants in the overburden soils and groundwater into the bedrock aquifer.

The presence of groundwater in the overburden hydrostratigraphic unit at the site is apparently very seasonal. During the early winter when groundwater samples were collected for this investigation, several of the overburden monitoring wells were dry. However, in early spring after abundant winter precipitation, groundwater was present in all of the previously dry wells. In many wells, water levels in the overburden in March 1995 were within 3 feet of the surface. At the Pentolite Road Red Water Ponds, in March 1995 groundwater was about 5 feet deep in the three overburden wells in and immediately adjacent to the former ponds. Depth to water in the two wells closest to the West Area Red Water Ponds was 6 feet or less in March 1995.

At the Pentolite Road Red Water Ponds, significant levels of explosives residues were detected in three of the four overburden wells. The highest levels were present in two wells that are completed within the pond footprint. Red water was present in both wells. The most elevated concentrations were detected for 1,3,5-TNB, 1,3-DNB, and 2,4-DNT. Explosives residues were not detected in the downgradient overburden well indicating that horizontal migration of contamination is probably not occurring.

Low levels of nitroaromatics were detected in the bedrock well at the NASA Reactor Area, which is downgradient of the Pentolite Road Red Water Ponds. However, this well is some distance from the Pentolite Road Red Water Ponds. Nitroaromatics may be present in the bedrock groundwater in the immediate vicinity of the Pentolite Road Red Water Ponds in the area where overburden wells DM-MW7 and DM-MW8 are located. No bedrock wells are located in this area.

At the West Area Red Water Ponds, nitroaromatics were also present in two of the overburden wells, but at significantly lower levels than at the Pentolite Road Red Water Ponds. However, red water collected in the bottom of a trench installed immediately downgradient of the west pond. The highest concentrations of nitroaromatics detected in the groundwater samples were present in this sample indicating that significant levels of nitroaromatics are also present in the groundwater at the West Area Red Water Ponds. No nitroaromatics were detected in the downgradient overburden well, again indicating that significant horizontal migration of contamination is probably not occurring.

Low levels of nitroaromatics were detected in both bedrock wells at the West Area Red Water Ponds.

Elevated levels of nitrates were detected in five overburden wells. The elevated levels were present in the same wells in which high concentrations of nitroaromatics were detected, three overburden wells at the Pentolite Road Red Water Ponds and two overburden wells at the West Area Red Water Ponds.

Groundwater at the site is not used for potable water. However, for evaluation purposes, concentrations of metals were compared to the applicable Maximum Contaminant Levels (MCL) established by EPA. Copper was present at concentrations above the MCL at the Pentolite Road Red Water Ponds, and nickel was present at concentrations above the MCL in both red water ponds areas. Manganese was present at levels above the Secondary MCL (SMCL) in both areas.

Several VOCs and SVOCs were detected in the bedrock aquifer. These were generally hydrocarbons and associated compounds.

West Pond Surface Water and Sediment Investigation

The volume of water and sediments remaining in the west pond of West Area Red Water Ponds was calculated based on field depth measurements. At the time of this investigation the pond surface was at elevation 634.90. At this elevation the volume of ponded water is estimated at 850,000 gallons (114,000 cubic feet). The volume of sediments in the pond is estimated at 132,000 cubic feet with an average thickness of 1 foot. The sediments are very soft and extraction of the water without disturbing the sediments would be very difficult.

Four samples of the water from the existing west pond and one sample from a shallow ponded area from the now backfilled east pond were analyzed for explosives residues and metals. A sample was also analyzed for biological activity for possible remediation considerations.

Low levels of explosives residues were found in the surface water sample from the east pond. No explosives residues were found in the west pond samples.

Three metals, chromium, lead and nickel, were detected in one unfiltered sample with one, lead, at a concentration of 65.5 μg/L which is above the MCL of 15 μg/L. However, the metals were not detected in the dissolved phase.

Manganese was detected in both filtered and unfiltered samples in all samples with the most elevated values from the east pond. Values ranged from 150 μg/L to 1,600 μg/L which are above the SMCL of 50 μg/L.

The concentrations of the other metals were all well below their SMCLs.

Based on these results it would appear that no remediation is required of the surface water or sediments of the west pond.

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LIST OF ACRONYMS

AL	Action Level
ASI	Analytical Services, Inc.
ATV	all terrain vehicle
BDL	below detection limit
BTEX	benzene, toluene, ethylbenzene, xylenes
CEORN	U.S. Army Corps of Engineers, Nashville District
COD	chemical oxygen demand
CRREL	Cold Regions Research and Engineering Laboratories
DNB	dinitrobenzene
DNT	dinitrotoluene
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
gpm°	gallons per minutes
HMX	cyclotetramethylene tetranitramine
ID	inside diameter
IT	IT Corporation
MCL	Maximum Contaminant Level
MDL	method detection limit
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
MRD	Missouri River Division
msl	Mean Sea Level
NASA	National Aeronautics and Space Administration
NPDES	Nation Pollutant Discharge Elimination System
NB	nitrobenzene
NT	nitrotoluene

OD	outside diameter
OEPA	Ohio Environmental Protection Agency
ORD	Ohio River Division
PBOW	Plum Brook Ordnance Works
PBRF	Plum Brook Reactor Facility
PBS	Plum Brook Station
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
PQL	practical quantitation limit
PVC	polyvinyl chloride
QC	quality control
RDX	cyclotrimethykene trinitramine
SAIC	Science Applications International Corporation
SCS	Soil Conservation Service
SVOC	semivolatile organic compound
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	total organic carbon
*u*g/Kg	micrograms per kilogram
*u*g/L	micrograms per liter
*u*mhos/cm	microhoms per centimeter
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
V-J	Victory Over Japan
VOCs	volatile organic compounds

1.0 INTRODUCTION

The former Plum Brook Ordnance Works (PBOW), an approximately 9,000 acre site located in Sandusky, Ohio, was used as an explosives manufacturing facility during World War II. The site is now owned by the National Aeronautics and Space Administration (NASA) and is operated as the NASA Lewis Research Center, Plum Brook Station (PBS). The site location is illustrated on Figure 1-1. Under provisions of the Department of Defense (DoD) Defense Environmental Restoration Program - Formerly Used Defense Sites, the U.S. Army Corps of Engineers (USACE), Nashville District (CEORN) conducted a Focused Remedial Investigation of the two former Red Water Ponds areas, the West Area Red Water Ponds and the Pentolite Road Red Water Ponds.

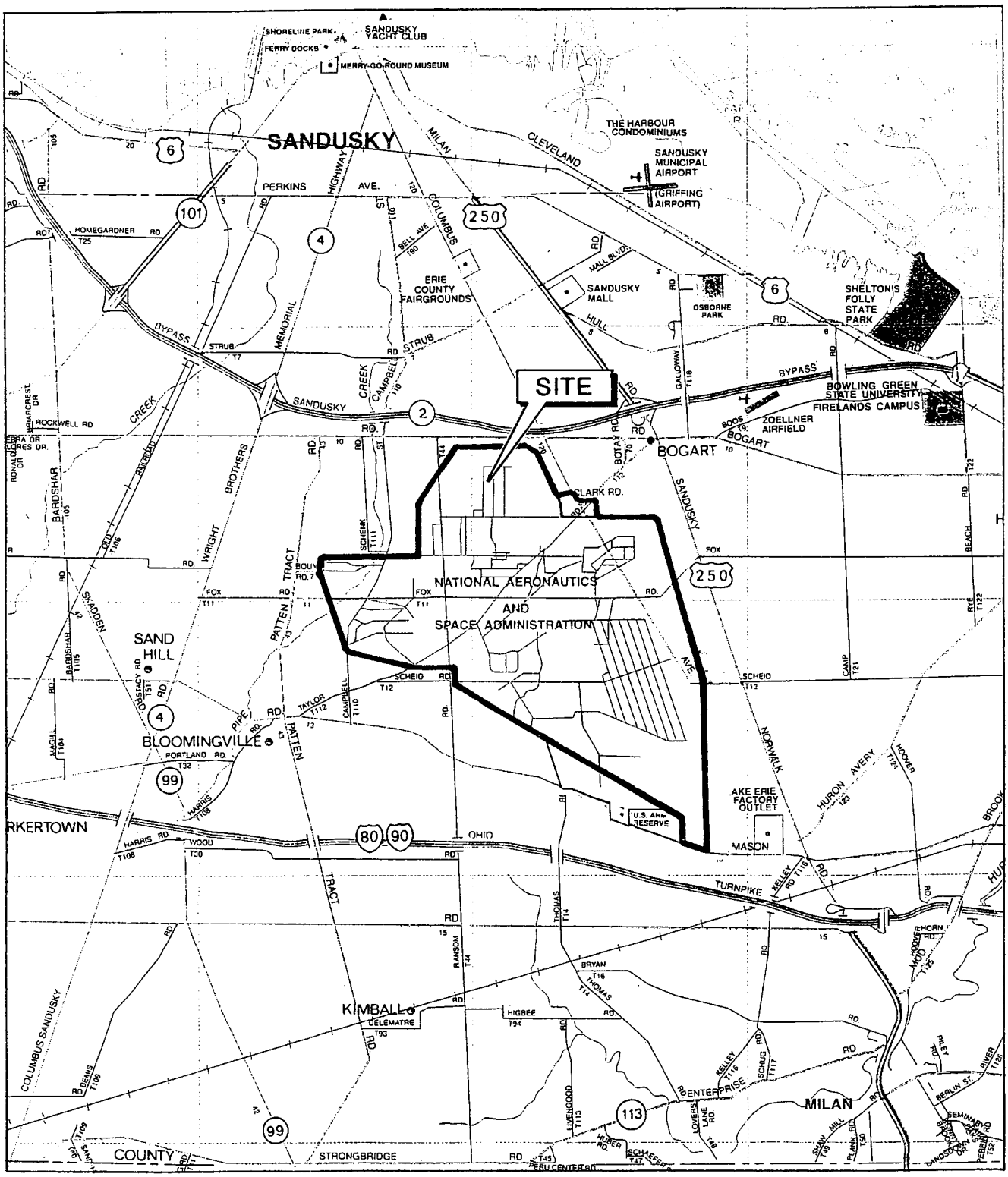
1.1 SITE BACKGROUND

1.1.1 Site Location

The PBS is a 6,453.5-acre research facility located in Erie County, Ohio 4.7 miles south of Sandusky and 59 miles west of Cleveland. Although primarily in Perkins (T6N, R23W) and Oxford (T5N, R23W) Townships, the eastern edge of PBS extends into Huron and Milan Townships. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the east by U.S. Highway 250, and on the west by County Road 43. State Route 4 is also located to the west. The PBS is served internally by a 62.5-mile paved road system and a currently unused 15.7-mile rail system.

The geographic coordinates for the extreme boundaries of PBS are:

Northern Boundary Latitude: 41° 23′ 39"
Southern Boundary Latitude: 41° 20′ 04"
Eastern Boundary Longitude: 82° 38′ 39"
Western Boundary Longitude: 82° 43′ 12"



8000 4000 0 8000 16000 FEET

N

Figure 1-1

SITE LOCATION MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

1.1.2 Site History

The original PBOW site consisted of 9,071.06 acres of primarily agricultural land which were acquired by DoD for construction of an explosives manufacturing plant. From 1941 to 1945, the Trojan Powder Company manufactured trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite at the PBOW. Production of explosives ceased 2 weeks after Victory Over Japan (V-J) Day. During the 4-year operating period, over one billion pounds of explosives were manufactured.

After manufacturing activities ceased in 1945, the U.S. Army conducted decontamination and decommissioning of many of the structures used to manufacture ordnance. Decontamination of TNT, acid, and pentolite manufacturing lines was performed until the end of 1945. Typical decontamination procedures consisted of moving all structures, equipment, and manufacturing debris to a burning ground, where everything was burned. MK Ferguson estimated that 65 percent of the decontamination of the PBOW was completed by the end of 1945 (MK Ferguson, 1994).

The magazine area of the PBOW was renamed the Plum Brook Depot and was used for ammunition storage. Otherwise, virtually the entire site was mothballed from 1946 to 1954 when the Plum Brook Reactor Facility (PBRF) was constructed on a 500 acre parcel in the northern part of the site. NASA acquired the entire site on March 15, 1963. Many of the remaining original structures from the PBOW were removed by NASA soon after it acquired the property.

NASA uses the site to conduct space research as a satellite operation of the NASA Lewis Research Center in Cleveland, Ohio. Throughout the 1960's and early 1970's a variety of test and research facilities were constructed and operated. NASA also operated the PBRF from 1963 to 1973. In 1974, PBS was placed in standby condition.

On April 18, 1978, NASA declared 2,152.15 acres of land excess. Of this excess, 46.023 acres were conveyed to the Perkins Board of Education on June 2, 1978. This area is used as a bus transportation center. The General Services Administration

retained the remaining acreage and currently has a use agreement with the Ohio National Guard for 604 acres of the land. In 1988, PBS began to emerge from standby status and started utilizing several of the research and test facilities again.

There are approximately 106 permanent structures and 99 munitions bunkers at the site, including a variety of structures that were a part of the original PBOW. Utilities are provided from off site, while sanitary waste discharge is processed on site. Ohio Edison Company provides the electrical power and the City of Sandusky provides the potable water supply. A PBS-owned water intake at Lake Erie supplies water for cooling, testing, and fire protection. PBS has five sanitary waste treatment systems, three of which are currently operating. The largest is a 110,000 gallon per day, high rate, trickling-filter, secondary treatment plant located on Taylor Road.

1.1.3 Environmental Investigation History

Hazardous waste disposal practices during the period of explosives manufacturing and DoD site control are unknown. Explosives manufacturing and/or handling at the site resulted in the operation of holding ponds ("red water ponds") for process waste water. Typical red water contains residues of the explosives manufacturing process and is acidic in nature. Out-of-specification explosives may have been burned or discarded on the site. Possible effects of these materials on soil, groundwater, and surface water at the site are unknown. Some of the remaining original structures (e.g., the power plants) and site features (e.g., the red water ponds) have not been remediated (USACE, 1994).

A number of environmental investigations have been conducted at the PBOW. In 1989, IT Corporation (IT) performed a limited investigation of areas of potential concern to the DoD. The field investigation activities included: collection of soil, surface water, sediment, and groundwater samples for geotechnical or chemical analysis and performance of one hydraulic conductivity test. MK Ferguson performed a preliminary sitewide environmental investigation for NASA in 1993 (report date 1994). Additional investigations have been performed by NASA (e.g., investigation

of underground storage tanks) and other interested parties (the U.S Army Reserve conducted a limited investigation of the West Area Red Water Ponds).

Three additional environmental investigations have been performed at the PBS. Science Applications International Corporation (SAIC) completed a Preliminary Assessment of the PBS in 1991. Also in 1991, Ebasco Environmental performed an assessment of underground storage tanks. H^{+}GCL characterized the Snake Road Burn Ground and the adjacent burn grounds used by NASA (referred to as "Disposal Area Three") in 1992.

1.2 PROJECT OBJECTIVES

Red water ponds were created at the PBOW in two areas, referred to as the West Area Red Water Ponds and the Pentolite Road Red Water Ponds. Previous investigations of the two Red Water Ponds areas indicated that contamination by explosives residues was present in both. Contamination was identified in both soils and groundwater, but the previous investigations were not designed to delineate the extent of contamination.

Possible human exposure to contamination could result through inhalation, ingestion, or absorption of either contaminated soil or groundwater at both the West Area Red Water Ponds or the Pentolite Road Red Water Ponds. At the West Area Red Water Ponds, exposure to human and wildlife populations could result from ingestion or absorption of contamination present in the surface water in the west pond, the only one of the four original ponds which still contains water.

The objective of the Focused Remedial Investigation was to attempt to identify and evaluate the source, nature, and extent of contamination resulting from past DoD-related uses of the red water ponds. To accomplish this objective, the Focused Remedial Investigation was designed to assess the extent of contamination in the soil and groundwater at the two Red Water Ponds Areas; to evaluate whether contamination is present in the surface water and sediment of the remaining west pond at the West Area Red Water Ponds; to evaluate, based on information developed

during the investigation the potential nature of risk associated with the contamination; and to establish whether additional investigation is warranted.

1.3 SCOPE OF WORK

The Focused Remedial Investigation of the Red Water Pond areas was performed as part of the Statement of Work for Delivery Order 0020 of Dames & Moore's Indefinite Delivery Order Contract DACA62-92-D-0015 with CEORN. This Statement of Work also included a Sitewide Groundwater Investigation (reported separately) and Site Assessment of the TNT Areas (reported separately). The primary tasks to be performed included:

- Installation of shallow soil borings and collection of soil samples to assess the potential for soil contamination;
- Installation of shallow background soil borings and collection of soil samples to establish background soil quality conditions;
- Installation of shallow groundwater monitoring wells completed in the overburden materials and assessment of the groundwater quality in the overburden hydrostratigraphic unit;
- Installation of deep groundwater monitoring wells completed in the consolidated bedrock and evaluation of baseline groundwater quality in the bedrock hydrostratigraphic unit;
- Assessment of groundwater flow conditions in the overburden and bedrock hydrostratigraphic units; and
- Assessment of the physical distribution of sediment and the chemical quality of that sediment in the existing pond at the West Area Red Water Ponds;
- Evaluation of the quality of surface water in the existing pond at the West Area Red Water Ponds; and
- Preparation of the Focused Remedial Investigation Report presenting the results of the investigation.

The original Statement of Work included in Delivery Order 0020 was modified by mutual agreement between Dames & Moore and CEORN at meetings conducted at the

PBS on August 29 to 31, 1994 and on September 19 through 22, 1994. The modifications, generally changes in the sampling locations based on review of historical documents and access limitations identified when sample locations were staked in the field, were incorporated into the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Additional modifications were made during the course of the field investigation. The modifications that related to the Focused Remedial Investigation of the Red Water Pond Areas included:

- Installation of a bedrock groundwater monitoring well on the north side of the site immediately downgradient from the West Area Red Water Ponds (substituted for a well intended to be installed in another part of the site);
- Relocation of one of the overburden wells at the Pentolite Road Red Water Ponds based on field observations during the investigation;
- Addition of an eighth background soil boring (when shallow bedrock was encountered before the target depth of 5 feet was reached) in two of the seven planned background soil borings;
- Addition of analysis of nitrates in all groundwater samples;
- Deletion of laboratory analysis for one dry overburden well at the West Area Red Water Ponds and addition of analysis of a groundwater sample from one overburden well at the West Area Red Water Ponds that had been installed as part of a previous investigation;
- Addition of analysis of one water sample collected from a pit excavated on the north side of the west pond for explosives residues concentrations;
- Modification of soil sampling locations and depths based on field conditions;
- Deletion of analysis of filtered surface water samples from the West Area Red Water Pond for explosives residues concentrations;
- Relocation of one of the six planned surface water samples for the west pond at the West Area Red Water Ponds to an area of standing water in what was formerly the east pond; and
- Addition of three surface soil samples at the West Area Red Water Ponds and five surface soil samples from the Pentolite Road Red Water Ponds, all of which were analyzed for metals and explosives residues.

All of these modifications were approved by representatives of CEORN during the course of the field work.

1.4 REPORT ORGANIZATION

The Focused Remedial Investigation Report is organized in eight sections preceded by an Executive Summary.

This section, Section 1.0, presents the project background, the Site Investigation objectives, the Scope of Work, and the report organization.

Section 2.0 describes the PBOW environmental setting.

Section 3.0 discusses the history of the Red Water Ponds Areas at the PBOW.

Section 4.0 outlines the investigation methods and activities.

Section 5.0 describes the Soils Investigation.

Section 6.0 discusses the Groundwater Investigation.

Section 7.0 discusses the Surface Water and Sediment Investigation at the remaining pond in the West Area Red Water Ponds.

Section 8.0 provides conclusions.

References are provided after Section 8.0 The tables and figures are included in the text after the page on which they are first mentioned.

Eleven appendices are included in this report.

Appendix A includes a copy of the NASA Drilling and Excavation Permit.

Appendix B includes the Boring Logs for the soil borings.

Appendix C provides the Boring Logs for the overburden and bedrock groundwater monitoring wells.

Appendix D contains the Monitoring Well Construction Diagrams.

Appendix E provides the sieve analysis results.

Appendix F contains the well development documentation.

Appendix G includes the well survey documentation.

Appendix H provides the Groundwater Sampling Records.

Appendix I provides the sediment logs for the west pond sediment cores collected from the West Area Red Water Ponds.

Appendix J provides the laboratory reports.

Appendix K includes the biological activity laboratory analysis.

Appendix L provides Dames & Moore's Data Quality Assessment of the analytical laboratory data.

2.0 ENVIRONMENTAL SETTING

This section describes the environmental setting at PBS.

2.1 PHYSIOGRAPHY AND TOPOGRAPHY

The PBS is located within the Eastern Lake section of the Central Lowland Province near the southwestern shore of Lake Erie (U.S. Department of Agriculture, Soil Conservation Service [SCS], 1971). The region is characterized by lake plains, outwash plains, and till plains with occasional small hills produced during the retreat of the Wisconsin ice sheet. Approximately two-thirds of Erie County was once covered by a glacial lake that produced features such as beach ridges and wave-cut cliffs.

The area was originally a flat lake bottom resulting from glacial melt waters. Across PBS, the topography is relatively flat with a gentle NNE slope towards Lake Erie. Elevations at the site range from 675 feet above mean sea level (msl) at the southwest edge of the site to 625 feet msl in the northern portion of the property at Bogart Road (U.S. Geological Survey [USGS] Topographic Quadrangles Sandusky and Kimball, Ohio; 1969). The land surface has an average slope of less than 1 percent with steeper areas having approximately 2 percent slope.

2.2 LAND USE

Prior to acquisition of the site for construction of the PBOW, the area was largely agricultural. During construction of the PBOW, most of the forested areas were cleared. Today, second generation forests have returned to large portions of the site that are not used by NASA. Other undeveloped areas of the site are maintained in open fields. The surrounding area is mostly agricultural and residential.

2.3 CLIMATE

The climate for the Sandusky area is continental, but strongly influenced by Lake Erie. Predominantely westerly winds parallel the shoreline of Lake Erie. In a 1956 study by National Advisory Committee for Aeronautics, the wind direction at PBS was from the southwest approximately 55 percent of the time throughout the year (SAIC, 1991). The frequency of northerly and northeasterly winds increases during the spring and summer.

The average annual precipitation for the city of Sandusky from 1961 to 1990 is 34.05 inches (Midwestern Climate Center, 1997). The mean monthly precipitation at the U.S. Weather Bureau Station for Sandusky for that 30 year period ranged from a low of 1.65 inches for February to a high of 3.70 inches for July. The monthly average precipitation for all months for the period 1961 to 1990 is provided on Table 2-1. This table also lists the extreme total high and low monthly precipitation for the period 1936 to 1996 and the year the extreme occurred. Finally, Table 2-1 lists the mean snowfall for the period 1961 to 1990.

Average annual temperatures for Sandusky for the 30 year period 1961 to 1990 ranged from 32.2° F in January to 82.3° F in August. The average this period was 32.2° F. Summers are moderately warm and humid, with temperatures occasionally exceeding 90° F. The monthly average maximum, minimum, and mean temperatures for all months for the period 1961 to 1990 are provided on Table 2-2. This table also lists the extreme mean high and low monthly temperatures for the period 1936 to 1996 and the year the extreme occurred. Winters are cold and cloudy, with sub-zero temperatures an average of 5 days per winter. The temperature usually first falls to freezing in October and the last freezing temperature normally occurs in April. Weather changes often occur every few days as fronts pass through the region.

TABLE 2-1

PRECIPITATION DATA FOR SANDUSKY, OHIO

Month	Mean (inches)	Extreme High (inches)	Year of Extreme High	Extreme Low (inches)	Year of Extreme Low	Mean Snowfall (inches)
January	1.73	6.58	1937	0.19	1961	8.0
February	1.65	4.53	1950	0.02	1987	7.0
March	2.60	5.44	1985	0.74	1958	3.6
April	2.95	7.19	1961	0.75	1946	0.6
May	3.44	9.04	1943	0.70	1988	0.0
June	3.85	12.51	1937	0.68	1988	0.0
July	3.70	12.60	1966	0.80	1944	0.0
August	3.41	9.93	1975	0.40	1996	0.0
September	3.12	7.72	1950	0.91	1963	0.0
October	2.18	4.91	1954	0.03	1963	0.0
November	2.80	6.53	1982	0.23	1976	0.3
December	2.62	6.44	1990	0.65	1943	6.1
Annual	34.05	50.50	1950	18.29	1963	24.8

Source: Midwestern Climate Service, 1997

TABLE 2-2

TEMPERATURE DATA FOR SANDUSKY, OHIO

Month	Average Monthly Temperature			Mean Extreme High Temperature (°F)	Year of Extreme High	Mean Extreme Low Temperature (°F)	Year of Extreme Low
	Maximum (°F)	Minimum (°F)	Mean (°F)				
January	32.2	17.5	24.8	37.2	1950	11.9	1977
February	34.3	19.2	26.7	37.1	1954	14.9	1978
March	44.4	28.8	36.7	49.2	1945	26.7	1960
April	56.6	39.3	48.0	56.5	1955	42.1	1975
May	68.1	50.5	59.3	66.5	1962	53.8	1967
June	78.0	60.1	69.1	74.9	1949	64.1	1972
July	82.4	64.8	73.6	79.1	1949	70.7	1992
August	80.6	62.9	71.7	77.8	1947	67.3	1992
September	74.1	56.1	65.1	70.2	1961	59.9	1975
October	62.2	44.5	53.4	62.0	1947	47.6	1988
November	49.9	35.3	42.6	47.4	1975	34.9	1976
December	37.2	25.7	30.5	39.7	1982	17.2	1989
Annual	58.3	41.9	50.1	54.2	1949	45.6	1982

Source: Midwestern Climate Service, 1997

2.4 SOILS

Most of the soils of Erie County were formed from either glacial till or glacial melt-water deposits. The dominant soil material was deposited by glacial till, outwash, and lacustrine deposits. Glacial till is material laid down directly from glaciers with minimum water action. Typically, it consists of particles of different sizes, and many pebbles in glacial till have sharp corners, indicating that they have not been rounded or worked by water. Outwash materials were deposited by running water from melting glaciers. The size of the particles that make up the outwash material varies according to the speed of the water in which particles were carried. Outwash deposits generally consist of layers of particles of similar size, such as sand and gravel. Lacustrine deposits, material settled from still, ponded glacial melt water, contain only the finer particles such as very fine sand, silt, and clay because the coarser material dropped out as outwash. Other soils formed from more recent deposits of alluvium or the weathering of parent rock (SCS Soil Survey of Erie County, Ohio).

Within the PBS, the soil origins are listed as lacustrine (Erie Planning Commission Report on Land Capability, 1967). The glacial drift is less than 20 feet on average and bedrock is exposed in many places (Ohio Department of Natural Resources, Division of Geological Survey; Drift Thickness of Erie County, Ohio; Open File Map 209).

The General Soil Map of Erie County, Ohio (SCS, 1970) identified four soil associations at the PBS site: Arkport-Galen, Prout, Del Rey-Lenawee, and Lewisburg. The Arkport-Galen and Prout soil associations make up the majority of soils at PBS. The Arkport-Galen soils are present in the western, central, and northern portions of the site. The Prout soils occur in the southeastern portion of PBS. The Del Rey-Lenawee soils are listed for the extreme southeast corner of PBS and Lewisburg soils are listed for the southwestern edge of PBS.

The Arkport-Galen association is characterized by deep, nearly level to moderately sloping, well-drained to moderately-well-drained soils that have a subsoil of loamy fine sand and fine sand. The Arkport soils are gently to moderately sloping, and well drained, formed in fine sand deposited by wind and water at the edge of a glacial lake. The permeability of the Arkport soils is estimated to be approximately 12 inches/hour.

The Galen soils are mostly level and moderately well-drained, formed as small sandy deposits on outwash plains and deltas. Galen soils have a fine sand or sandy loam surface layers, a subsurface of fine sand which is underlain by silt or clay. Runoff is slow, permeability is rapid, and the available moisture capacity is low. The permeability of the Galen soils is estimated to be between 6 and 12 inches/hour. The Arkport-Galen association is made up of about 40 percent Arkport soils, 30 percent Galen soils, and 30 percent minor soils.

Prout soils are moderately-deep to deep, nearly level to gently sloping, somewhat poorly drained soils that have a subsoil of heavy silt loam to silty clay loam. Prout soils are commonly underlain by shale bedrock. They are somewhat poorly drained, with slow runoff and permeability. The permeability of the Prout soils is estimated to be between 0.2 and 0.6 inches/hour. Prout soils commonly occur in uplands such as the sides of stream valleys and shale outcrop ridges.

Del Rey-Lenawee soils generally lie on old lake beds and are deep, nearly level, somewhat poorly-drained to very poorly-drained soils that have a subsoil of silty clay to clay loam. The Lewisburg association are moderately deep to deep, nearly level in depressions, and are narrow strips along natural drainageways. Runoff is slow, and permeability is moderately slow.

The thickness of soils at PBS ranges from approximately 5 feet or less for most of the site to approximately 20 feet for the extreme northern portion of the site (Erie Planning Commission Report on Land Capability, 1967).

2.5 BEDROCK GEOLOGY

The bedrock formations of northwestern Ohio consist of Devonian and Silurian carbonates (limestones and dolomites) and clastics (sandstones and shales). The regional dip is to the southeast, with younger rocks outcropping to the east. The Silurian and Devonian formations unconformably overlie sedimentary sequences of Ordovician and Cambrian Age, which in turn unconformably overlie the Pre-Cambrian crystalline Grenville basement (Ohio Department of Natural Resources, Division of

Geology, Generalized Column of Bedrock Units in Ohio, 1990). A generalized stratigraphic section of the Silurian and Devonian strata which underlie the site was presented by SAIC in their Preliminary Assessment and is reproduced in Figure 2-1 of this report.

At PBS, four Devonian formations crop out beneath the glacial drift cover. From oldest to youngest, these formations are the Delaware Limestone, the Plum Brook Shale, the Prout Limestone, and the Huron Shale. The formations dip to the southeast with a regional dip angle of approximately 35 feet per mile (Campbell, 1955). Structurally, these formations are located on the eastern limb of the Findlay Arch (Campbell, 1955). Figure 2-2 shows the estimated outcrop areas of each of the four formations beneath the PBS site.

The Delaware Limestone conformably overlies the Columbus Limestone, and is approximately 75 feet thick. The contact between the two formations occurs to the northwest of PBS. The Delaware Limestone crops out beneath the extreme northwestern corner of PBS. It is described as a massive to thin-bedded brown to gray fossiliferous limestone and dolomite. According to the PBS Preliminary Assessment (SAIC, 1991), karst topography occurs selectively in some of the Silurian and Devonian carbonates in the northern and western sections of Erie County. Subsequently, cavernous porosity occurs in some areas of the underlying carbonates.

The Plum Brook Shale unconformably overlies the Delaware Limestone and crops out underneath most of the northwest portion of the site. It is approximately 35 feet thick, and is described as a blue, soft, fossiliferous shale containing thin layers of dark, hard, fossiliferous limestone.

The Prout Limestone is a 15 foot thick limestone which conformably overlies the Plum Brook Shale. The Prout Limestone crops out as a thin (1000 to 2000 foot wide) northeast striking band across the middle of PBS. It is described as a dark-gray to bluish-gray to blue, very hard, silicious, fossiliferous limestone or dolomitic mudstone.

The Huron Shale is the lower member of the Ohio Shale and crops out under much of the southern and eastern portions of PBS. It is described as a grayish-black, dense,

Age	Formation/Group	Depth to Top (ft)	Thickness (ft) a	Hydrologic Unit b	Rock Description
DEVONIAN	Ohio Shale	c	300	Zone 3	Shale : *black, thin-bedded with bituminous and carbonaceous material.*
	Prout Limestone/ Plum Brook Shale	Surface	210		Shale : *light grey, calcareous.*
	Delaware Limestone	40	50	Zone 1 and Zone 2	Limestone : *buff, earthy, foss. interbedded with brown crystalline dolomite.*
	Columbus Limestone	90	110		Limestone : *brown to grey, fine crystalline, foss. with tan to buff-grey, partly sandy dolomite at base.*
	Lucas Dolomite	200	70		Dolomite : *brown, crystalline, porous, chert.*
	Amherstburg Dolomite	270	20		Dolomite : *tan to grey, microcrystalline, sl. argillaceous.*
SILURIAN	Bass Island Dolomite	290	30		
	Salina	320	590'		Dolomite : *anhydrite and shale sequence. Interbedded and intercalated. Dolomite is tan to brown and mostly tight. Scattered shale laminae. Few scattered oil stains. Some dolomite is shaly. few massive beds of dolomite and anhydrite.*

a. Depth to formation, formation thickness, and lithology based on deep borehole located at N 288+68, E 155+54.

b. Refer to Figure 5. for areal distribution of Zones 1, 2, and 3.

c. The Ohio shale was not encountered in the deep borehole, it outcrops in the southeasternmost portion of Plum Brook Station.

Figure 2-1

GENERALIZED STRATIGRAPHIC SECTION OF SILURIAN AND DEVONIAN STRATA UNDERLYING PLUM BROOK STATION

Plum Brook Ordnance Works
Sandusky, Ohio

REFERENCE: Reproduced from SAIC Preliminary Assessment, 1991

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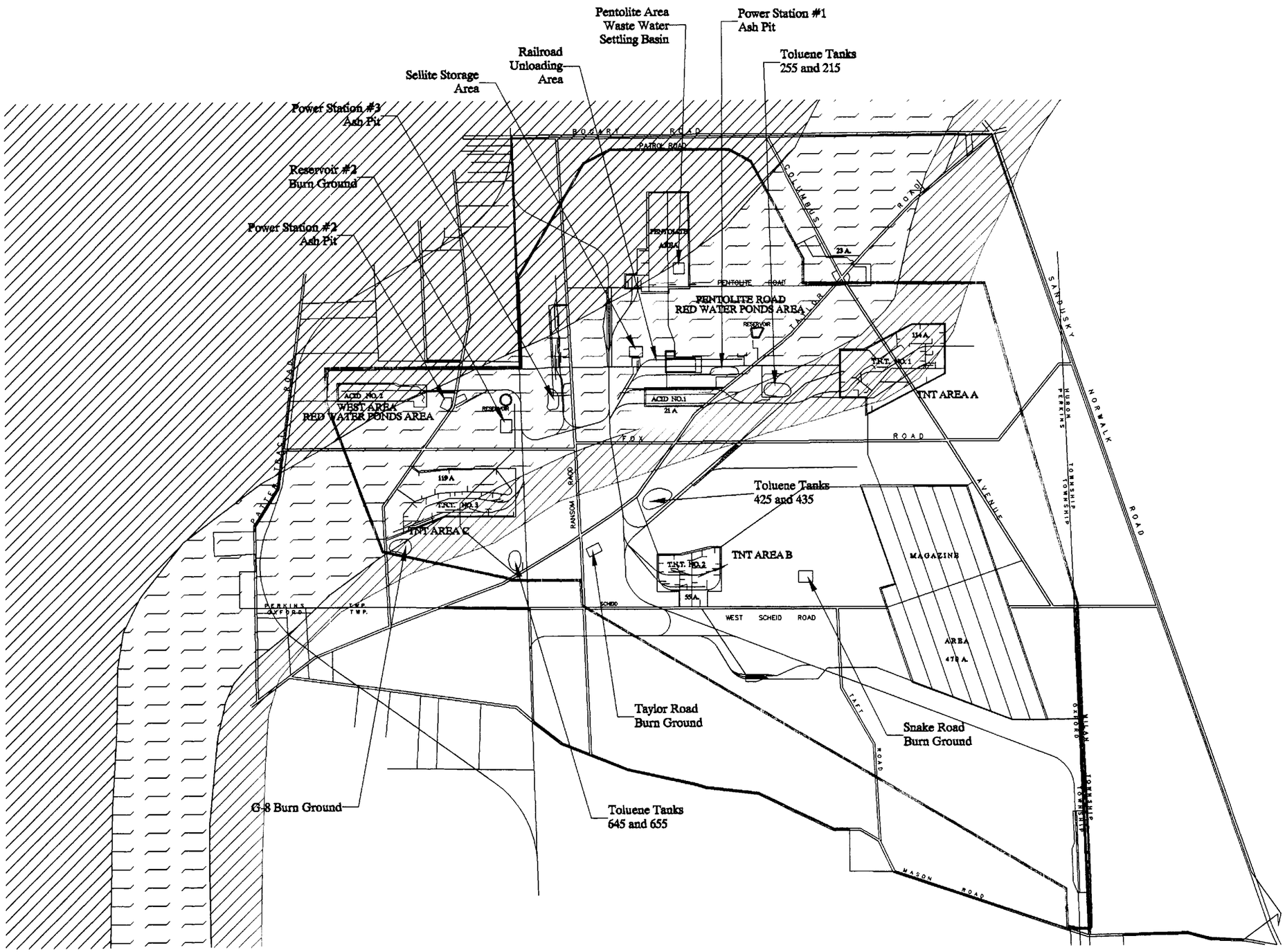

N

Scale: 1" = 2800'

- Ohio (Huron) Shale
- Prout Limestone
- Plum Brook Shale
- Delaware Limestone

Source: Geologic contact and bedrock unit information is from a portion of the "Bedrock Geology" map of the "Comprehensive Planning Study" included in the "Land Capability Report" by the Erie Planning Commission, 1967

Figure 2-2
Bedrock Units at NASA Plum Brook Station
Plum Brook Ordnance Works
Sandusky, Ohio

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Government Services Division; Atlanta, Georgia
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platy to fissile shale containing large pyrite/carbonate concretions (1 to 6 feet in diameter). It is up to 300 feet thick. The glacial drift cover over the Huron Shale is generally thinner than over the other formations, in many places the shale is within several feet of the surface.

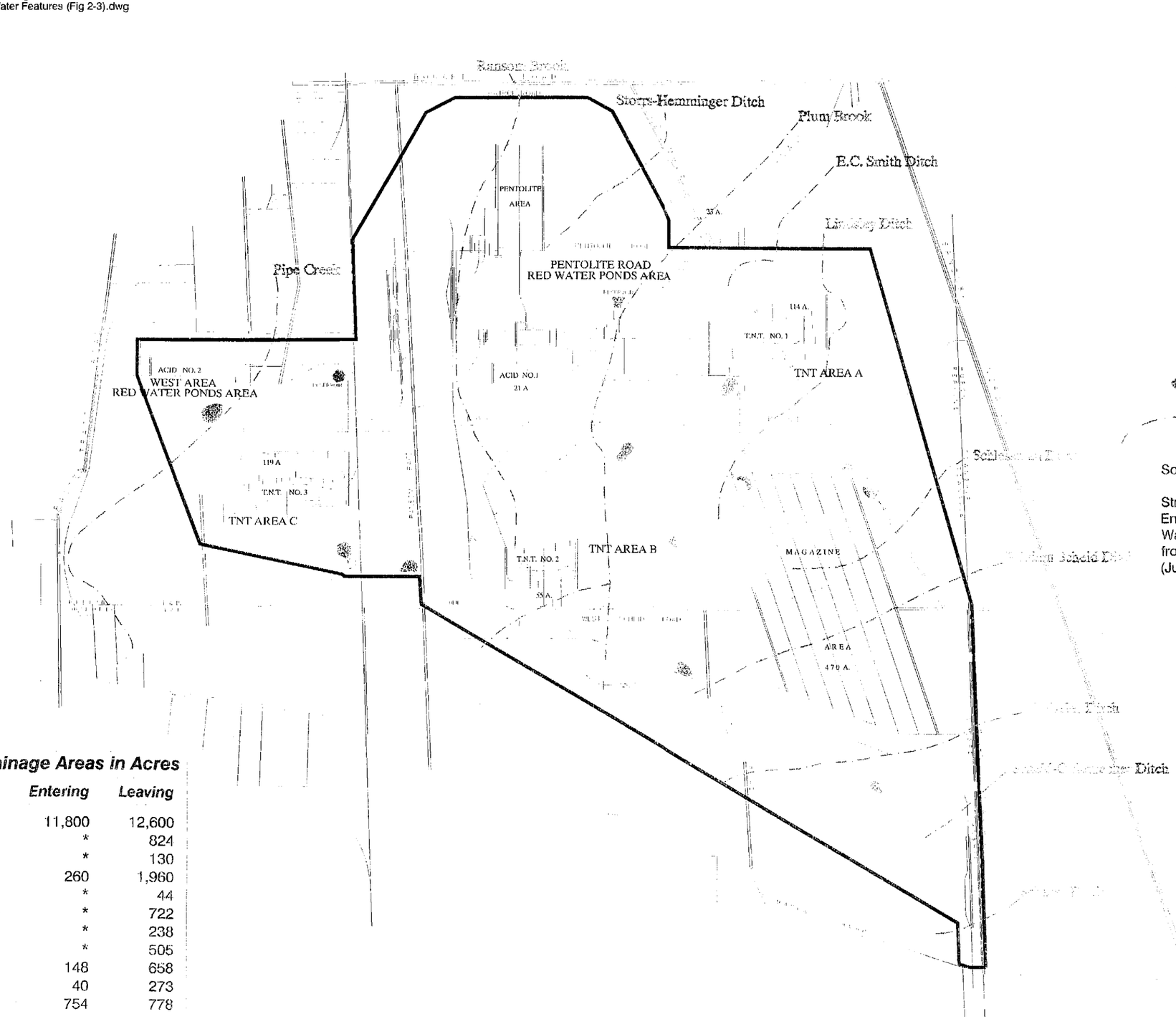
2.6 SURFACE WATER

PBS lies in the eastern region of the Pickeral Creek-Pipe Creek Basin, which, in turn, lies within the St. Lawrence River drainage basin (Ohio Department of Natural Resources Availability of Underground Water, Pickeral Creek - Pipe Creek Area, 1962 and Ground Water Pollution Potential of Erie County, Ohio; 1994). The Huron River Basin lies approximately 3.5 miles east of PBS. Sandusky Bay and Lake Erie are the largest surface water bodies within a 15 mile radius of PBS, approximately 4.5 miles north of the site.

Eleven streams pass through or originate within PBS and are a part of four drainage areas: (1) Sawmill Creek (southern PBS), (2) Plum Brook (central PBS), (3) Pipe Creek (western PBS) and (4) Storrs-Hemminger Ditch (USGS Topographic Quadrangles Sandusky and Kimball, Ohio; 1969 and SAIC, 1991). All streams flow north or northeasterly into Sandusky Bay. The locations of these streams and other selected surface water features are illustrated on Figure 2-3.

Although Sawmill Creek does not pass through PBS itself, several ditches cross the southern portion of PBS, flow easterly and feed into Sawmill Creek. The ditches, listed in order from north to south, are Schlessman Ditch, W. Scheid Ditch, Kuebelar Ditch, Scheid-Olemacher Ditch and Scherer Ditch. Lindsey and E.C. Smith Ditches flow north along the northern portion of PBS into Plum Brook just north of PBS. Ransom Ditch (northern PBS) flows northward into Pipe Creek. Additionally, ditches totalling 380,000 lineal feet are within PBS (SAIC, 1991). Numerous ponds lie within and around PBS. Seventeen isolated ponds and reservoirs and one former red water pond are located on PBS. The ponds are probably fed from shallow groundwater, and the pond water levels remain high even during dry months. (SAIC, 1991)

Government Services Division; Atlanta, Georgia
D:\COE-PLUM\January 1997\Surface Water Features (Fig 2-3).dwg



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Scale: 1" = 2800'

Pond or Reservoir

Surface Water Drainage Feature

Sources:

Stream and ditch locations and names from NASA Environmental Resources Document (August 1990). Watershed areas and locations of ponds and reservoirs from SAIC Plum Brook Station Preliminary Assessment (June 1991).

Stream	Drainage Areas in Acres	
	Entering	Leaving
Pipe Creek	11,800	12,600
Ransom Brook	*	824
Storrs-Hemminger Ditch	*	130
Plum Brook	260	1,960
E.C. Smith Ditch	*	44
Lindsley Ditch	*	722
Schlessman Ditch	*	238
William Scheid Ditch	*	505
Kuebeler Ditch	148	658
Scheid-Ohlemacher Ditch	40	273
Scherer Ditch	754	778

* Stream originates within station boundaries

Figure 2-3
Selected Surface Water Features at Plum Brook Station

Plum Brook Ordnance Works
Sandusky, Ohio

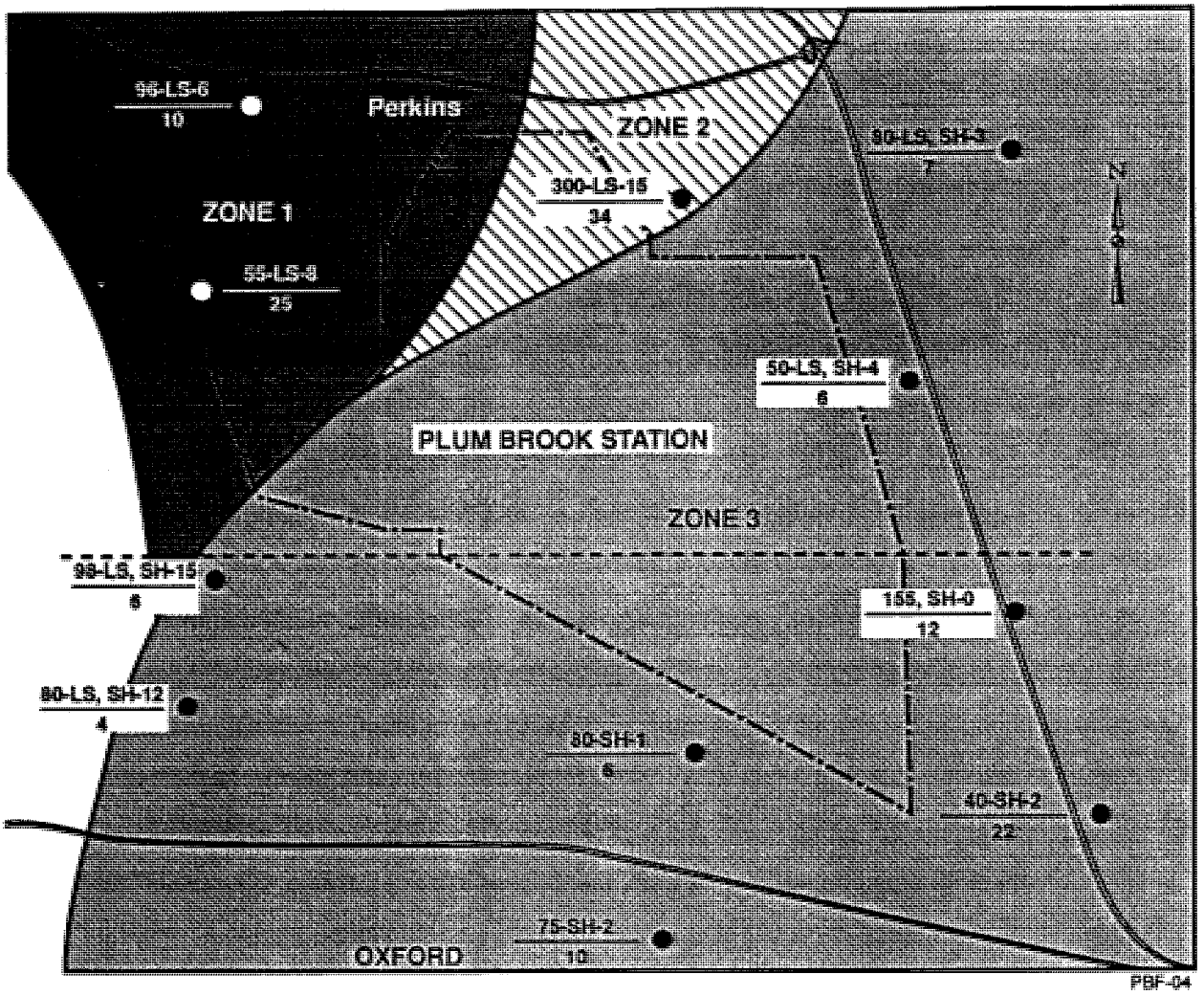
2.7 GROUNDWATER USE

Two aquifer systems are utilized for drinking water in the area surrounding PBS: a carbonate aquifer cropping out in the western portion of Erie County and a shale aquifer cropping out in the eastern portion. PBS covers the transition of the two aquifer systems. Both aquifer systems are overlain by a veneer (generally less than 20 feet) of glacial drift that is considered a poor source of ground water except in areas of sand and gravel lenses (Ground Water Pollution Potential of Erie County, Ohio; 1994).

The carbonate aquifer is subdivided into two zones by the Ohio Department of Natural Resources based on their areas of usage and yields. The shale aquifer and overlying discontinuous sand and gravel deposits are designated as zone three. Figure 2-4, reproduced from SAIC's Preliminary Assessment, illustrates the three zones. Zone one occurs in the north and northwestern portion of PBS and includes wells with yields of 100 to 500 gallons per minute (gpm) developed in cavernous limestone and dolomite, generally obtained from depths of around 100 feet. Zone two occurs in the north portion of PBS and includes wells with yields of 15 gpm or less developed in a deeper carbonate aquifer at an approximate depth of 300 feet. Zone three occurs over all of the eastern and southern portions of PBS and includes wells with yields that seldom exceed 3 gpm.

Yields from zone one are high in the karst terrain of western Erie County. From west to east in zone one yields decrease as evidenced by a well just west of PBS that has a yield of 8 gpm. Additionally, the carbonate aquifer beneath the shale aquifer will yield larger quantities of water than the shale aquifer, but the quality is considered likely to be poor due to high mineral content (Ohio Department of Natural Resources, Availability of Underground Water, Pickeral Creek - Pipe Creek Area, 1962).

According to SAIC (1991), 179 permitted private drinking water wells, listed at the Erie County Health Department, were within a 4-mile radius of PBS. Permits are not required for agricultural use.



LEGEND

ZONE 1

AREAS IN WHICH YIELDS OF 100 TO 500 GALLONS PER MINUTE MAY BE DEVELOPED.

Yields of more than 500 gallons per minute have been developed at depths of less than 200 feet in cavernous limestone and dolomite. Domestic supplies are generally obtained at depths of around 100 feet.

Hydrogen sulfide, in varying amounts, may be encountered in the bedrock.

ZONE 2

AREAS IN WHICH YIELDS OF 5 TO 25 GALLONS PER MINUTE MAY BE DEVELOPED.

Yields of 15, or less, gallons per minute are developed from wells drilled into the limestone. Hydrogen sulfide may be present in varying amounts.

ZONE 3

AREAS IN WHICH YIELDS SELDOM EXCEED 3 GALLONS PER MINUTE

Limited quantities of ground water are obtained from thin, discontinuous sand and gravel deposits interbedded in fine, sandy clay or from the underlying shale. Drilling deeper than 30 feet into the shale is not recommended. Occasional gas or salt noted in the eastern half of the county.

Larger yields may be obtained in western Huron and Oxford townships and southeastern Perkins Township. Wells may encounter water-bearing limestone beneath as much as 60 feet of impervious shale.

SCALE

1 0 1 mile

Depth (ft)

75-SH-2 — Existing Domestic Wells

Water-bearing formation

Yield (gpm)

10 — Depth to bedrock (ft.)

Figure 2-4

REGIONAL WATER-BEARING ZONES IN THE BEDROCK AQUIFERS (Modified from Walker, 1986)

Plum Brook Ordnance Works
Sandusky, Ohio

REFERENCE: Reproduced from SAIC Preliminary Assessment, 1991

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Residences to the north and east of PBS are served by city, county and rural water departments. Residences south and west of PBS are supplied by wells and cisterns (SAIC, 1991). According to SAIC (1991) the nearest recorded well is at 6115 Schenk Road; however a closer well was observed at 1810 Schenk Road. Additionally, two other wells are considered public drinking water supplies (used by 25 or more people for 60 days or more a year): Woussickett Golf Course clubhouse (6311 Mason Road) and Stanley's Tavern (4408 Mason Road), (SAIC, 1991).

Prior to the construction of a sewage treatment facility by Bellevue in 1971, the carbonate aquifer was contaminated by the injection of waste water through privately and municipally owned wells (Ground Water Pollution Potential of Erie County, Ohio, 1994). Samples of potable wells in the Bellevue-Castille area in 1961 contained alkyl benzene sulfonate (indicative of household detergents), ammonium nitrogen, as well as higher concentrations of nitrogen compounds than the adjacent limestone areas (Ohio Department of Natural Resources Availability of Underground Water, Pickeral Creek - Pipe Creek Area, 1962).

2.8 SURFACE WATER USAGE

Surface water intakes within 15 miles of PBS include Lake Erie, Huron River, and reservoirs fed by tributaries of the west branch of Huron River or the west branch itself.

The Erie County Health Department does not permit the use of surface water for private drinking water supply and no surface water within PBS is used as a drinking water supply (SAIC, 1991). It is unknown if surface waters are used for livestock in the local area. Crop irrigation is not common in Ohio (SAIC, 1991). Lake Erie and Sandusky Bay are a resource for recreational sports including fishing, swimming, and boating.

3.0 DESCRIPTION AND HISTORY OF RED WATER PONDS

The PBOW used a batch manufacturing process in which sequential steps were performed in a series of separate buildings comprising a process line. A general description of the process is provided in Section 3.1. Waste known as "red water" was generated during the manufacturing process and was processed through a series of waste water disposal facilities, including waste water settling tanks located at each of the three TNT manufacturing areas and three waste water treatment plants, and eventually disposed of in "red water ponds." The Pentolite Road Red Water Ponds, in the central part of the site, are located south of Pentolite Road and northwest of Reservoir #1. The Pentolite Road Red Water Ponds received waste water from TNT Areas A and B. The West Area Red Water Ponds, in the far western portion of the site, are located near Pipe Creek. The West Area Red Water Ponds received waste water from TNT Area C. The locations of the two "red water ponds" areas were constructed at the PBOW at the locations illustrated on Figure 3-1. Summaries of the readily available information about the construction, use, and previous investigations of the Pentolite Road Red Water Ponds and the West Area Red Water Ponds areas are provided in Sections 3.2 and 3.3, respectively.

3.1 TNT MANUFACTURING PROCESS

TNT is made by nitrating toluene in a three-step process (USATHAMA 1990). In this process, nitration is the substitution of a nitro group ($-NO_2$) for a hydrogen on the benzene ring of the toluene molecule. A mixture of three nitrotoluene (NT) isomers (2-NT, 3-NT, and 4-NT) and a layer of waste acid are formed during the first nitration. The second nitration produces the six DNT isomers, with 2,4-DNT; 2,6-DNT; and 3,4-DNT being most abundant. Ninety five percent of the production in the third nitration step is 2,4,6-TNT, which is the desired product. To effect nitration, toluene is mixed with a solution of sulfur trioxide in sulfuric acid (oleum) and nitric acid, and heated. Water is formed by the nitration reaction, and the water combines with the sulfur trioxide to form sulfuric acid. The production of additional sulfuric acid makes the mixture of oleum and nitric acid a more effective nitrating agent than a combination

BASE PHOTOGRAPH: October 19, 1950; Photo PW-3G-62; Site - Plum Brook Ordnance Works, Sandusky, Ohio

N

Figure 3-1

LOCATIONS OF RED WATER POND AREAS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

combination of sulfuric and nitric acids. Each nitration step is progressively more difficult and stronger acid solutions are required in order to complete the reactions.

In the TNT manufacturing process, the acid mixture and the organic compounds flow in opposite directions. A fresh feed of oleum and nitric acid is used in the third step, and the acid waste is used, after fortification with nitric acid, in the second nitration. Acid from the second step is fortified and reused in the first nitration. The waste acid from the first nitration is separated from the organic phase and denitrated using steam; the nitrogen oxide is recovered in water and heated to produce nitric acid. This acid is used to fortify the acid mixtures for the first and second nitration steps.

Following nitration, the crude TNT is washed to remove acids, neutralized with soda ash, and crystallized by adding cold water. Sodium sulfite (sellite) is added to the crystalline TNT because it forms a water-soluble salt with the unwanted TNT isomers, which are removed in a water wash. The purified TNT is then melted, dried to remove water, and solidified in flake form.

The waste streams from normal production include spent sulfuric and nitric acids and red water from the purification process. The red water contains sodium salts of sulfite, sulfate, nitrite, nitrate, and sulfonates of the unwanted isomers (2-NT, 3-NT, 4-NT, 2,4-DNT, 2,6-DNT, 3,4-DNT), plus other organic compounds such as 1,3,5-trinitrobenzene (TNB), 1,3-dinitrobenzene (DNB), and nitrobenzene (NB). Some of the other organics found in red water include trinitrobenzoic acid, trinitrobenzaldehyde, and trinitrobenzyl alcohol (USATHAMA 1990). In addition to the water waste stream, unusual occurrences can create waste from intermediate steps in the process, which could include NT and DNT compounds. For example, the contents of reaction vessels have been dumped when the process was thought to be out of control.

3.2 PENTOLITE ROAD RED WATER PONDS

3.2.1 Description of the Pentolite Road Red Water Ponds

The Pentolite Road Red Water Ponds are located between Maintenance Road and Pentolite Road, northwest of Reservoir #1 at the location shown on Figure 3-1. During field reconnaissances of the area conducted in March 1994 and fall 1994, the area consisted of thick masses of cattails with bare areas which seasonally contain ponded water, as shown on Photos 3-1 through 3-4. Ponded water within this area was observed to have a reddish tint, as shown on Photo 3-5.

An approximately 10-foot deep southwest-northeast trending ditch traverses the area to the east. This ditch flows northeasterly into another ditch which parallels Pentolite Road. According to information provided by NASA PBS employees, an underground clay pipe ("drainage tile") drains the Pentolite Road Red Water Ponds area and discharges into the ditch which parallels Pentolite Road. Photo 3-6 shows the drainage pipe where it discharges into this ditch.

The ponds received waste water from TNT Areas A and B from initiation of plant operations to 1945. Review of historical site drawings indicate that waste water from the waste water settling basins at the TNT areas flowed through wooden flumes and pipes to a waste water treatment and incineration area (Waste Water Disposal Plant #1), then to the pond disposal area via an elevated 12-inch diameter discharge pipe.

Drawing No. 1663-W-2 (E.B. Badger & Sons Co., October 1941) illustrates construction details of the waste water disposal area. Figure 3-2 is derived from this Drawing No. 1663-W-2. The waste water basin measured 200 feet in width and 400 feet in length. It was 3 feet in depth and was surrounded by a 1-foot high levee. A note on the 1941 drawing states that 3-foot boreholes were to be drilled at the corner of each square yard within the basin, and pop shots of dynamite were to be inserted into the holes and detonated to loosen the subsoil. Production at the PBOW actually started in December 1941 (2 months after this drawing was prepared); no information was found which verified the construction details shown on the drawing.

PHOTO 3-1. Bare areas containing ponded surface water at Pentolite Road Red Water Ponds (photo taken in March 1994)

PHOTO 3-2. View looking northeast toward bare areas at Pentolite Road Red Water Ponds (photo taken in March 1994)

PHOTO 3-3. Dry bare area at Pentolite Road Red Water Ponds (photo taken in November 1994)

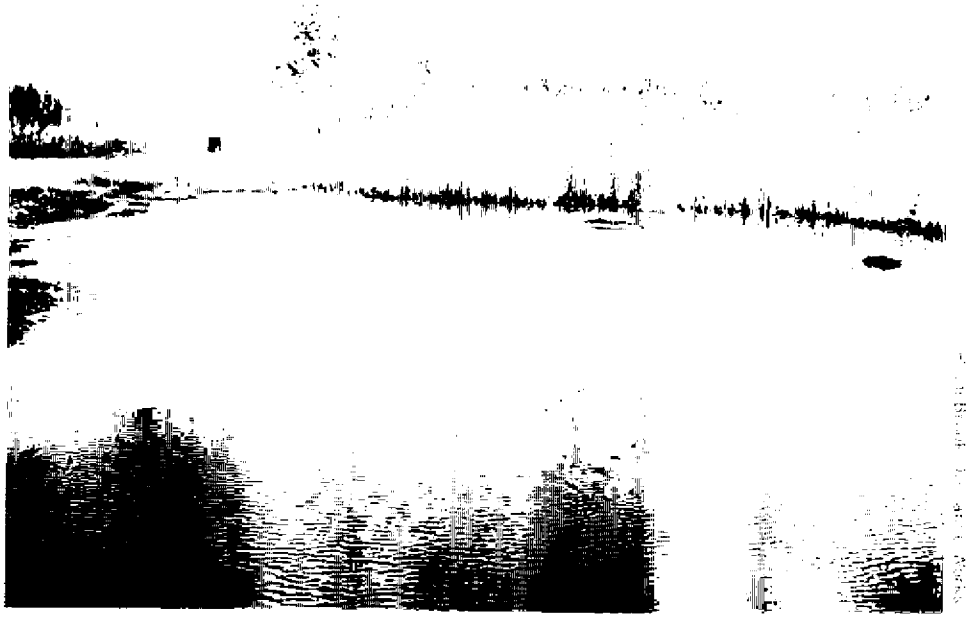


PHOTO 3-4. Ponded surface water in the same bare area as shown in Photo 4-3 (photo taken in December 1994)

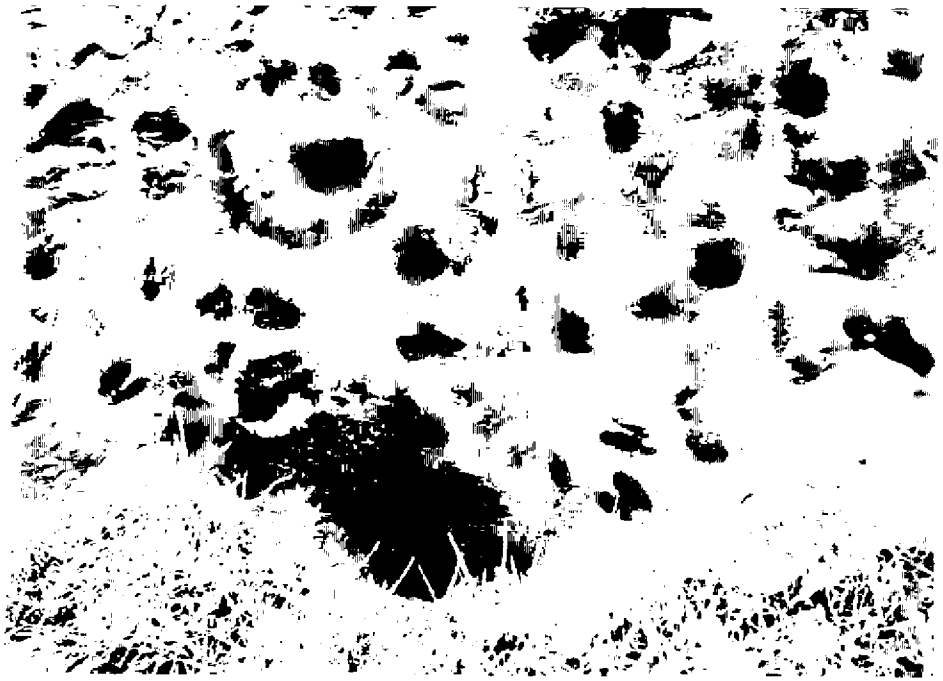
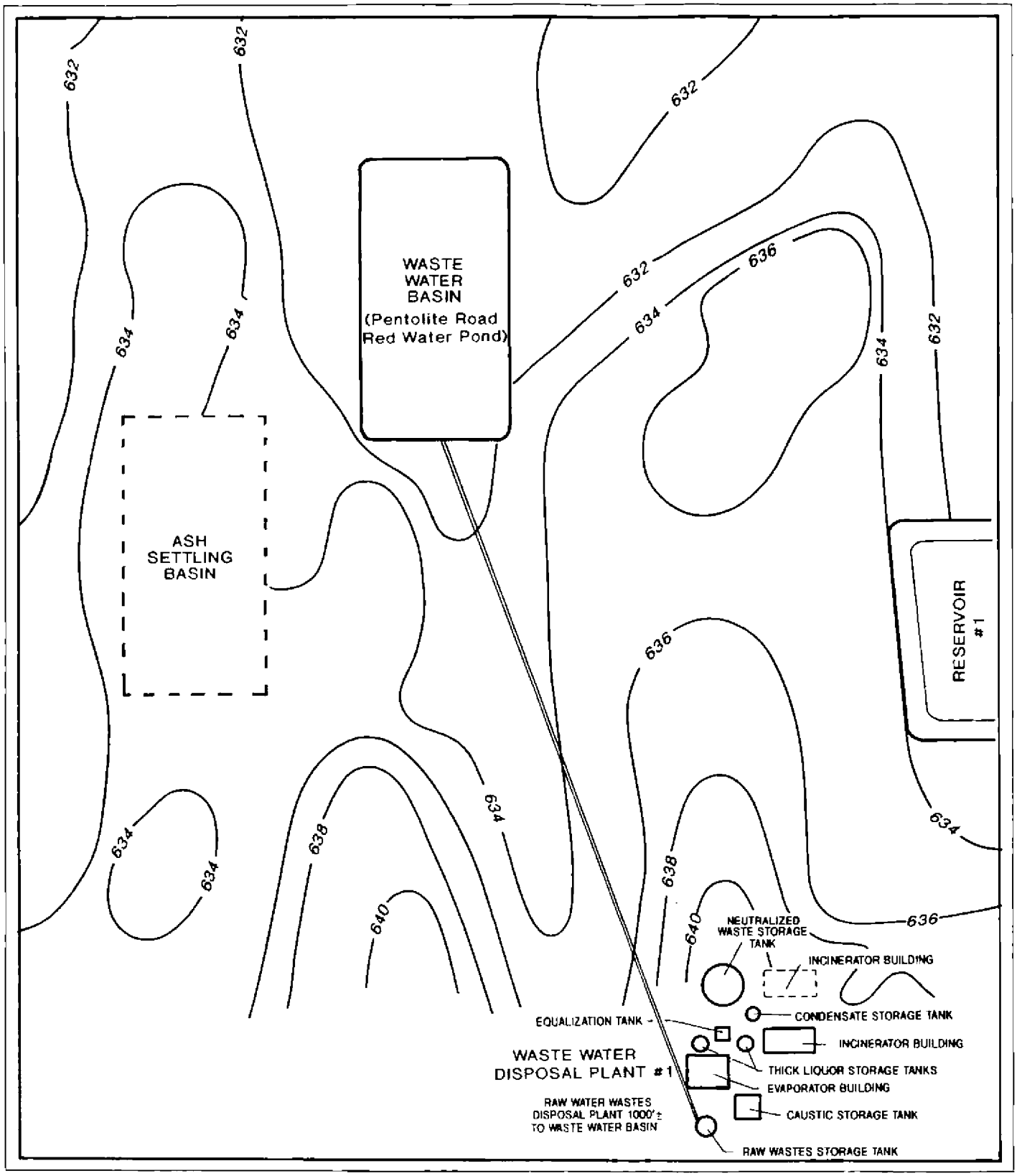


PHOTO 3–5. Close-up view showing reddish tint of ponded water at Pentolite Road Red Water Ponds (photo taken in fall 1994)

Plum Brook Ordnance Works

PHOTO 3–6. Drainage tile from Pentolite Road Red Water Ponds; tile discharges into ditch parallel to Pentolite Road (photo taken in fall 1994)



200 100 0 200 400 FEET

REFERENCE DRAWING No. 1663-W-2 "Temporary Storage Pit for Neutralized Waste Water", E.B. Badger & Sons, 1941

Figure 3–2

CONSTRUCTION DIAGRAM FOR PENTOLITE ROAD RED WATER POND AND WASTE WATER DISPOSAL PLANT #1

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

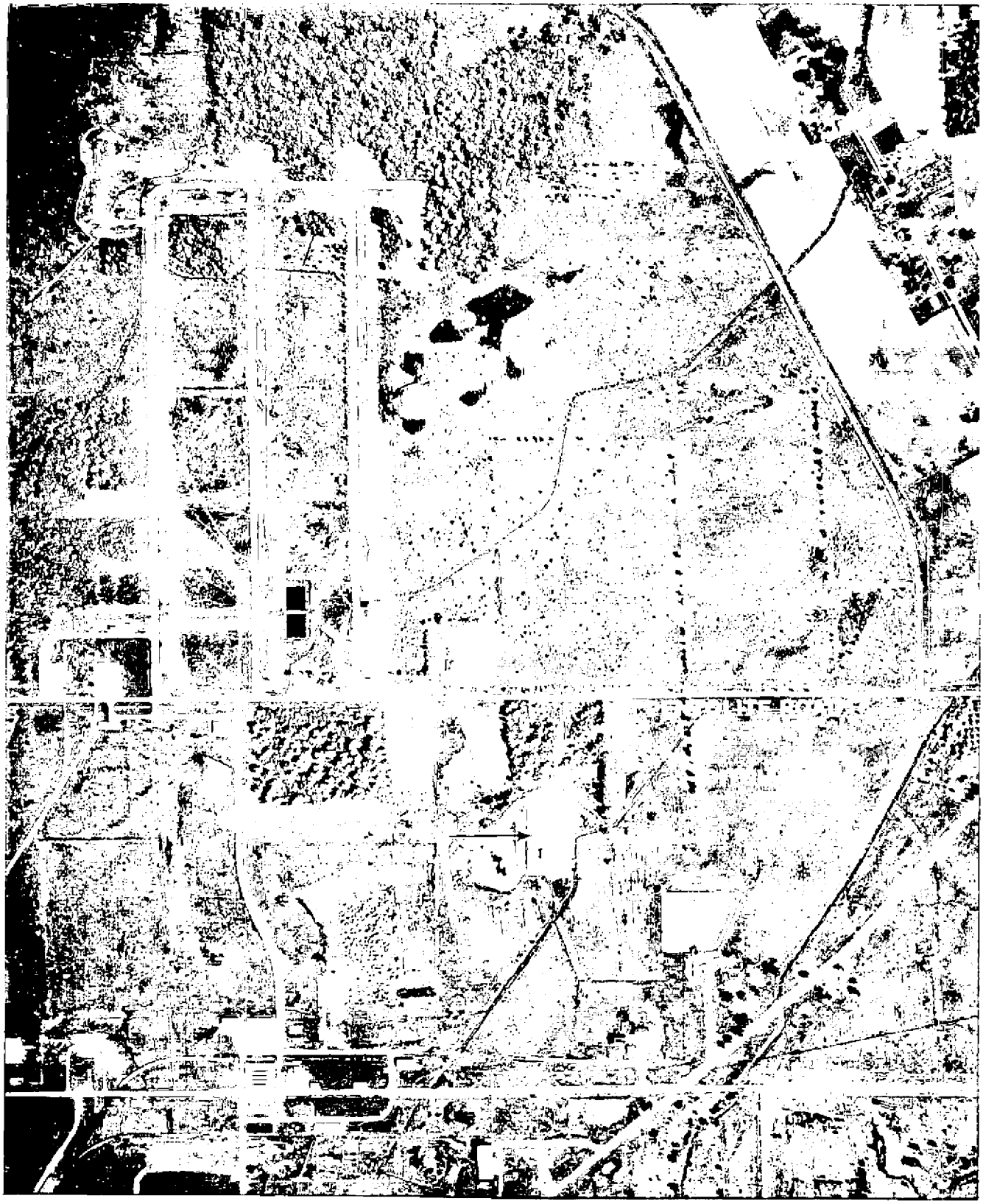
Figure 3-1 is an aerial photograph of the area taken in October 1950. This photograph shows a disturbed area where the Pentolite Road Red Water Ponds were located. The eastern portion of the disturbed area resembles the shape of the waste water basin shown on Figure 3-2. It appears to be predominately dry. The western portion of the disturbed area, which is irregularly shaped but is approximately the same size, appears to contain water. Figure 3-3, which is an aerial photograph of the area taken in 1956 shows a similarly shaped area. A close-up aerial photograph of the Pentolite Road Red Water Ponds (photograph obtained from NASA; no title or date) showed two distinct ponds in this location; the ponds appeared to be diked (in agreement with Drawing No. 1663-W-2, referenced above). The ponds in this close-up photograph (not reproduced herein) resemble the shape of the ponds shown on Figure 3-3.

Review of additional historical drawings (such as Plan No. R-32, "Unit Layout Map, Waste Disposal & Water Supply Area No. 1" [E.B. Badger & Sons Co., no date]) indicates that waste water was transported to the Pentolite Road Red Water Ponds via an elevated 12-inch discharge pipe from a raw waste water tank at Waste Water Disposal Plant #1 (the location and layout of this plant are shown on Figure 3-2). Apparently, waste water was transported from the waste water settling basins at TNT Areas A and B to a raw waste water tank at this plant prior to disposal at the Pentolite Road Red Water Ponds.

3.2.2 Post-PBOW Actions

3.2.2.1 Ravenna Arsenal, Inc. Actions in 1960s

A letter to Ravenna Arsenal, Inc. from the U.S. Army Ammunition, Procurement, and Supply Agency in Joliet, Illinois (Braig, 1963) describes work to be accomplished by Ravenna Arsenal, including apparent decontamination and decommissioning activities. Item 2 of this letter states: "Examine leaching bed near Reservoir #1, destroy some of the contaminants and re-route drainage to reduce amount of red water flowing into Plum Brook." The leaching bed referred to in this letter may be the Pentolite Road Red Water Ponds.



600 300 0 600 1200 FEET

(APPROX.)

N

Figure 3-3

1956 AERIAL PHOTOGRAPH SHOWING PENTOLITE ROAD RED WATER POND AREA

Plum Brook Ordnance Works

Sandusky, Ohio

DAMES & MOORE

3.2.2.2 1977 Actions

In an April 1977 memorandum (Teledyne Isotopes, 1977), PBS personnel reported an observation of localized pockets of reddish brown water in the small surface ditch east of, and adjacent to, the Pentolite Road Red Water Ponds area, which was referred to as a surface spoils site. The source was discovered to be a broken drain tile on the southeast corner of the "spoils area." The memorandum stated that retention dikes and sump pits were promptly excavated to prevent leakage of the material to surface streams. From April 13, 1977 to May 3, 1977, approximately 60,000 gallons of the "red" water were removed by a private disposal contractor. Grading and drainage improvements were made to the area to alter surface runoff patterns.

The memorandum further described actions being undertaken by the local Air National Guard which included backfilling the original settling basin to bring it higher in elevation than the surrounding area. The memorandum stated that a new drainage ditch would be dug approximately 300 feet east of the original ditch, which would then be backfilled. The intent of these activities was to eliminate ponding in the area, thus reducing the amount of surface water that could mix with the red water residue, thus producing red-colored water.

On April 14, 1977, one surface water sample was collected from the surface drain tile pool; on April 15, 1977, a second sample was collected from the retention trench that was dug to prevent runoff to surface streams. The memorandum states that both samples were "deep red in color, odorless and aqueous in nature, with a pH of 7.3." Several minnows were observed in the contaminated drain tile pool of water.

"Flame tests gave a bright yellow-orange flame suggesting the presence of sodium. Sodium was subsequently verified by atomic absorption spectrophotometry to be present in a ratio of 2 to 1 to sulfate. This suggests strongly that the major inorganic constituent is Sodium Sulfate (Na_2SO_4)." (Teledyne Isotopes, 1977)

The Lewis Chemistry Lab analyzed replicate samples of these samples and reported that tannin was the prime constituent present in the samples as determined by infra red analysis.

Additionally, PBS laboratory personnel collected soil samples at different strata within the "spoils area." A thin layer (approximately 1/8-inch) of salt-like crystalline material was reported at or near the surface. About 1 foot of sand and top soil covered a clay sub-strata. The top soil samples were dispersed in water and the water turned red in color. The clay sub-strata samples did not cause discoloration of water. (Teledyne Isotopes, 1977) The memorandum further stated that the salt-like surface strata samples had the highest concentrations of sulfate and the clay sub-strata apparently did not absorb the chemical spoils.

Under a "Data Interpretation" heading in the memorandum, the author stated:

> The major constituent in the spoils area is sodium sulfate probably resulting from the neutralization of acid wastes by use of caustics. The presence of significant quantities of tannin probably resulted from acid reaction with wooden vats and plumbing in the old arsenal days at Plum Brook. The presence of significant quantities of iron in the range of 20 [parts per million] ppm probably resulted from acid/chemical reaction with iron plumbing. Other trace elements identified are consistent with what could be expected to be present in soil or are consistent with process materials used 3 decades ago. The presence of phenols in two samples cannot be explained.
>
> This red water as such does not appear to be an acute toxin to aquatic life based on abundant minnow population in the local ditches and subsequent downstream ditches and creeks (approximately 1,000 feet away).

3.2.2.3 1989 Actions

In 1989, NASA personnel (Ms. Amy L. Bower and Mr. Harry McCune) observed reddish-brown water emanating from the drainage tile into Pentolite ditch (NASA, 1989). Water samples were collected and analyzed for chemical oxygen demand (COD), pH, chromium, copper, lead, iron, and zinc. The iron and COD concentrations were approximately 6 to 10 times higher at the discharge pipe than at the National Pollutant Discharge Elimination System (NPDES) sampling weir located downstream.

3.2.2.4 1990 Actions

In April 1990, Ms. Amy Bower of NASA noticed rust-colored water discharging into Pentolite Ditch from the drainage tile which originates in the vicinity of the Pentolite Road Red Water Ponds. Ms. Bower assumed the water to be "red water" which had leached into the drainage tile (NASA, 1990). She notified several NASA and PBS individuals as well as the Ohio Environmental Protection Agency (OEPA), the National Emergency Response Center, and the U.S. Environmental Protection Agency (EPA).

Water samples were collected and analyzed for total chromium, COD, total copper, total iron, total lead, total nickel, nitrate, nitrate, total phosphorus, total sodium, sulfate, total zinc, TNT, 2,4-DNT, 2,6-DNT, cyclotetramethylene tetranitramine (HMX), cyclotrimethylene trinitramine (RDX), o-NT, m-NT, and p-NT. None of the NPDES limits were exceeded as a result of the discharge. However, levels of iron, nickel, nitrate, sulfate, and zinc at the outfall were significantly higher than the upstream levels as a result of the discharge. Concentrations of explosives were below the detection limit of the analytical method (NASA, 1990).

3.2.2.5 1991 Actions

In April 1991, Ms. Amy Bower of NASA observed another discharge of rust-colored water into Pentolite ditch from the drainage tile (NASA, 1991). The OEPA was notified and incident number 2-72-0508 was assigned. The National Response Center was also notified; incident report number 60215 was assigned. Ms. Bower also notified Mr. Doug Webb of the CEORN regarding the incident.

Analysis of a NPDES sample collected 2 days later at a downstream location indicated levels for COD, suspended solids, nitrate, zinc, copper, and pH to be within daily NPDES permit levels.

3.2.3 Environmental Investigations

IT investigated the Pentolite Road Red Water Ponds area during their 1989 Contamination Evaluation. In their report (IT, 1991), IT refers to this area as "Waste Disposal Area #1", and stated that areas of surface contamination were evident.

Monitoring well IT-MW5 was installed in the northern portion of the area to a total depth of 21 feet. Groundwater in this well was measured at approximately 15 feet below ground surface. IT also installed six soil borings and collected soil samples (SB-13 through SB-18). Soil samples collected from either 0 to 2 feet or 4 to 6 feet were submitted for analysis. IT also collected one surface water sample (SW-04) from standing water within the area.

Groundwater, surface water, and soil samples collected by IT were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), nitrates, metals, and nitroaromatic compounds. IT reported that significant concentrations (greater than or equal to 740 parts per billion [ppb]) of 2,4-DNT and 2,6-DNT were detected in the soil samples collected from the Pentolite Road Red Water Ponds area. No nitroaromatic explosive compounds were reported in the groundwater sample collected from monitoring well IT-MW5 or in the surface water sample collected from this area.

MK Ferguson's investigation of the Pentolite Road Red Water Ponds area was limited to collection of surface water and sediment samples from a drainage swale north of the Pentolite Road Red Water Ponds. No explosive contaminants were detected.

3.2.4 Current Use

The Pentolite Road Red Water Ponds area is not currently used for any NASA-related activities. It is normally covered with vegetation including cattails and grasses.

3.3 WEST AREA RED WATER PONDS

3.3.1 Description of West Area Red Water Ponds

The West Area Red Water Ponds are located in the western portion of the site near Pipe Creek, as shown on Figure 3-1. Figure 3-4 provides a site plan of the West Area Red Water Ponds using the USGS topographic map as a base. As illustrated on Figure 3-4, the two ponds which comprise this area are designated as the "east" pond and the "west" pond. During operation of the PBOW the ponds were separated by a berm. NASA drained the east pond and it is generally dry, except for small areas of standing water that accumulate during periods of wet weather. Pipe Creek is located south of both ponds and east of the east pond. A northwest-southeast trending ditch is located to the northeast of the east pond (Figure 3-1); this ditch flows in a southeasterly direction and discharges into Pipe Creek. The area surrounding the ponds is predominately wooded.

The West Area Red Water Ponds received waste water from TNT Area C from initiation of plant operations until 1945, when the production of ordnance ceased (SAIC, 1991). Review of historical site drawings indicate that the waste water from the waste water settling basins at the TNT production areas flowed through wooden flumes and pipes to a waste water treatment and incineration area (Waste Water Disposal Area No. 2), then to the West Area Red Water Ponds via an elevated 12-inch diameter vitreous pipe. Review of historic aerial photographs indicates that the west pond has existed and contained standing water from the 1940s to present. The east pond existed and contained standing water from the 1940s to the late 1970s. According to information provided by Mr. Jim Knoll, an employee at the PBS, the berm around the east pond was breached at its southwestern corner in the late 1970s to try to drain the pond (personal communication with P. Westermann, 1994).

During field reconnaissances of the area conducted in March 1994 and fall 1994, the western pond contained standing water as shown on Photos 3-7 and 3-8. The sides of the earthen berm separating the eastern and western ponds were predominantly wooded (Photo 3-8). The eastern pond was generally dry except for small areas of standing water that appear to accumulate during periods of wet weather (Photo 3-9).

Scale: 1" = 350'

Figure 3-4
Site Plan of West Area
Red Water Ponds
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

Government Services Division; Atlanta, Georgia
H:\CAD\CCE-PLUM\PLOT\EXPRWS34.DWG

PHOTO 3-7. Northern portion of existing pond at West Area Red Water Ponds (photo taken in March 1994)

PHOTO 3-8 View looking south at berm and western portion of existing pond [illegible] Area Red Water Ponds (photo taken in September 1994)

PHOTO 3-9. View looking south at berm and former eastern pond of the West Area Red Water Ponds; note the reddish tint of the water (photo taken in March 1994)

PHOTO 3-10. Pipe Creek south of West Area Red Water Ponds (photo taken in March 1994)

Fort Frank Ordnance Works

Shallow red-tinted water was observed in the former eastern pond area adjacent to the earthen berm separating this area from the western pond.

3.3.2 Construction Details

Drawing R-36 "Power Hse., Waste Water Disposal Area No. 2" (E.B. Badger & Sons Co., undated) illustrates the buildings located within Waste Disposal Area No. 2 and the waste water discharge line to the western pond. The drawing indicates that an elevated 12-inch diameter line carried water from the Waste Disposal Area No. 2 Raw Waste Tank to the West Area Red Water Ponds.

Drawing No. 1763-S-954 "Details of Flume Connecting Raw Wastes Storage Tank and Waste Water Basin Including Basin Layout" (E.B. Badger & Sons Co., March 1942) illustrates construction details of the flume connecting the Raw Water Storage Tank at Waste Water Disposal Area No. 2 to the western pond. Review of the drawing indicates that the western pond was originally designed to be 200 feet wide by 400 feet long with an approximately 4 feet high earthen berm surrounding the basin. The area depicted on this drawing generally corresponds to the rectangular shaped eastern portion of the western pond. Figure 3-5 presents a historic aerial photograph (date unknown) of the western pond area. Based on the apparent absence of vegetation in the areas north and south of the pond (which were also observed on a 1944 aerial photograph of the area, but not on a 1950 aerial photograph of the same area), this photograph is believed to represent early 1940 West Area Red Water Ponds conditions. As shown on Figure 3-5, the western pond appears to have been expanded to the approximate limits shown on Figure 3-1 during PBOW operation. Review of Figure 3-5 also indicates that several trees are apparent within the western pond, suggesting that extensive grading of the pond bottom was not performed during construction of the western pond.

Drawing 1763-S-954 also indicates that the elevated 12-inch diameter line from the Waste Water Disposal Area No. 2 Raw Waste Tank discharged water in the middle of the northern berm of the rectangular shaped eastern portion of the western pond. No information regarding discharge from the pond was included on the drawing.

Figure 3-5

ASSUMED EARLY 1940s AERIAL PHOTOGRAPH SHOWING WESTERN POND

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

Drawing No. 1763-T-901-2 "Waste Water Disposal No. 2 Pond No. 2" (Trojan Powder Company, 1943) illustrates construction details for the eastern pond. Review of the drawing indicates that the eastern pond was designed to be approximately 407 feet wide in an east-west direction at its maximum extent. The eastern pond was constructed with an approximately 10 foot high earthen berm (typical), which varied in elevation from approximately 637.1 to 640.6 feet. The lowest top of berm elevation (637.1 feet) noted on the drawing occurred in the northeast corner of the pond near the northwest-southeast trending ditch. Based on the design water level (noted on the drawing) of 637.71 feet, discharge from the pond may have occurred at this location. An 8- to 10-inch diameter pipe penetrating the earthen berm in this area of the eastern pond was observed during a fall 1994 site reconnaissance. Evidence of former concrete pedestals that may have supported a discharge pipe were also observed in the area between the eastern pond and the northwest-southeast trending ditch.

The drawing also indicates that the elevation of the bottom of the pond varied significantly, further evidence suggesting that extensive grading of the pond bottom was not performed during construction. The drawing estimates the total volume of the eastern pond to be approximately 5,400,000 gallons. No information regarding influent or effluent lines was included on the drawings.

As noted above, specific information regarding the discharge of the eastern or western ponds or the transfer of water from the western pond to the eastern pond was not documented on the available drawings. SAIC (1991) noted that the western pond was constructed with an 8-inch diameter overflow tile that allows the ponds to overflow into Pipe Creek, but did not document the location of this overflow tile in their Preliminary Assessment Report. No evidence of this reported drain tile from the western pond to Pipe Creek was observed during a site reconnaissance of Pipe Creek conducted in fall 1994. During the March 1994 site reconnaissance, Pipe Creek contained approximately 3 to 5 feet of flowing water (Photo 3-10). Seeps of reddish water into Pipe Creek south of the western pond were also observed as shown on Photo 3-11. Pipe Creek was predominantly dry, with no flowing water, during the fall 1994 site reconnaissance. A breach and overflow area in the southwestern corner of

PHOTO 3-11 Reddish water seep into Pipe Creek south of West Area Red Water Ponds (photo taken in March 1994)

PHOTO 3-12 Breach and overflow area south of existing pond at West Area Red Water Ponds (photo taken in September 1994)

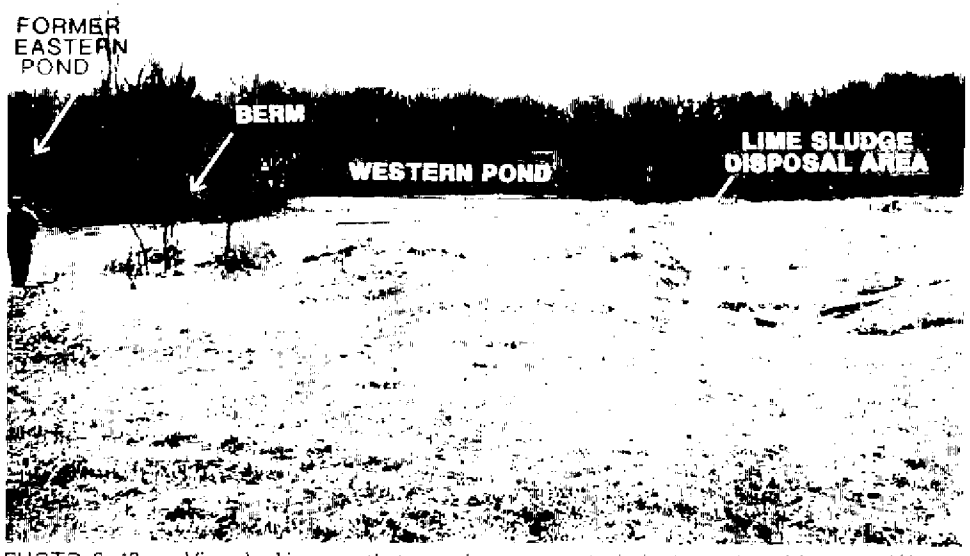


PHOTO 3-13. View looking south towards western (existing) pond and berm at West Area Red Water Ponds; lime sludge was disposed of in foreground (photo taken in March 1994)

the rectangular shaped eastern portion of the western pond was also observed during the field reconnaissances (Photo 3-12).

Figure 3-6 presents a 1960 aerial photograph of the eastern and western pond area. As shown on the figure, an apparent wooden structure is located on the berm separating the eastern and western ponds. A roadway to the area of the structure is also apparent on this photograph, as well as the 1950 (Figure 3-1) and 1958 aerial photographs. Information documenting the nature of this structure was not included in the documents reviewed. However, a figure included in the Ohio Army National Guard Report (Ohio Army National Guard, 1985) shows an influent pipe at this location. No evidence of the former structure was observed during the 1994 and 1995 site reconnaissances of this area. However, the roadway to the former structure location apparent on the photograph was observed during the site reconnaissances.

Figure 3-7 presents a layout of the West Area Red Water Ponds and Waste Water Disposal Area No. 2. The figure is derived from Dames & Moore's review of available information including drawings R-36, 1763-S-954, and 1763-T-901-2. The western limits of the western pond have been modified from those presented on Drawing No. 1763-S-954, and approximate those shown on Figure 3-1. Specifically, the western pond's width (east-west direction) at the center is depicted as being approximately 550 feet, rather than 200 feet. This western pond configuration was depicted based on a review of a presumed early 1940s aerial photograph (Figure 3-5) and a 1944 aerial photograph which indicate the expanded western pond configuration during PBOW operation. Figure 3-7 also illustrates the approximate location of the elevated discharge pipe from the Waste Water Disposal Area No. 2 Raw Waste Tank to the western pond and the location of the pipe penetrating the eastern pond berm observed during the 1994 field reconnaissances. The location of the apparent former structures shown on the 1960 aerial photograph and the apparent natural breach in the western pond berm observed during the 1994 field reconnaissances are also documented on Figure 3-7.

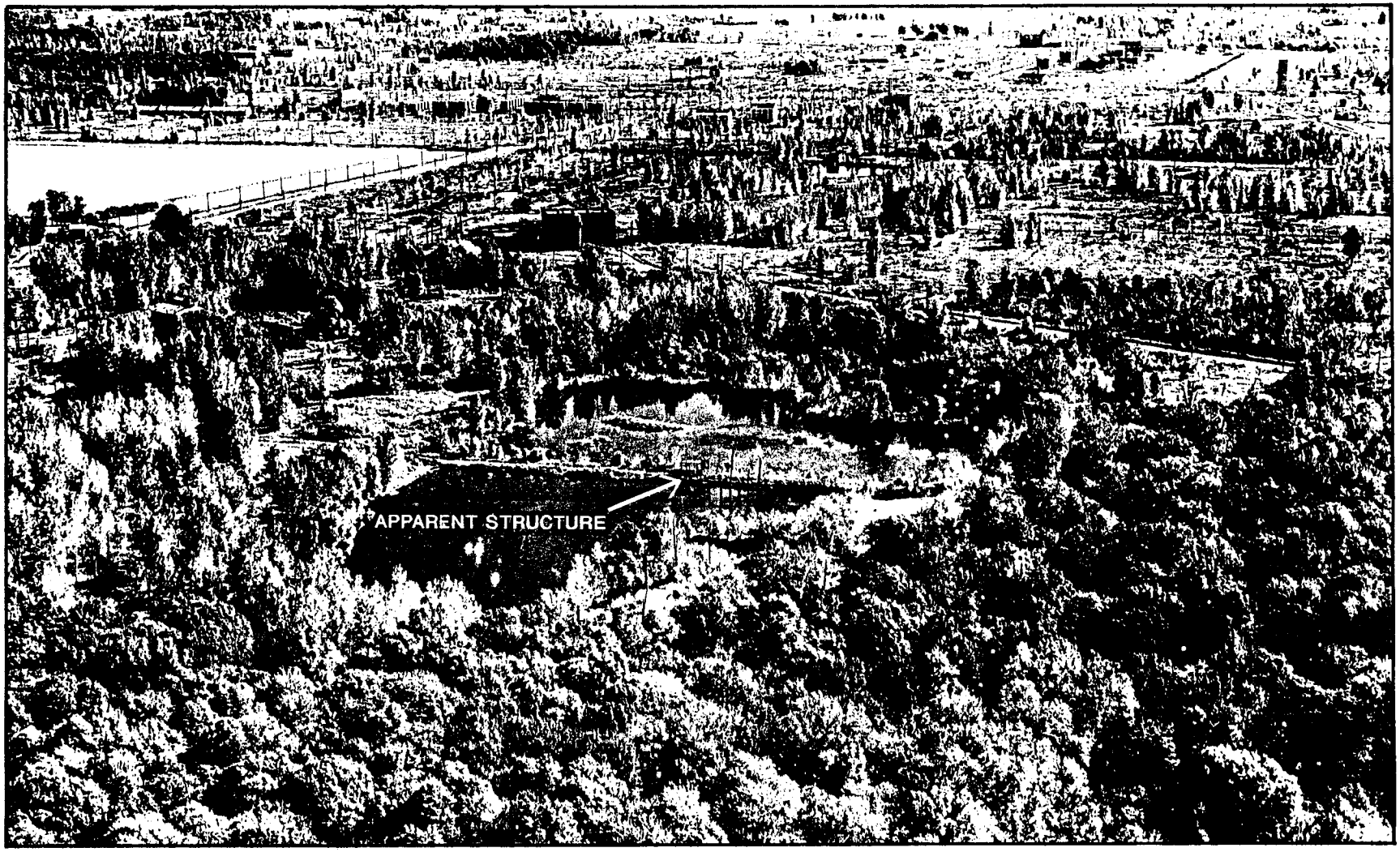
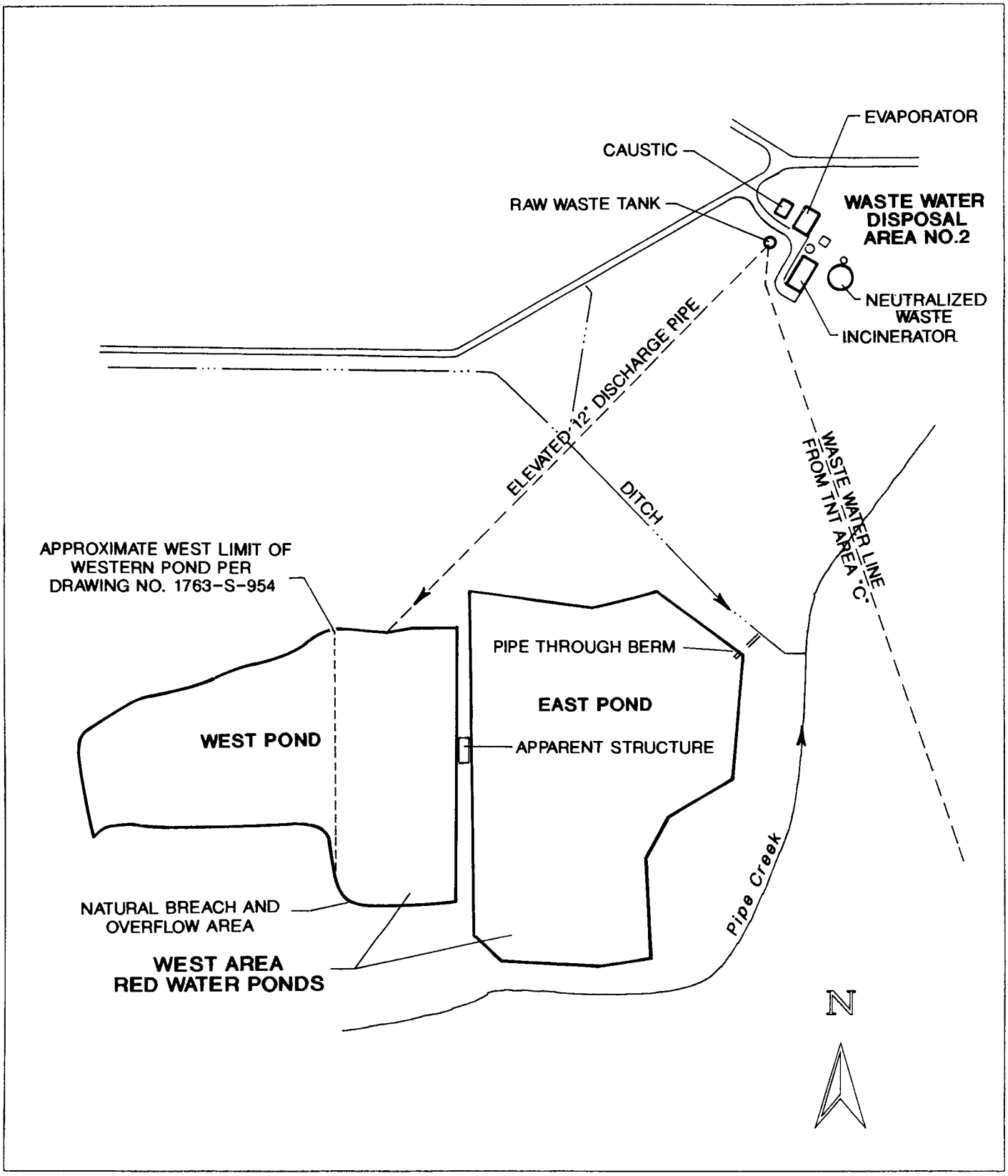


Figure 3-6

1960 AERIAL PHOTOGRAPH SHOWING WEST AREA RED WATER PONDS AREA

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



200 100 0 200 400 FEET

REFERENCE DRAWING NUMBERS:

R-36 "POWER HSE., WASTE DISPOSAL AREA NO.2", E.B. Badger & Sons

1763-S-954 "DETAILS OF FLUME CONNECTING RAW WASTES STORAGE TANK AND WASTEWATER BASIN INCLUDING BASIN LAYOUT", E.B. Badger & Sons, 1942

1763-T-901-2 "WASTEWATER DISPOSAL NO.2 POND NO.2", Trojan Powder Company, 1943

Figure 3-7

CONSTRUCTION DIAGRAM FOR WEST AREA RED WATER PONDS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

Figure 3-8

1968 AERIAL PHOTOGRAPH SHOWING WEST AREA RED WATER PONDS AREA

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

During the summer 1985, sediment sampling was performed throughout the western pond by the State of Ohio Environmental Officer and Army Trained Environmental Specialists. Sediment samples were obtained from 34 locations within the western pond and composite samples were analyzed for TNT and DNT concentrations. Selected composite samples were also analyzed for metal concentrations. The results of this study indicated that low levels of TNT and DNT were present within the western pond sediments (Ohio Army National Guard, 1985).

Pipe Creek was tested for water quality in both December 1986 and January 1987. Surface water samples were obtained both upstream, downstream, and adjacent to the West Area Red Water Ponds. Based on the results of these studies it was concluded that "comparisons between samples and between studies show very little difference in any of the samples, and the concentration of elements seemed in no way related to the distance up or downstream of the West Area Red Water Ponds" and "aquatic and terrestrial life thrive in and around Pipe Creek just as they do at the West Area Red Water Ponds" (Ohio Army National Guard, 1985).

3.3.4 Environmental Investigations

IT investigated the West Area Red Water Ponds area during their 1989 Contamination Evaluation. In their report (IT, 1991), IT refers to this area as "Waste Disposal Area #2, and stated that areas of surface contamination were evident.

Monitoring well IT-MW2 was installed at the northwestern corner of the former eastern pond to a total depth of 18.3 feet. Groundwater in this well was measured at approximately 11 feet below the top of riser. IT also installed five soil borings and collected soil samples (SB-07 and SB-09 through SB-12). SB-07 was installed south of the western pond and SB-09 through SB-12 were installed in the former eastern pond area. Soil samples collected from a depth of 0 to 2 feet were submitted for laboratory analysis.

Groundwater and soil samples collected by IT were analyzed for VOCs, SVOCs, nitrates, metals, and nitroaromatic explosive compounds. IT reported that significant

concentrations of 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, and 2,4-DNT were detected in soil samples from the West Area Red Water Ponds area. Although no nitroaromatic compounds were reported in the groundwater sample collected from monitoring well IT-MW2, 2,4-DNT and 2,6-DNT were detected as SVOCs at concentrations of 16 micrograms per liter (*u*g/L) and 27 *u*g/L, respectively.

MK Ferguson's investigation of the immediate West Area Red Water Ponds area during their Site Investigation included the installation of three monitoring wells (MK-MW9, MK-MW10, and MK-MW11) at locations north of the West Area Red Water Ponds. The wells were installed to sample groundwater which may have been influenced by the West Area Red Water Ponds. Surface water and sediment samples were also collected from Pipe Creek. Red water was noted seeping out of the northern bank of Pipe Creek during the sampling (summer 1993). Surface water and sediment samples (SW03 and SD03, respectively) were collected immediately below the seeps. No VOCs, SVOCs, pesticides/polychlorinated biphenyls, or nitroaromatic compounds were detected in the groundwater, surface water, and sediment samples.

3.3.5 Current Use

The West Area Red Water Ponds are located in the western portion of the PBS. NASA has no significant facilities in this part of the site although some of the existing structures in the general vicinity are used for storage. The area on the north side of the ponds is mowed by NASA on a regular basis. Otherwise the surrounding area is wooded.

3.4 ENVIRONMENTAL FATE OF NITROAROMATICS

Nitroaromatics such as TNT and its related compounds are relatively stable in a dry aerobic environment. Particulate nitroaromatics become encrusted with surface oxidation and condensation products which inhibit environmental degradation. However, in an aqueous environment, nitroaromatics are readily transformed by biological action. 2,4-DNT is microbially mediated through a series of transformations

to end products 4-Am-2-NT and 2-Am-4-NT. Dissolved TNT is biologically transformed (by plants) through a series of intermediate steps to 4-Am-2,6-DNT and 2-Am-4,6-DNT. Studies (Personal communication, Saunders, 1996) have indicated that frequently biotransformation of TNT is limited more by the rate at which TNT dissolves than by the rate at which plant mediated biotransformation occurs.

4.0 INVESTIGATION PROCEDURES

The field procedures for the Red Water Ponds Focused Remedial Investigation were performed in accordance with the Final Work Plan (Dames & Moore, 1994) and are summarized in this section of the report.

Sampling activities were conducted between October 12 and December 17, 1994. CEORN representatives, including Captain Mike Riebel, Mr. Doug Webb, Mr. Tom Lerner, and Mr. Bob Hoyle, observed portions of the field investigation activities. Copies of the A/E Daily Quality Control Reports prepared for each field day were provided to CEORN during the course of the field work.

Environmental samples were analyzed by Analytical Services, Inc. (ASI) of Atlanta, Georgia. Quality Assurance samples were submitted to the USACE Ohio River Division (ORD) laboratory.

4.1 COORDINATION OF SITE ACCESS AND UTILITY CLEARANCE

Dames & Moore coordinated site access and utility clearance for field work activities with appropriate NASA personnel. A NASA "Digging and Excavation Permit" was prepared to identify proposed subsurface sampling locations to NASA for clearance at the beginning of the field work. A copy of the permit is provided in Appendix A. NASA personnel checked and cleared all sampling locations prior to initiation of subsurface activities. Sampling locations were adjusted as necessary to avoid underground utilities.

NASA personnel cleared brush and vegetation from overgrown areas of the site providing access for field sampling personnel and equipment. NASA also provided storage and staging facilities, decontamination areas, and a storage facility for investigation-derived waste. At the West Area Red Water Ponds, NASA personnel excavated a trench to facilitate examination of the subsurface. A grab sample of groundwater was collected from this pit.

Dames & Moore and NASA coordinated the schedule for performing field activities to avoid conflicts among site uses and identify access limitations to specific areas during certain portions of the field work.

4.2 HEALTH AND SAFETY PROGRAM

The Final Site-Specific Safety and Health Plan (Dames & Moore, 1994) prepared for this project was followed during the field investigation of the PBOW. An initial site safety briefing/kick-off meeting was held prior to the initiation of field work including all Dames & Moore field personnel; field personnel from Belasco Drilling Company, the subcontracted drilling company; and the on-site CEORN representatives. The briefing addressed pertinent sections of the site Health and Safety Plan, including the potential constituents of concern and their recognition, field procedures, emergency procedures, and the type of monitoring and personal protective equipment (PPE) to be used during the field work. CEORN personnel provided a review of the types of ordnance and ordnance-related items which could be encountered on the PBOW and the safety considerations related to the same. The participants also discussed how to recognize potential contamination and the actions to be followed in the event that contamination was suspected or encountered. An additional site safety briefing for all field team members was held each morning to address specific health and safety concerns and to review health and safety protocol.

No significant health and safety issues arose during the field activities. Level D PPE, including latex gloves, nitrile gloves, safety glasses, and work boots and clothes were utilized. A photoionization detector, HNu, was calibrated and zeroed to background each day and used during the soil sampling activities; readings against background were noted on the boring logs. The buddy system, whereby two personnel worked together at all times, was adhered to during all phases of the field work.

4.3 SOIL SAMPLING PROCEDURES

Stainless steel trowels were used to sample surface soils. Soil borings installed to a depth of 5 feet were installed using bucket-type hand augers. However, 10-foot borings were installed using a D-50 diesel or a CME-45 all terrain vehicle (ATV) truck mounted rotary drill rig equipped with 4-1/4 inch inside diameter (ID) hollow-stem augers Each 10-foot boring was advanced from ground surface using hollow stem augering techniques. Soil samples were collected continuously using a 2-inch outside diameter (OD) stainless steel split spoon sampler attached to drill rods. The drill rods were attached to a 140-pound free fall hammer used to drive the split spoon sampler into the undisturbed soil in advance of the hollow stem augers. Samples were collected using the split spoon sampler.

Stainless steel bowls and spoons were used to composite the soils collected. Background soil samples collected for analysis of VOCs were taken directly from the auger as it was removed from the ground, as described in the Final Sampling and Analysis Plan (Dames & Moore, 1994). However, for all remaining soil samples, the samples from the entire target depth interval was composited.

Each soil boring and sample was identified according to a pre-determined scheme. Each sample was first identified with the area of concern (e.g., PR for Pentolite Road Red Water Ponds, etc.) and then with the letter "S" followed by the sample number to designate it as a soil sample. Depth intervals were also included in the sample name to more accurately describe the sample. To the extent possible, the sample depth intervals specified in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were satisfied. Some variations from target depth intervals did occur, however, due to debris and/or characteristics of the sample location.

A Dames & Moore geologist or engineer completed a field log for each of the soil borings. Copies of the boring logs are included in Appendix B.

After sampling had been completed, all boreholes were backfilled to the original ground surface level with cement grout.

4.4 GROUNDWATER MONITORING WELL INSTALLATION AND SAMPLING PROCEDURES

Groundwater monitoring wells were installed in accordance with procedures outlined in the Final Monitoring Well Installation Plan (Dames & Moore, 1994) and in the USACE guidance document EM 1110-7-XX(FR) (Draft). Groundwater sampling procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were followed during the sample collection.

Five shallow groundwater monitoring wells were installed in the unconsolidated overburden materials, three at the Pentolite Road Red Water Ponds and two at the West Area Red Water Ponds. The purpose of the shallow wells was to evaluate the water quality in the uppermost water-bearing unit. The shallow wells were constructed so that the screened interval intersected the water table.

Three deep groundwater monitoring wells were installed in the bedrock, one at the Pentolite Road Red Water Ponds and two at the West Area Red Water Ponds. The purpose of the bedrock wells was to evaluate whether nitroaromatics had migrated from the site soils into the local bedrock aquifer and to establish baseline information on water quality in the bedrock aquifer.

The monitoring wells were installed under the technical observation of experienced Dames & Moore geologists. The Dames & Moore geologists coordinated the drilling operations, maintained a detailed boring log of each monitoring well, collected samples of subsurface materials and classified them in accordance with geologic classification systems, developed well construction diagrams, and maintained a field log of events and procedures. Drilling for the monitoring wells was performed by Belasco Drilling Company, a drilling company experienced in the construction of monitoring wells in north central Ohio.

4.4.1 Monitoring Well Installation in the Overburden

A D-50 diesel or a CME-45 ATV truck mounted rotary drill rig equipped with 4-1/4 inch ID hollow-stem augers was used to drill boreholes for wells to be completed in the overburden stratigraphic unit. The boring for each overburden well was advanced from ground surface using hollow stem augering techniques and was extended to the top of rock as defined by auger refusal. Soil samples were collected continuously using a 2-inch OD stainless steel split spoon sampler attached to drill rods. The drill rods were attached to a 140-pound free fall hammer used to drive the split spoon sampler into the undisturbed soil in advance of the hollow stem augers.

Samples collected using the split spoon sampler were used to document and classify the soils underlying the site at each location. Soil samples were also scanned with an Hnu for the presence of contamination. The boring logs prepared during the drilling are included in Appendix C.

All drilling and sampling equipment was steam cleaned prior to drilling; between each boring; and at the conclusion of the field work prior to taking the equipment from the PBOW. During drilling of each boring, sampling equipment was decontaminated in accordance with procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994).

After reaching terminating depth in each boring, a groundwater monitoring well was constructed in each borehole. The monitoring wells were constructed of 2-inch ID flush joint, threaded, schedule 40 polyvinyl chloride (PVC) riser pipe and No. 10 (0.010-inch) slot size PVC well screen.

A bottom cap was placed on the end of the screen which was then placed directly on the bottom of the borehole, with 2-inch riser pipe extending from the top of the screen to the ground surface. The annular space between the well screen and the inside wall of the boring was filled with a 20/30 silica sand pack, a material in which the grain size is such that the majority of the material should be retained on No. 20 and No. 30 slot sieves. The sand pack was extended above the top of the screen. A bentonite seal was placed above the sand pack to inhibit fluid movement vertically downward

along the casing and to prevent grout migration into the sand pack from above. The remaining annular space from the top of the bentonite seal to near the ground surface was grouted with a cement grout.

The top of the well was then completed above grade with a stand-up lockable protective steel casing cemented in the center of a concrete pad. Concrete-filled posts were installed at each corner of the concrete pad. The posts were painted orange for easy visibility. A plate which listed the well identification and other well specific information was adhered to the top of the lockable protective steel casing. Monitoring well construction details are provided in Table 4-1, Overburden Monitoring Well Details. Well construction diagrams are included in Appendix D.

Construction of each of the wells was discussed with the on-site CEORN representative during the field activities.

Soil samples from the screened interval in each well were collected for grain size analysis. Additionally, one sample of each type of filter pack material used in the construction of the monitoring wells was collected for grain size analysis. The samples were analyzed by Dames & Moore's geotechnical laboratory located in Salt Lake City, Utah in accordance with American Society for Testing and Materials Test Procedure D422, "Particle Size Distribution in Soils." The laboratory reports and interpretation of the grain size analyses are included in Appendix E.

All waste soil from the well boreholes was placed in 55-gallon drums.

4.4.2 Monitoring Well Installation in the Bedrock

A Diedrich D-120 truck-mounted rotary drill rig, NX and NQ core equipment, and a 6-inch roller cone were used for the bedrock well installation. The bedrock monitoring wells were advanced through the overburden to the top of rock using a 12-inch ID hollow stem augers, while continuously sampling with a split spoon sampler. After encountering the top of rock, the boring was advanced until competent rock was

TABLE 4-1

OVERBURDEN MONITORING WELL DETAILS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)	Total Depth of Well (feet BGS)	Screened Interval (feet BGS)	Top of Sand Pack (feet BGS)	Top of Bentonite Seal (feet BGS)
PB-WA-MW1	642.32	644.43	22.3	4.3 - 22.3	3.7	2.0
PB-WA-MW2	631.16	633.65	12.0	3.0 - 12.0	2.5	2.0
PB-PR-MW7	631.50	633.99	22.3	4.3 - 22.3	3.0	1.8
PB-PR-MW8	632.50	635.02	27.5	5.0 - 27.5	4.0	3.0
PB-PR-MW9	630.70	633.70	19.0	4.0 - 19.0	3.0	2.0

MSL - Mean Sea Level
BGS - Below Ground Surface
TOC - Top of Casing

encountered using a 10-inch diameter roller cone bit. The boring logs prepared during the drilling are included in Appendix C.

In order to ensure the integrity of the bedrock well, at least 20 feet of 4-inch diameter PVC casing was installed in each bedrock well to seal off the unconsolidated overburden materials and incompetent bedrock near the bedrock surface. Once the borehole had been cleaned of loose material, a 4-inch PVC riser casing was installed into the borehole and grouted in place. The casing was grouted to the surface.

The grout was allowed to cure for a minimum of 48 hours before continuing coring operations on the well. When the grout had cured, NQ coring equipment was placed through the 4-inch surface casing and a 3-inch diameter open hole was cored until the first water bearing zone was reached. Bedrock monitoring well construction details are presented on Table 4-2. Well construction diagrams are included in Appendix D.

The rock cores were stored in covered core boxes and labeled. The core within each complete box was photographed.

4.4.3 Monitoring Well Development

Following construction, the monitoring wells were developed by hand bailing water until the well water met the conditions set forth in the USACE guidance document EM 1110-7-XX(FR)(draft). Difficulty was encountered in achieving well water clarity in several of the wells after all other well development criteria were met. After concurrence with the on-site CEORN representative on when to stop well development, it was decided that, if after additional bailing was performed and no improvement in water quality was recognized, development could be terminated. After development was terminated, a water sample was collected from each well and photographed. A well development record was completed for each monitoring well. Copies of the well development records and photographs of the water collected from the wells after development are included in Appendix F.

TABLE 4-2

BEDROCK MONITORING WELL DETAILS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)	Depth to Top of Rock (BGS feet)	Top of Rock Elevation (feet MSL)	Depth to Bottom 4" Casing (BGS)	Length of Open Rock Hole (feet)	Total Depth of Well (BGS feet)
PB-BED-MW14	643.05	646.04	24.5	618.6	29.0	23.2	52.2
PB-BED-MW15	629.08	631.64	24.3	604.8	31.5	42.9	74.4
PB-BED-MW19	640.51	643.07	19.1	621.4	32.0	17.5	49.5
PB-BED-MW20	673.57	676.33	21.5	652.1	35.0	14.5	49.5

MSL = Mean Sea Level
TOC = Top of Casing
BTOC = Below Top of Casing
BGS = Below Ground Surface

Development water from each well was placed in 55-gallon drums which were moved to the drum storage area on Pentolite Road for later disposal.

4.4.4 Survey of Well Locations

Coordinates and elevations were established for each of the monitoring wells installed by Dames & Moore in accordance with EM 1110-7-XX(FR)(draft). The top of casing and ground surface elevations are included in Tables 4-1 and 4-2. Additionally, locations of wells installed by MK Ferguson and IT during previous investigations and used in this investigation and the locations of the four NASA wells in the Reactor Area were surveyed. The top of casing and ground surface elevations for the MK Ferguson and IT wells are listed in Table 4-3. The top of casing and ground surface elevations for the four NASA Reactor wells are listed in Table 4-4. A tabulated list of the sample location coordinates and elevations is included in Appendix G.

4.4.5 Monitoring Well Sampling

Groundwater samples were collected approximately 2 weeks after the development was completed to allow the groundwater to chemically stabilize from impacts caused by drilling and construction of the monitoring wells. The procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were followed during the sampling of the monitoring wells.

Prior to sampling, the volume of water in each monitoring well was calculated utilizing water level measurements and well construction information. The monitoring wells were then purged of five volumes of water contained in the casing, screen and filter pack (or until dry) using a new dedicated bailer for each well. After purging, groundwater samples were collected from the approximate upper 5 feet in each well using each well's dedicated bailer.

TABLE 4-3

MK FERGUSON AND IT WELL ELEVATIONS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)
MK-MW10	638.06	640.89
MK-MW11	634.71	637.69
IT-MW2	636.69	639.60
IT-MW5	631.91	634.99

MSL - Mean Sea Level
TOC - Top of Casing

Overburden wells MK-MW10 and MK-MW11 were installed for the MK Ferguson Site Inspection performed in 1993.

Overburden wells IT-MW2 and IT-MW5 were installed for the 1989 IT investigation.

TABLE 4-4

NASA REACTOR WELL ELEVATIONS

Well Identification	Ground Surface Elevation (feet MSL)	TOC Elevation (feet MSL)
Reactor Well 1	630.21	630.12
Reactor Well 2	630.72	630.68
Reactor Well 3	630.73	630.88
Reactor Well 4	630.76	631.15

MSL - Mean sea level

TOC - Top of Steel Casing

Note: All NASA Reactor Wells are completed in the bedrock.

Specific conductance, pH, and temperature were recorded in the field at the time of sampling. Groundwater sampling records were completed and are included in Appendix H.

4.5 WEST AREA RED WATER POND INVESTIGATION

The West Area Red Water Ponds investigation included an evaluation of the water and sediment in the remaining west pond. The investigation included water depth measurements, the performance of penetrometer testing, collection of sediment and natural soil cores, and collection of surface water samples.

To provide an efficient means of locating the various survey points and sample locations, an approximately 50 feet by 50 feet grid system was established. The grid system included 12 control points (A through L) spaced 50 feet apart (center to center) in an approximately east-west trending direction along the northern shore of the pond. Eight control points (0 through 7) spaced 50 feet apart (center to center) were also established in a generally north-south trending direction along the eastern shore of the pond.

4.5.1 Water Depth Measurements

The height of the water column above the sediment was measured at various grid locations for the purpose of estimating the volume of water within the pond.

The depth of water measurements were performed using a sounding line equipped with an approximately 6-inch diameter flat circular disk to minimize penetration of the loose surficial sediments. The sounding line was carefully lowered to the sediment surface and the depth of water was recorded.

4.5.2 Sediment Measurements

The sediment thickness at various grid locations was estimated based on the assumption that the sediments and underlying natural soils would have significantly varying penetration resistances. In general, materials which were penetrated by a penetrometer under static conditions were assumed to be sediments; whereas, materials which required dynamic penetration (multiple blows with a slide hammer) were assumed to represent the underlying natural soils.

The penetrometer testing was performed utilizing a 1.5-inch diameter stainless steel cone attached to extension piping and a 15-pound slide hammer. The penetrometer testing was performed in accordance with the following procedures:

1) The height of the water column above the sediment was measured and marked on the extension piping.

2) The penetrometer was lowered to the sediment surface.

3) The penetrometer was allowed to penetrate the sediment under the static weight of the extension piping and hammer.

4) The static weight penetrometer penetration distance was recorded.

5) The penetrometer was advanced a distance of approximately 6 inches using the slide hammer.

6) The number of blows required to advance the penetrometer 6 inches was recorded.

To calibrate the penetrometer, sediment and natural-soil cores were collected at three locations in conjunction with the penetrometer testing.

4.5.3 Sediment and Natural-Soil Core Sampling

To evaluate the vertical extent of contamination within the pond, 10 core samples of the sediments and underlying natural-soils were collected. The boring logs prepared during the sediment sampling are included in Appendix I. The sample locations were

established based on the results of the penetrometer testing and the records review. In general, the sediment and natural-soil cores were collected in the eastern portion of the pond, where the penetrometer testing results indicated the greatest sediment thickness. The records review also indicated that process water from the east pond discharged to the eastern portion of the west pond.

At each core location, the sampler was advanced a sufficient depths to obtain samples of both the sediment material as well as the underlying natural soils. The sediment and natural-soil cores were collected using a disposable 2-½-inch diameter PVC sediment sampler in accordance with the procedures specified in the Final Sampling and Analysis Plan (Dames & Moore, 1994). Initially, the height of the water column was measured and marked on the PVC sediment sampler. The sampler was then carefully lowered to the sediment surface and manually advanced through the sediment until the underlying natural soils had been penetrated at least 6 inches (total distance of 24 to 30 inches). Subsequent to the removal of the water overlying the collected core, the core was extruded from the sampler from the top down and placed in the sample tray covered with a sheet of aluminum foil. The recovered cores were examined by a geotechnical engineer to evaluate the sediment thickness. The sediments and underlying natural-soils were photographed and logged on the HTRW Drilling Log Form.

At six of the sediment and natural-soil core locations, samples were obtained for laboratory chemical analysis. The recovered cores were extracted from the sampler and the portions of the core consisting of sediment were segregated from the portions consisting of natural-soils. The uppermost 2-inches of sediment were discarded. The sediment and natural-soils were placed in separate stainless steel bowls and thoroughly homogenized. The samples were then placed in the appropriate laboratory jars.

Each of the sediment and natural-soil samples were analyzed for explosives residues and metals. Additionally, two of the six sediment samples were also analyzed for biological activity and one of the sediment samples was analyzed for extractable sulfate, pH, extractable total organic carbon (TOC), extractable alkalinity, extractable nitrate, total Kjeldahl nitrogen, extractable phosphorous, potassium, cation exchange capacity, and moisture content. The results of the laboratory analysis are discussed in Section 7.3. The laboratory reports for the chemical analyses of the sediment

samples are provided in Appendix J. The laboratory reports for the biological activity analysis are provided in Appendix K.

4.5.4 Surface Water Sampling

A total of five surface water samples were collected during this investigation. Four of the samples were collected within the western pond and one sample was collected from an area of ponded water within the former eastern pond area.

The surface water samples were collected using disposable tygon tubing and a peristaltic pump. The tygon tubing was lowered into the water column and water was pumped directly into the appropriate sample containers. The depth of the tygon tubing was modified during sampling in order to collect a composite of the entire water column.

Each of the surface water samples were submitted for laboratory analyses of explosives residues and metals concentrations and total suspended solids. Filtered samples were also collected at each location and tested for explosives residues and metals. Additionally, one sample was analyzed for biological activity. The results of the laboratory analyses are discussed in Section 7.4. The laboratory reports for the chemical analyses of the surface water samples are provided in Appendix J. The laboratory reports for the biological activity analysis are provided in Appendix K.

4.6 SAMPLE PACKAGING, SHIPPING, AND DOCUMENTATION OF CUSTODY

Sample packaging, shipping and documentation procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) were followed during the field investigation of the TNT manufacturing areas. Samples were packaged and shipped to the analytical laboratories via Federal Express.

4.7 EQUIPMENT DECONTAMINATION

Equipment decontamination procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) and Final Monitoring Well Installation Plan (Dames & Moore, 1994) were followed during the field investigation.

Prior to use at each location, sampling equipment was decontaminated following the procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994). Dames & Moore personnel wore clean latex gloves and monitored the borehole and breathing zone with a photoionization detector, HNu, during all sampling activities. Latex gloves under nitrile gloves and safety glasses were worn during decontamination.

All drilling and sampling equipment used to install the groundwater monitoring wells was steam cleaned prior to drilling; between each boring; and at the conclusion of the field work prior to taking the equipment from the PBOW. During drilling of each borehole, sampling equipment was decontaminated in accordance with procedures outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Two main decontamination areas were established, one for cleaning sampling equipment and one for cleaning drilling equipment. The sampling equipment was decontaminated in NASA's Red Barn, a facility made available for field work support during the investigation. The drill rig decontamination area was set up near the parking lot at the Maintenance Building. Care was taken during decontamination to avoid contaminating the surrounding area. Upon completion of the field activities, the decontamination materials were removed and placed in 55-gallon drums for later disposal.

4.8 HANDLING OF INVESTIGATION-DERIVED WASTES

Investigation-derived wastes were managed and handled in accordance with procedures described in the Final Sampling and Analysis Plan (Dames & Moore, 1994) and Final Monitoring Well Installation Plan (Dames & Moore, 1994).

Soil cuttings and decontamination waste water were placed in separate 55-gallon drums which were labeled and stored on-site north of Pentolite Road, east of the intersection of Ransom Road and Pentolite Road.

4.9 ANALYTICAL LABORATORY ANALYSIS AND DATA EVALUATION

The laboratory analytical reports are included in Appendix J. As a preface to the presentation of the results of the investigation, it is useful to describe the laboratory analytical methods and data evaluation, and discuss the limitations of the data presented herein. These are discussed in the following sections.

4.9.1 Laboratory Analysis

Soil samples and their associated equipment blank samples were analyzed for explosives residues concentrations using EPA Method 8330 and for concentrations of 14 metals (13 priority pollutant metals plus manganese) using methods outlined in the Final Sampling and Analysis Plan (Dames & Moore, 1994).

Background soil samples were analyzed for explosives residues, metals, VOCs, and SVOCs.

Groundwater samples were analyzed for explosives residues, nitrates, and total and dissolved metals. Additionally, groundwater samples from the bedrock wells were analyzed for VOCs and SVOCs.

ASI, Dames & Moore's subcontracted analytical laboratory provided laboratory quality control (QC) documentation with the sample results. This documentation included the results of matrix spike and matrix spike duplicates analyses; the results of method blanks and laboratory control standards analyses; analyses of surrogates, calculations of percent recovery and precision of the above (as applicable); and inclusion of the extraction and analysis dates. A brief case narrative was included with each sample set to document methods used and any QC problems encountered.

4.9.2 Evaluation of Laboratory Data

4.9.2.1 Data Quality Assessment

Dames & Moore evaluated approximately 10 percent of the data collected during the field work. A combined data quality assessment was completed for samples collected for the Site Investigation of the TNT areas, the Focused Remedial Investigation of the Red Water Ponds areas, and the Sitewide Groundwater Investigation. Data sets which included samples from all media and all areas of the site were included in the review. The Data Quality Assessment was performed in accordance with guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (EPA, 1993) and the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Date Review" (EPA, 1994). The Data Quality Assessment is provided as Appendix L. The qualifiers applied to the data are listed on the laboratory reports provided in Appendix J, as described in the referenced report, should be acknowledged whenever reviewing the data or assessing the qualitative or quantitative reliability of the data.

4.9.2.2 Establishment of Practical Quantitation Limits for Groundwater Analysis

Groundwater samples for this project were analyzed using a Cold Regions Research and Engineering Laboratories (CRREL) modification of EPA Method 8330. The modified method was used to try to obtain the lowest possible detection limits for groundwater samples. Extremely low detection limits are necessary in some of the risk calculations which may eventually be performed for the site. Dames & Moore and ASI, in coordination with CEORN, established a Practical Quantitation Limit (PQL) of 5 μg/L for use in interpreting the results for groundwater samples. The rationale for use of a PQL was prepared by ASI and is presented in Appendix J with the laboratory reports. Only sample results above the PQL are interpreted in this Focused Remedial Investigation Report. However, the laboratory reports included in Appendix J list all results, including those below the PQL and above the method detection limit (MDL) which is referred to as Below the Detection Limit (BDL) on the laboratory reports.

4.9.3 Groundwater Data Limitations

Several limitations were identified with respect to the laboratory data generated during this investigation. These limitations are discussed in the following sections.

4.9.3.1 Explosives

Dames & Moore collected a sample of the potable water from PBS at the conclusion of the field work on December 15, 1994. Water from this source was utilized during drilling of the bedrock wells during rock coring. Duplicate samples were submitted to the ORD laboratory and to ASI.

No explosives residues were detected in the sample analyzed by ORD. However, ASI detected 1,3,5-TNB at a concentration of 13 μg/L; 4-Am-2-NT at a concentration of 1.6 μg/L; and 2-Am-DNT at a concentration of 0.4 μg/L. The PBS potable water supply does not originate on site and the presence of explosives residues in the sample was suspect. Therefore, in order to confirm the results, a second sample was collected on February 13, 1995 and analyzed by ASI. Explosives were again detected. In the February 1995 sample, 1,3,5-TNB was detected at a concentration of 1.1 μg/L and 4-Am-DNT was detected at a concentration of 1.7 μg/L.

A third sample was collected on August 15, 1995. Four replicate samples were collected and analyzed by ASI, a private laboratory contracted by CEORN, the USACE Missouri River Division (MRD) laboratory, and the USACE Waterways Experiment Laboratory. No explosives residues were detected in any of the four replicate samples collected in August 1995. Therefore, it is reasonable to assume that explosives residues are not present in the potable water supply at PBS.

The reason explosives residues were detected by ASI in the first two samples is not known. Most of the concentrations are below the PQL and are considered estimated. However, the concentration of 13 μg/L 1,3,5-TNB in the December 1994 sample is well above the PQL. Personnel from the USACE MRD laboratory who reviewed the laboratory data considered the 1,3,5-TNB concentration a false positive. However, ASI

considered that the method requirements for reporting the compound were technically satisfied. Users of the groundwater data are advised to interpret it with caution in the event false positives were detected in one or more of the groundwater samples. For purposes of this report all concentrations reported above the PQL were interpreted.

4.9.3.2 Metals

Groundwater monitoring wells installed for the TNT Areas Site Investigation, Red Water Ponds Focused Remedial Investigation, and Sitewide Groundwater Investigation were all sampled within a few days of each other in December 1994. Three groundwater equipment blanks were collected during the sampling, one from a bedrock monitoring well (BED-MW18) and two from overburden wells (WA-DM-MW2 and TNTA-DM-MW10). This provided an equipment blank to sample type ratio of at least 10 percent. Both filtered and unfiltered equipment blanks were submitted for metals analysis.

Two metals were detected in the equipment blanks. Zinc was detected in the unfiltered equipment blanks prepared during sampling of wells BED-MW18 and WA-DM-MW2. The concentrations were 28 μg/L and 37 μg/L, respectively. Zinc was also detected in the equipment blank prepared during collection of background soil samples. This may indicate that some of the zinc detected in the samples is related to the sampling procedures. However, because zinc was not consistently detected in the equipment blanks, all of the zinc detected in the samples cannot be attributed to collection procedures.

Antimony was detected in eight groundwater samples during the PBOW investigation. Seven of the eight times, it was reported in the filtered sample and not in the corresponding unfiltered sample. Antimony was also detected in the filtered drill water sample collected on December 15, 1994 at a concentration of 10 μg/L but not in the corresponding unfiltered sample. Finally, antimony was detected in two of the three equipment blank samples collected during the groundwater sampling. In both samples, antimony was detected in the filtered sample, but not in the unfiltered sample. The consistent presence of antimony only in filtered samples appears to indicate that it is

related to the filtering process. The equipment blanks were prepared with distilled water which should have contained no metals.

5.0 SOILS INVESTIGATION

During operation of the PBOW, process waste water was disposed of in Red Water Ponds located in two areas of the site. This process waste water, referred to as "red water," results from the final washing of TNT as described in Section 3. It is acidic, and generally contains elevated concentrations of nitroaromatics. At the PBOW, the ponds in both areas were constructed by excavating a shallow depression and then detonating explosives in the bottom to enhance the permeability of the subsurface.

Previous investigations and field observations at the two Red Water Pond areas indicated that contamination by explosives residues is present. Therefore, the objective of this investigation was to try to delineate the extent of soil contamination caused by use of the Red Water Ponds during operation of the PBOW. The sampling locations were selected based on review of historical information documenting the areal extent of the ponds from their creation to the present. Further, the sampling scheme was designed to obtain preliminary information which may be useful during later stages of the project.

The sampling locations for the investigations of the Red Water Ponds areas were related to the configurations of the ponds when they were in use. The original shapes of the ponds have altered, in some cases significantly, since the ponds were constructed and used. As discussed in Section 3, historical records indicate that the shape of the ponds changed even during operation of the PBOW.

- The ponds in the Pentolite Road Red Water Pond Area have been filled in. Actual ponds are no longer present in this area. The surface at the former Pentolite Road Red Water Ponds has been reworked by NASA and the configurations of the original ponds have been obscured.

- The western pond at the West Area Red Water Ponds Area retains generally the same shape as the pond used during operation of the PBOW. However, the east pond was drained by NASA. With the passage of time, the east pond has become a marshy area. The configuration of the berm surrounding the original east pond is still clearly visible.

The Focused Remedial Investigation included collection of 103 soil samples from the two former Red Water Ponds areas, the Pentolite Road Red Water Ponds and the West

Area Red Water Ponds. Soil sampling locations at both red water ponds areas were surveyed to provide a permanent record of the precise sampling locations for future investigations and remedial activities. All soil samples were analyzed for explosives residues and metals.

The investigation indicates that explosives residues are present in soils in each of the former Red Water Ponds areas.

- 1,3,5-TNB, an impurity produced during TNT production, and 2,4-DNT, an intermediate product in TNT production, were the most commonly detected explosives residues. 1,3,5-TNB was present in 43 of the 103 samples and 2,4-DNT was present in 40 samples. These are two of the compounds specifically intended to be removed in the washing process that generates "red water."

- Nitroaromatics were much more prevalent in the samples collected from the Pentolite Road Red Water Ponds than from the West Area Red Water Ponds. Explosives residues were detected in 34 of the 63 samples (54 percent) collected from the Pentolite Road Red Water Ponds. At the West Area Red Water Ponds, explosives residues were present in 18 of 40 samples (45 percent).

- Ten of the 14 explosives residues analytes were detected at the Pentolite Road Red Water Ponds. Only eight were identified at the West Area Red Water Ponds. Concentrations were generally higher in the samples collected from the Pentolite Road Red Water Ponds.

- The highest concentrations of explosives residues were detected in the sample from the boring installed near the inlet to the Pentolite Road Red Water Ponds. 2,4,6-TNT concentrations in samples from the 3 to 5 foot interval and the 5 to 10 foot interval in this boring exceeded the risk-based industrial scenario screening level developed by the U.S. EPA, Region III (Region III).

- 1,3,5-TNB was present at levels exceeding the residential scenario risk-based screening level in several locations at the Pentolite Road Red Water Ponds.

Sections 5.1 and 5.2 below describe the sampling locations and discuss the explosives residues detected in the Pentolite Road Red Water Ponds and the West Area Red Water Ponds, respectively.

Fourteen background soil samples were collected from eight borings installed in areas of the site least likely to have been impacted by former DoD activities. Background borings were installed to depths of 4 to 5 feet. Background soil samples were analyzed for explosives residues, metals, VOCs and SVOCs. No explosives residues were detected in the background soils. Background soil conditions for all analytical parameters except metals are assessed in Section 5.3.

Soil samples were analyzed for concentrations of 13 priority pollutant metals and manganese. Metals concentrations in the red water ponds areas were compared to background metals concentrations to evaluate whether a correlation existed between high levels of metals and the presence of explosives residues. No correlations were identified. The metals analysis is provided in Section 5.4.

Soil samples from both Red Water Ponds Areas were analyzed for biological activity and other general chemical parameters that may be useful in assessing remedial options. The results of these analyses are provided in Sections 5.5 and 5.6, respectively.

5.1 PENTOLITE ROAD RED WATER PONDS

Two ponds were present at the Pentolite Road Red Water Ponds during operation of the PBOW. Both ponds have been filled in and little physical evidence of their former configuration remains. What evidence is left is limited to areas of denuded soils and stressed vegetation. In these areas, surface water ponded after rainfall has a reddish tint.

To try to establish the extent of nitroaromatics contamination, a grid was laid out over the area thought to encompass the former ponds. This area was identified using a 1956 aerial photograph. Boring locations on the grid were surveyed prior to initiating sampling activities. Twenty soil borings were installed at the grid nodes, 12 inside the pond perimeter and eight outside the pond perimeter. This included six 5-foot borings and fourteen 10-foot borings. Surface soil samples were collected at four additional locations where denuded soils or stressed vegetation were observed. The boring

locations and surface soil sampling locations are illustrated on Figure 5-1. This figure also shows the outline of the ponds in a 1956 aerial photograph which was used as the basis for the sampling grid.

The concentrations of explosives residues detected in the 63 soil samples collected from the Pentolite Road Red Water Ponds are listed on Table 5-1 and are also provided on Figure 5-1.

5.1.1 Distribution of Explosives Residues Outside the Pond Perimeter

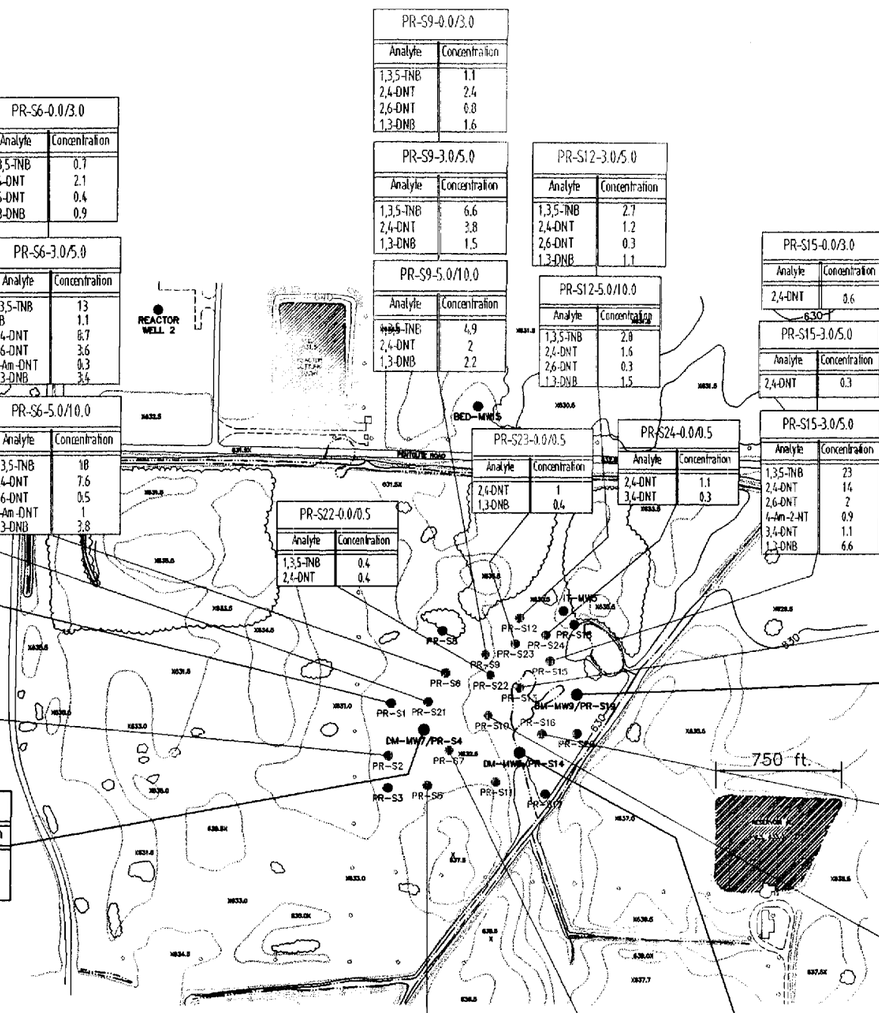
Eight borings were installed around the perimeter of the former ponds footprint. The purpose of these borings was to assess the areal extent of contamination and evaluate whether use and/or releases from the ponds resulted in contamination of the soils surrounding the ponds.

Fourteen samples were collected from six hand-augered 5-foot borings, PR-S1, -S3, -S8, -S17, -S18, and -S20. Samples were collected from 0 to 2 feet and from 2 to 5 feet in all six borings. Additionally, surface samples were collected from 0 to 0.5 feet in borings PR-S8 and -S17. Soils in this area were relatively loose with some clays. Several of the samples became moist at approximately 4 feet, but no standing water was observed in the borings.

10-foot borings were installed on the east and south sides of the assumed pond perimeter. Seven samples were collected from these two 10-foot borings, PR-S11 and -S19. Samples were collected from 0 to 3 feet, from 3 to 5 feet, and from 5 to 10 feet in each boring. A surface sample was also collected from boring PR-S19 from 0 to 0.5 feet.

Nitroaromatics were detected outside the apparent footprint of the pond in only two areas.

- Low levels of explosives residues were detected in the 2 to 5 foot sample collected from boring PR-S1. This boring is located on the northwest side



PR-S9-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	1.1
2,4-DNT	2.4
2,6-DNT	0.8
1,3-DNB	1.6

PR-S6-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	0.7
2,4-DNT	2.1
2,6-DNT	0.4
1,3-DNB	0.9

PR-S9-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	6.6
2,4-DNT	3.8
1,3-DNB	1.5

PR-S12-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	2.7
2,4-DNT	1.2
2,6-DNT	0.3
1,3-DNB	1.1

PR-S6-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	13
NB	1.1
2,4-DNT	6.7
2,6-DNT	3.6
4-Am-DNT	0.3
1,3-DNB	3.6

PR-S9-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	4.9
2,4-DNT	2
1,3-DNB	2.2

PR-S12-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	2.0
2,4-DNT	1.6
2,6-DNT	0.3
1,3-DNB	1.5

PR-S15-0.0/3.0	
Analyte	Concentration
2,4-DNT	0.6

PR-S15-3.0/5.0	
Analyte	Concentration
2,4-DNT	0.3

PR-S13-3.0/5.0	
Analyte	Concentration
2,4-DNT	0.4

PR-S6-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	18
2,4-DNT	7.6
2,6-DNT	0.5
4-Am-DNT	1
1,3-DNB	3.8

PR-S21-0.0/0.5	
Analyte	Concentration
2,4-DNT	0.3

PR-S23-0.0/0.5	
Analyte	Concentration
2,4-DNT	1
1,3-DNB	0.4

PR-S24-0.0/0.5	
Analyte	Concentration
2,4-DNT	1.1
3,4-DNT	0.3

PR-S15-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	23
2,4-DNT	14
2,6-DNT	2
4-Am-2-NT	0.9
3,4-DNT	1.1
1,3-DNB	6.6

PR-S13-5.0/10.0	
Analyte	Concentration
2,4,6-TNT	0.5
1,3,5-TNB	9.4
2,4-DNT	5.2
2,6-DNT	0.5
3,4-DNT	0.5
4-Am-DNT	0.7
1,3-DNB	3.2

PR-S22-0.0/0.5	
Analyte	Concentration
1,3,5-TNB	0.4
2,4-DNT	0.4

PR-S1-2.0/5.0	
Analyte	Concentration
2,4,6-TNT	0.3
2,4-DNT	0.4

PR-S19-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	1.5
2,4-DNT	1
1,3-DNB	1.4

PR-S2-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	2.4
1,3-DNB	0.3

PR-S2-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.5

PR-S16-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	14
2,4-DNT	8.9
2,6-DNT	1
4-Am-2-NT	0.6
3,4-DNT	0.8
1,3-DNB	4.3

PR-S4-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	6.8
2,4-DNT	2.8
1,3-DNB	2.1

PR-S4-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	12
2,4-DNT	5.7
2,6-DNT	0.5
1,3-DNB	3.2

PR-S4-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	1.7
2,4-DNT	1.1
1,3-DNB	0.8

PR-S10-3.0 / 5.0	
Analyte	Concentration
1,3,5-TNB	2.8
2,4-DNT	2.6
1,3-DNB	1.6

PR-S10-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	5.2
2,4-DNT	2.2
1,3-DNB	2.5

PR-S5-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.7

PR-S5-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	0.4

PR-S7-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	0.5
2,4-DNT	0.4
1,3-DNB	0.3

PR-S7-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	6.6
2,4-DNT	3.4
2,6-DNT	0.4
4-Am-DNT	0.3
1,3-DNB	2.1

PR-S7-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	1.3
2,4-DNT	0.3
1,3-DNB	0.5

PR-S14-3.0/5.0	
Analyte	Concentration
2,4,6-TNT	12000
1,3,5-TNB	58
3,4-DNT	4.5
4-Am-DNT	9.5
1,3-DNB	6.4

PR-S14-5.0/10.0	
Analyte	Concentration
2,4,6-TNT	340
1,3,5-TNB	18
2,4-DNT	19
2,6-DNT	2.9
3,4-DNT	1.7
4-Am-DNT	2
2-NT	0.9
1,3-DNB	6.7

Scale: 1" = 850'

PR-S3 — 5-Foot Soil Boring

DM-MW7/PR-S4 — 10-Foot Soil Boring Converted to Overburden Monitoring Well

PR-S7 — 10-Foot Soil Boring

PR-S21 — Surface Soil Sample

Concentrations are in mg/kg

FIGURE 5-1
PENTOLITE ROAD RED WATER PONDS
SOIL BORING LOCATIONS AND
EXPLOSIVES RESIDUES CONCENTRATIONS

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Sandusky, Ohio

Dames & Moore, Inc.

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of the ponds. Sample PR-S1-2.0/5.0 contained 0.3 milligrams per kilogram (mg/Kg) and 0.4 mg/Kg of 2,4,6-TNT and 2,4-DNT, respectively. During operation of the PBOW, this area may have been within the pond footprint. This was the only one of the 12 samples collected from the six 5-foot perimeter borings in which explosives residues were detected.

- Low levels of explosives residues were also detected in the 5 to 10 foot sample collected from boring PR-S19. This boring was installed on the east side of the ponds. Based on interpretation of the 1956 aerial photograph, it is immediately outside the pond perimeter. However, if the pond configuration was larger during operation of the PBOW, this location may have been inside the ponds. Sample PR-S19-5.0/10.0 contained 1.5 mg/Kg of 1,3,5-TNB, 1.0 mg/Kg of 2,4-DNT, and 1.4 mg/Kg of 1,3-DNB.

No explosives residues were detected in any of the other samples collected from the 5-foot borings on the north, east, and south side of the ponds (including two surface soil samples) or from the 10-foot boring on the south side of the ponds.

QC sample PR-S29-2.0/5.0 is a split of sample PR-S18-2.0/5.0 collected from a 5-foot boring on the northeastern side of the ponds. No explosives residues were found in either sample.

5.1.2 Distribution of Explosives Residues Inside the Pond Perimeter

Within the footprint of the former ponds, 36 soil samples were collected from 12 10-foot borings, PR-S2, -S4, -S5, -S6, -S7, -S9, -S10, -S12, -S13, -S14, -S15 and -S16. Based on review of historical information, the depth of the ponds was thought to be less than 10 feet. Sampling to this depth was intended to provide information on the vertical extent of contamination below the bottom of the former ponds. Three samples were collected from each boring, one from 0 to 3 feet, one from 3 to 5 feet, and one from 5 to 10 feet.

Six surface soils samples (also referred to as sediment samples) were collected from areas inside the pond perimeter. Two types of samples were collected.

- Four surface samples were collected from areas which were denuded and/or contained stressed vegetation. The areas are noted on Figure 5-1. These

samples were collected to evaluate whether the observed site conditions related to the presence of nitroaromatics in the surface soils.

- Two additional surface soil samples were collected adjacent to randomly selected 10-foot borings (PR-S13 and -S14). These samples were collected to compare contaminant levels immediately at the surface with levels in the upper 3 feet of the soil profile.

Explosives residues were detected throughout the area thought to have been occupied by the two Pentolite Road Red Water Ponds. The greatest number of compounds and highest concentrations were detected in the 5 to 10 foot interval. Nitroaromatics were present in the 5 to 10 foot interval in all twelve borings installed within the ponds area.

Explosives residues concentrations detected in each sampling interval are discussed below.

5.1.2.1 Surface Soils

Low levels of explosives residues were detected in the four surface soil samples (PR-S8-0.0/0.5; PR-S13-0.0/0.5; PR-S14-0.0/0.5; and PR-S17-0.0/0.5) collected from the areas of bare soil/stressed vegetation. 2,4-DNT was present in each sample at concentrations ranging from 0.3 mg/Kg to 1.1 mg/Kg. Additionally, 1,3,5-TNB was detected at a concentration of 0.4 mg/Kg in sample PR-S22-0.0/0.5 located in the central portion of the ponds. 1,3-DNB was present at a concentration of 0.4 mg/Kg in sample PR-S23-0.0/0.5 which was located on the north side of the eastern pond. In sample PR-S24-0.0/0.5, 0.3 mg/Kg of 3,4-DNT was reported. This sample was collected from the west side of the western pond. All of the nitroaromatics detected in these surface soil samples are impurities or incomplete products of TNT production that would have been removed in the final wash process which created the red water.

No explosives residues were detected in three other surface soil samples.

QC sample PR-S30-0.0/0.5 is a split of sample PR-S23-0.0/0.5, a surface soil sample collected from a denuded/stressed vegetation area on the north side of the east pond.

Two compounds, 2,4-DNT and 1,3-DNB, were reported in both samples at almost identical concentrations.

5.2.1.2 0 to 3 Feet in Depth Interval

Explosives residues were detected in five of the 12 samples collected from the 0 to 3 foot depth. Three compounds, 1,3,5-TNB, 2,4-DNT, and 1,3-DNB were detected in each of borings PR-S4, -S6, -S7, and -S9. 2,6-DNT was also detected in the samples from borings PR-S6 and -S9. All four of these borings are located adjacent to areas of denuded soil/stressed vegetation. The compounds and concentrations detected correlate well with the compounds and concentrations detected in the surface soil samples collected in the denuded soils areas.

2,4-DNT was also detected in the 0 to 3 foot interval from boring PR-S15. This boring is located on the east edge of the east pond. Denuded soils or stressed vegetation were not noted in this area.

5.1.2.3 3 to 5 Foot Depth Interval

Explosives residues were detected in the 3 to 5 foot interval in 11 of the 12 borings. Eight nitroaromatics compounds were reported in soils within this interval: 2,4,6-TNT; 1,3,5-TNB; NB; 2,4-DNT; 2,6-DNT; 3,4-DNT; 4-Am-DNT; and 1,3-DNB.

The most significant finding in the 3 to 5 foot interval is the presence of 2,4,6-TNT at a concentration of 12,000 mg/Kg in boring PR-S14. This boring was installed near the location where the red water is thought to have entered the ponds. 2,4,6-TNT was not detected in any of the other samples within the 3 to 5 foot interval. The fact that this compound is relatively immobile in soils may account for its lack of distribution throughout the pond soils. Possibly, 2,4,6-TNT suspended in the red water settled out into the sediments near the point where waste water entered the pond and continued to accumulate. Even after 50 years, the concentration at this location remains

significant. The concentration in this sample is above both the industrial and residential risk screening criteria of 190 mg/Kg and 21 mg/Kg, respectively.

1,3,5-TNB was the most widely distributed nitroaromatic in the 3 to 5 foot interval. It was detected in nine of the 12 samples. The concentration of 58 mg/Kg 1,3,5-TNB in the sample from boring PR-S14 was significantly higher than concentrations detected in other Pentolite Road Red Water Ponds samples. Excluding this sample, concentrations ranged from 0.5 mg/Kg to 13 mg/Kg. Concentrations are highest in the central portion of the former ponds. 1,3,5-TNB was not detected in the 3 to 5 foot interval along the southwestern or the eastern edges of the pond area. As stated previously, 1,3,5-TNB is an impurity generated during TNT manufacturing. It is removed during the washing process and is a significant component of red water. It is also moderately to highly mobile in soils. Therefore, its distribution throughout the pond area is not unusual. In five of the samples (from borings PR-S4, -S6, -S7, -S9, and -S14) 1,3,5-TNB concentrations exceeded the Region III residential risk screening criteria of 3.9 mg/Kg.

The three other most commonly detected nitroaromatics in the 3 to 5 foot interval were 2,4-DNT, 2,6-DNT, and 1,3-DNB. None of these compounds were present in concentrations exceeding Regions III risk screening levels.

- 2,4-DNT was the second most widely distributed nitroaromatic, detected in eight of the 12 samples. Concentrations ranged from 0.3 mg/Kg to 8.7 mg/Kg. The highest concentrations were present in the central portion of the pond.

- 1,3-DNB was present in seven of the 12 samples at concentrations ranging from 1.1 mg/Kg to 6.4 mg/Kg. The distribution pattern of 1,3-DNB mirrors that of 1,3,5-TNB except that the concentrations of 1,3-DNB are lower in all cases.

- 2,6-DNT was detected in only four samples. Concentrations ranged from 0.3 mg/Kg to 3.6 mg/Kg. The distribution pattern of 2,6-DNT is similar to that of 2,4-DNT except that the distribution is not as wide and the 2,6-DNT concentrations are consistently lower.

The distributions of the four most commonly detected nitroaromatics (1,3,5-TNB, 2,4-DNT, 2,6-DNT, and 1,3-DNB) in the 3 to 5 foot interval in the former east and west

ponds at the Pentolite Road Red Water Ponds are illustrated on Figure 5-2. The concentrations are color coded to show the locations at which higher, intermediate, and lower concentrations of these four nitroaromatic compounds were detected.

Three other nitroaromatics were detected in the 3 to 5 foot interval within the ponds.

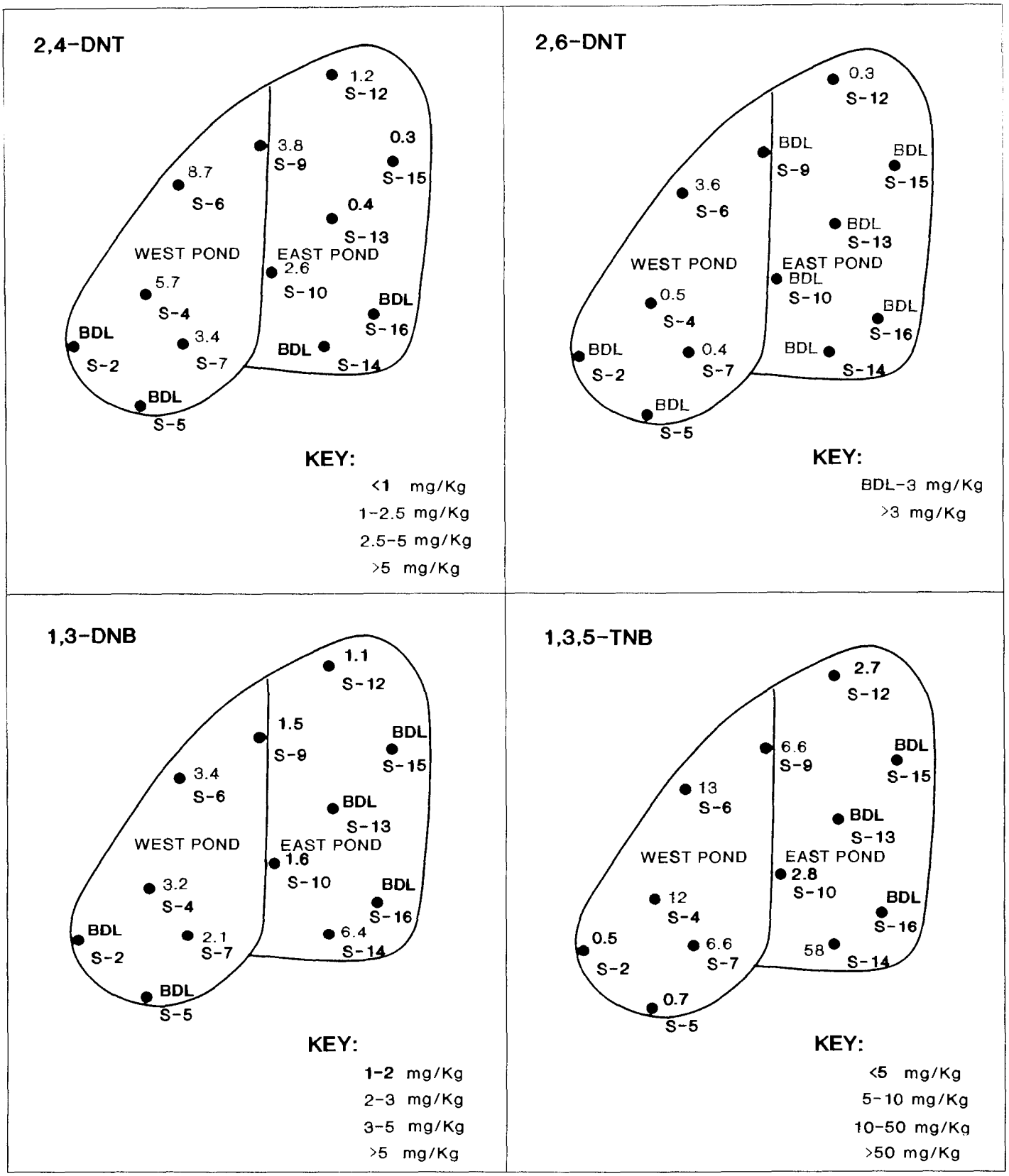
- NB was reported in boring PR-S6. This was the only occurrence of this compound in the samples collected from the Pentolite Road Red Water Ponds. 3,4-DNT was detected in the sample from boring PR-S14, located near the outfall from the sewage treatment plant. Both NB and 3,4-DNT are incomplete products or impurities in TNT manufacturing.

- 4-Am-DNT, a biotransformation product of TNT, was detected in three samples. The concentration at boring PR-S14 was 9.5 mg/Kg. The relatively high concentration at this location probably indicates that naturally occurring microbially mediated biotransformation of 2,4,6-TNT is taking place in the pond soils at depth. Much lower concentrations, 0.3 mg/Kg each, were detected in borings PR-S6 and -S7 located in the central part of the western pond.

5.1.2.4 5 to 10 Foot Depth Interval

Explosives residues were detected in the 5 to 10 foot depth interval in all 12 borings installed within the pond boundaries. Nine nitroaromatic compounds were reported in soils within this interval: 2,4,6-TNT; 1,3,5-TNB; 2,4-DNT; 2,6-DNT; 4-Am-2-NT; 3,4-DNT; 4-Am-DNT; 2-NT; and 1,3-DNB.

Again, as with the 3 to 5 foot interval, the most significant finding in the 5 to 10 foot interval is the elevated concentration of 2,4,6-TNT in boring PR-S14. The concentration of 310 mg/Kg (average of two split samples) is significantly less than in the 3 to 5 foot interval but is still above both the industrial and residential Region III risk screening criteria. In the 5 to 10 foot interval, 2,4,6-TNT was also detected in one other boring, PR-S13, at the low concentration of 0.5 mg/Kg. The concentration of 2,4,6-TNT appears to be decreasing with depth in boring PR-S14. However, because the entire sample interval between 5 and 10 feet was composited, it is not possible to evaluate whether 2,4,6-TNT is present throughout this interval or whether



200 100 0 200 Feet

Approximate Scale

NOTE: "BDL" indicates findings below detectable limits

N

Figure 5-2

DISTRIBUTION OF MOST PREVALENT COMPOUNDS IN 3-5 FT INTERVAL AT PENTOLITE ROAD RED WATER PONDS

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Sandusky, Ohio

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the contamination continues only a short distance beyond the 3 to 5 foot interval and does not extend to a depth of 10 feet.

As with the 3 to 5 foot interval, in the 5 to 10 foot interval 1,3,5-TNB was the most widely distributed nitroaromatic. It was detected in all twelve locations within the ponds. Concentrations ranged from 0.4 mg/Kg in boring PR-S5 located on the southwestern edge of the ponds to 23 mg/Kg in boring PR-S15 located on the northeastern edge of the ponds. Surprisingly, 1,3,5-TNB was not detected in the sample collected from boring PR-S15 in the 3 to 5 foot interval. Relatively high concentrations of 1,3,5-TNB were found in each of the three borings on the eastern side of the ponds in the 5 to 10 foot interval despite the fact that it was not present in the overlying soils. The concentration in boring PR-S6 on the northwestern side of the ponds was also among the highest reported in this depth interval. With the exception of the 1,3,5-TNB concentration in boring PR-S14 in the 3 to 5 foot interval, concentrations in the 5 to 10 foot interval were generally higher than in the 3 to 5 foot interval. In eight of the samples (from borings PR-S4, -S6, -S9, -S10, -S13, -S14, -S15, and -S16), 1,3,5-TNB concentrations exceeded the residential Region III risk screening criteria of 3.9 mg/Kg.

Again, similar to the 3 to 5 foot interval, the three other most commonly detected nitroaromatics in the 5 to 10 foot interval were 2,4-DNT, 2,6-DNT, and 1,3-DNB. As with the 3 to 5 foot interval, none of these compounds were present in concentrations exceeding Region III risk screening levels.

- 1,3-DNB was the second most widely distributed nitroaromatic, detected in 11 of the 12 samples. Concentrations throughout the ponds were similar to those noted in the 3 to 5 foot interval and ranged from 0.3 mg/Kg in boring PR-S2 located on the far western side of the ponds to 6.6 mg/Kg in boring PR-S15. The 1,3-DNB distribution pattern is similar to that for 1,3,5-TNB, both shown on Figure 5-3. The highest concentrations were present on the eastern and northwestern sides of the ponds.

- 2,4-DNT was present in ten of the 12 samples from the 5 to 10 foot interval at concentrations ranging from 0.3 mg/Kg at boring PR-S7 on the south side of the ponds to 14.5 mg/Kg in boring PR-S14 at the sewer outfall. As with 1,3,5-TNB and 1,3-DNB, 2,4-DNT is more widespread and concentrations are higher on the eastern side of the ponds, despite the low concentrations detected in the overlying 3 to 5 foot sampling interval.

- 2,6-DNT was detected in six locations. Concentrations were consistent with those detected in the 3 to 5 foot interval and ranged from 0.3 mg/Kg in boring PR-S12 on the north side of the east pond to 2.35 mg/Kg (average of two split samples) in boring PR-S14 located near the sewer outfall. Again, the highest concentrations of 2,6-DNT were detected in the samples from the eastern side of the ponds, an area where it was not present in the 3 to 5 foot interval. 2,6-DNT is not as widespread in the 5 to 10 foot interval as 2,4-DNT and the concentrations are consistently lower.

The distributions of the four most commonly detected nitroaromatics (1,3,5-TNB, 1,3-DNB, 2,4-DNT, and 2,6-DNT) in the 5 to 10 foot interval are illustrated on Figure 5-3. The concentrations are color coded to illustrate the locations at which higher,intermediate, and lower concentrations of these four nitroaromatic compounds were detected.

Four other nitroaromatics were detected in the 5 to 10 foot interval within the ponds.

- 2-NT was reported in boring PR-S14. This was the only occurrence of this compound in the samples collected from the Pentolite Road Red Water Ponds.

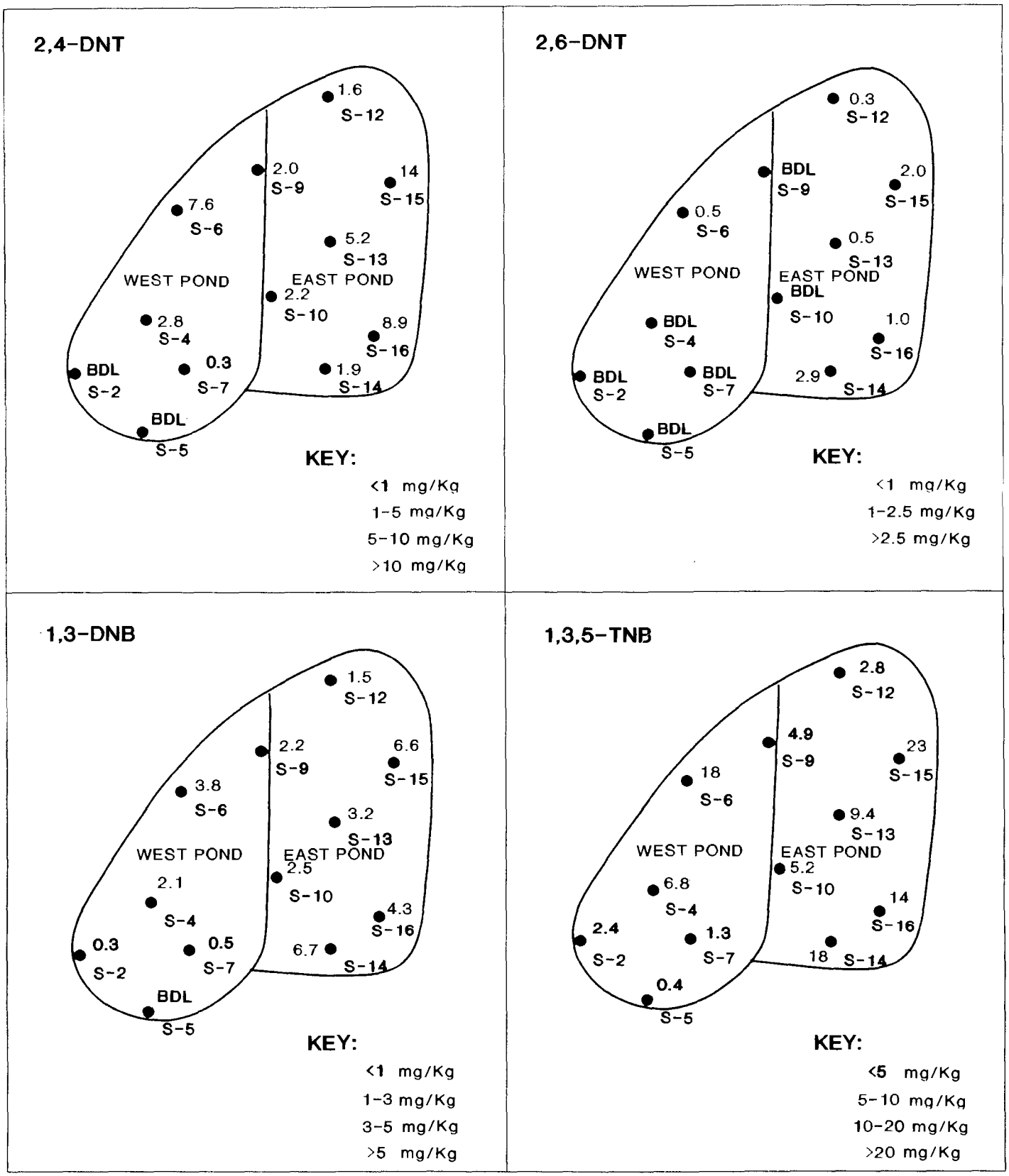
- 3,4-DNT was detected in four samples from borings PR-S13, -S14, -S15, and -S16, all located along the eastern side of the east pond. The highest concentration 1.4 mg/Kg (average of two split samples), was present in boring PR-S14, located near the sewer outfall.

- 4-Am-DNT was detected in three samples at concentrations generally comparable to those detected in the 3 to 5 foot interval. The highest concentration, 1.4 mg/Kg (average of two split samples), was reported in boring PR-S14. As noted above, 4-Am-DNT is a biotransformation product of TNT. It was also detected in the 5 to 10 foot interval in borings PR-S6 and -S13. 4-Am-2-NT was present at concentrations of less than 1.0 mg/Kg in the samples from borings PR-S15 and -S16 located along the eastern side of the ponds.

Four QC samples were collected from the 5 to 10 foot depth interval.

- QC sample PR-S25-5.0/10.0 is a split of sample PR-S11-5.0/10.0. No explosives residues were detected in either sample.

- QC sample PR-S26-5.0/10.0 is a split of sample PR-S10-5.0/10.0. The same three nitroaromatic compounds were detected in both samples at relatively consistent concentrations.



NOTE: "BDL" indicates findings below detectable limits

Figure 5-3

DISTRIBUTION OF MOST PREVALENT COMPOUNDS IN 5-10 FT INTERVAL AT PENTOLITE ROAD RED WATER PONDS

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- QC sample PR-S27-5.0/10.0 is a split of sample PR-S12-5.0/10.0. Three of the same nitroaromatics were detected in each sample at relatively consistent concentrations. 2,6-DNT was detected at a very low concentration, just above the laboratory detection limit, in one sample but was not detected in the other sample.

- QC sample PR-S28-5.0/10.0 is a split of sample PR-S14-5.0/10.0. Seven explosives residues compounds were reported in each of the split samples collected from this location. Concentrations were comparable, but generally lower in sample PR-S28-5.0/10.0 than in PR-S14-5.0/10.0. An eighth compound, 2-NT was reported at a low level in sample PR-S14-5.0/10.0 but was not reported in sample PR-S28-5.0/10.0.

5.1.3 Summary of Pentolite Road Red Water Ponds Nitroaromatics Contamination

The sampling scheme utilized at the Pentolite Road Red Water Ponds appears to have been successful in confirming the approximate perimeter of the former ponds. Nitroaromatics were detected outside the apparent footprint of the pond in only two areas. The concentrations in both areas were significantly lower than the concentrations detected inside the pond footprint. In general, the horizontal extent of contamination can be considered to be satisfactorily delineated.

Contamination was detected in all of the samples collected inside the pond perimeter from the 5 to 10 foot interval. Since samples were composited over the entire interval from 5 to 10 feet, it is not known whether contamination extends to and beyond 10 feet or is limited to a depth between 5 and 10 feet. However, as discussed in Section 6, the water table in this area rises seasonally to a depth of 3 to 5 feet below the ground surface, well above the depth of soil sampling included in this investigation. Since delineation of the vertical extent of soil contamination is usually limited to soils in the unsaturated zone, further delineation of the vertical extent of contamination within the 5 to 10 foot sampling interval may not be necessary. At the time of this investigation, the water table was less than a foot below the bottom of the soil borings within the pond perimeter. Consequently, additional delineation of the vertical extent of soil contamination at depths greater than 10 feet is probably not warranted.

TABLE 5-1

EXPLOSIVES RESIDUES CONCENTRATIONS IN SOIL SAMPLES
PENTOLITE ROAD RED WATER PONDS

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
5-Foot Boring	PR-S1-0.0/2.0														
	PR-S1-2.0/5.0	0.3			0.4										
10-Foot Boring	PR-S2-0.0/3.0														
	PR-S2-3.0/5.0		0.5												
	PR-S2-5.0/10.0		2.4												0.3
5-Foot Boring	PR-S3-0.0/2.0														
	PR-S3-2.0/5.0														
10-Foot Borings	PR-S4-0.0/3.0		1.7		1.1										0.8
	PR-S4-3.0/5.0		12		5.7	0.5									3.2
	PR-S4-5.0/10.0		6.8		2.8										2.1
	PR-S5-0.0/3.0														
	PR-S5-3.0/5.0		0.7												
	PR-S5-5.0/10.0		0.4												
	PR-S6-0.0/3.0		0.7		2.1	0.4									0.9
	PR-S6-3.0/5.0		13	1.1	8.7	3.6			0.3						3.4
	PR-S6-5.0/10.0		18		7.6	0.5			1.0						3.8
	PR-S7-0.0/3.0		0.5		0.4										0.3

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

TABLE 5-1
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
10-Foot Borings	PR-S7-3.0/5.0		6.6		3.4	0.4			0.3						2.1
(Continued)	PR-S7-5.0/10.0		1.3		0.3										0.5
5-Foot Boring	PR-S8-0.0/0.5														
	PR-S8-0.0/2.0														
	PR-S8-2.0/5.0														
10-Foot Borings	PR-S9-0.0/3.0		1.1		2.4	0.8									1.6
	PR-S9-3.0/5.0		6.6		3.8										1.5
	PR-S9-5.0/10.0		4.9		2.0										2.2
	PR-S10-0.0/3.0														
	PR-S10-3.0/5.0		2.8		2.6										1.6
	PR-S10-5.0/10.0		5.2		2.2										2.5
	PR-S11-0.0/3.0														
	PR-S11-3.0/5.0														
	PR-S11-5.0/10.0														
	PR-S12-0.0/3.0														
	PR-S12-3.0/5.0		2.7		1.2	0.3									1.1
	PR-S12-5.0/10.0		2.8		1.6	0.3									1.5
	PR-S13-0.0/0.5														

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample PR-S10-5.0/10.0 is a split of QC Sample PR-S26-5.0/10.0.
Sample PR-S11-5.0/10/0 is a split of QC Sample PR-S25-5.0/10.0.
Sample PR-S12-5.0/10.0 is a split of QC Sample PR-S27-5.0/10.0.

TABLE 5-1
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
10-Foot Borings (Continued)	PR-S13-0.0/3.0														
	PR-S13-3.0/5.0				0.4										
	PR-S13-5.0/10.0	0.5	9.4		5.2	0.5		0.5	0.7						3.2
	PR-S14-0.0/0.5														
	PR-S14-0.0/3.0														
	PR-S14-3.0/5.0	12,000	58					4.5	9.5						6.4
	PR-S14-5.0/10.0	340	18		19	2.9		1.7	2.0		0.9				6.7
	PR-S15-0.0/3.0				0.6										
	PR-S15-3.0/5.0				0.3										
	PR-S15-5.0/10.0		23		14	2.0	0.9	1.1							6.6
	PR-S16-0.0/3.0														
	PR-S16-3.0/5.0														
	PR-S16-5.0/10.0		14		8.9	1.0	0.6	0.8							4.3
2-Foot Borings	PR-S17-0.0/0.5														
	PR-S17-0.0/2.0														
	PR-S17-2.0/5.0														
	PR-S18-0.0/2.0														
	PR-S18-2.0/5.0														

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample PR-S14-5.0/10.0 is a split of QC Sample PR-S28-5.0/10.0.
Sample PR-S18-2.0/5.0 is a split of QC Sample PR-S29-2.0/5.0.

TABLE 5-1
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
10-Foot Boring	PR-S19-0.0/0.5														
	PR-S19-0.0/3.0														
	PR-S19-3.0/5.0														
	PR-S19-5.0/10.0		1.5		1.0										1.4
5-Foot Boring	PR-S20-0.0/2.0														
	PR-S20-2.0/5.0														
Surface Soil Samples	PR-S21-0.0/0.5				0.3										
	PR-S22-0.0/0.5		0.4		0.4										
	PR-S23-0.0/0.5				1.0										0.4
	PR-S24-0.0/0.5				1.1			0.3							
QC Samples	PR-S25-5.0/10.0														
	PR-S26-5.0/10.0		3.9		1.1										2.1
	PR-S27-5.0/10.0		2.8		0.8										0.9
	PR-S28-5.0/10.0	280	8.5		10	1.8		1.1	0.8						3.9
	PR-S29-2.0/5.0														
	PR-S30-0.0/0.5				0.9										0.4

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

QC sample PR-S25-5.0/10.0 is a split of PR-S11-5.0/10.0.
QC sample PR-S26-5.0/10.0 is a split of PR-S10-5.0/10.0.
QC sample PR-S27-5.0/10.0 is a split of PR-S12-5.0/10.0.
QC sample PR-S28-5.0/10.0 is a split of PR-S14-5.0/10.0.
QC sample PR-S29-2.0/5.0 is a split of PR-S18-2.0/5.0.
QC sample PR-S30-0.0/0.5 is a split of PR-S23-0.0/0.5.

5.2 WEST AREA RED WATER PONDS

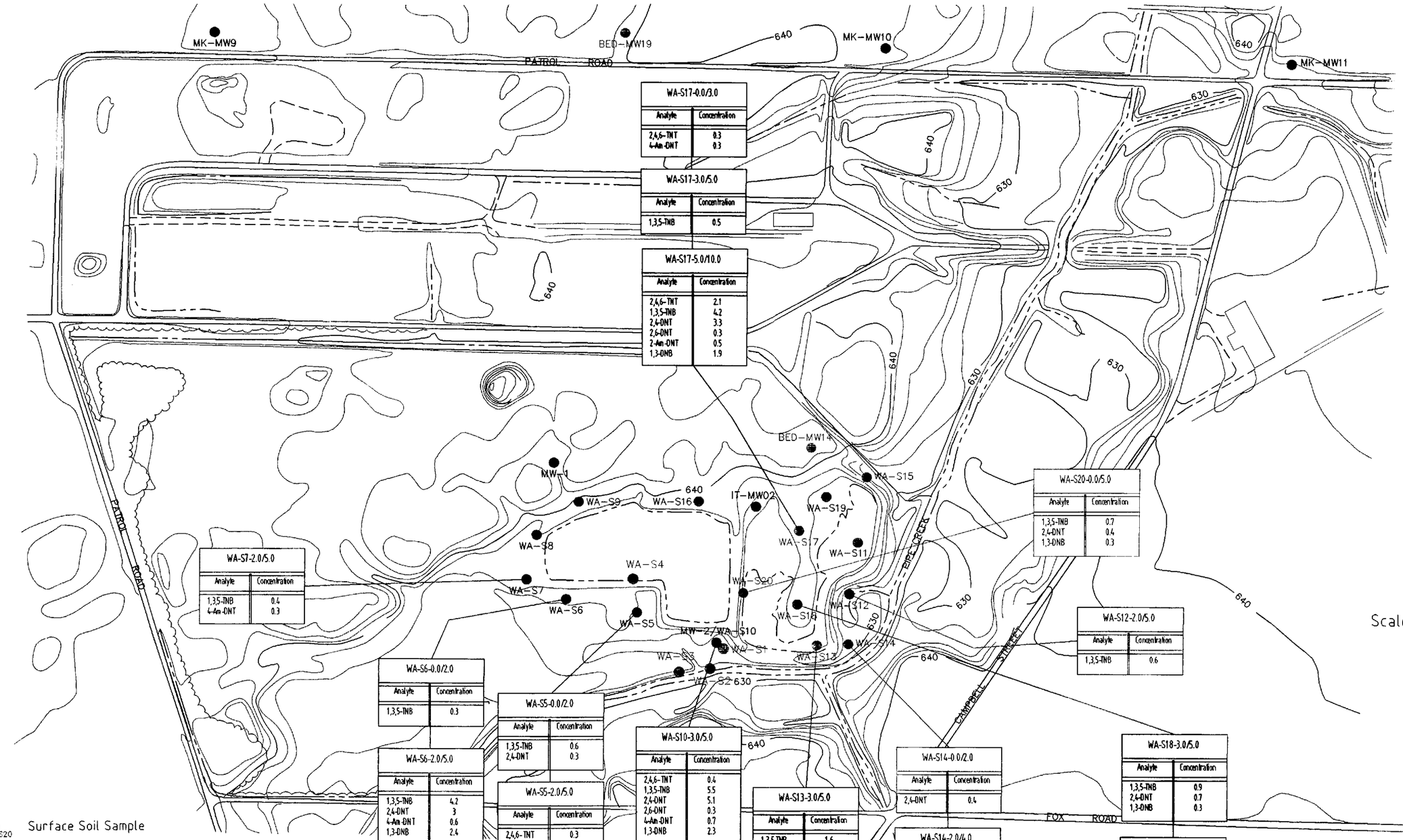
During operation of the PBOW, two ponds were present at the West Area Red Water Ponds. The west pond retains generally the same shape as the pond used during operation of the PBOW although it is probably smaller than when it was in use. The configuration of the east pond, which was drained by NASA during the 1970's, is still clearly discernible based on its surrounding berm. The ponds are located immediately above Pipe Creek. Fifteen soil borings were installed around the perimeter of the two ponds and inside the east pond. Surface soil samples were collected at an additional five locations along the bank of Pipe Creek in areas where seeps have been observed. The boring and surface soil sampling locations are illustrated on Figure 5-4.

The concentrations of explosives residues detected in the 40 soil samples collected from the West Area Red Water Ponds are listed in Table 5-2 and are illustrated on Figure 5-4.

5.2.1 Distribution of Explosives Residues Outside the Ponds Perimeter

Eleven 5-foot soil borings were installed around the perimeter of the two ponds that comprise the West Area Red Water Ponds, seven around the west pond and five around the east pond. The berm surrounding the east pond was used to delineate that pond. The existing pond level was used to delineate the west pond. The purpose of these borings was to evaluate whether use and/or releases from the ponds resulted in contamination of the surrounding soils. Twenty-two samples were collected from these 11 hand-augered borings from depths of 0 to 2 feet and 2 to 5 feet. Borings WA-S5, -S6, -S7, -S8, -S9, and -S16 were installed around the west pond. Borings WA-S11, -S12, -S14, -S15, and -S19 were installed around the east pond.

Target depth intervals were achieved in all 5-foot borings except WA-S16. Auger refusal was reached in this boring at approximately 4 feet. The object causing refusal was thought at first to be a pipe of some kind because of the hollow sound produced from banging it with the auger. A large rock was found after a backhoe was used to excavate soils in this area. After approximately ten minutes, "reddish colored" water



WA-S17-0.0/3.0	
Analyte	Concentration
2,4,6-TNT	0.3
4-Am-DNT	0.3

WA-S17-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.5

WA-S17-5.0/10.0	
Analyte	Concentration
2,4,6-TNT	2.1
1,3,5-TNB	4.2
2,4-DNT	3.3
2,6-DNT	0.3
2-Am-DNT	0.5
1,3-DNB	1.9

WA-S20-0.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.7
2,4-DNT	0.4
1,3-DNB	0.3

WA-S7-2.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.4
4-Am-DNT	0.3

WA-S12-2.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.6

WA-S6-0.0/2.0	
Analyte	Concentration
1,3,5-TNB	0.3

WA-S5-0.0/2.0	
Analyte	Concentration
1,3,5-TNB	0.6
2,4-DNT	0.3

WA-S6-2.0/5.0	
Analyte	Concentration
1,3,5-TNB	4.2
2,4-DNT	3
4-Am-DNT	0.6
1,3-DNB	2.4

WA-S5-2.0/5.0	
Analyte	Concentration
2,4,6-TNT	0.3
1,3,5-TNB	3
2,4-DNT	1.3
4-Am-DNT	0.4
1,3-DNB	0.7

WA-S10-3.0/5.0	
Analyte	Concentration
2,4,6-TNT	0.4
1,3,5-TNB	5.5
2,4-DNT	5.1
2,6-DNT	0.3
4-Am-DNT	0.7
1,3-DNB	2.3

WA-S10-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	1.1
3,4-DNT	0.3
1,3-DNB	0.5

WA-S13-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	1.6
2,4-DNT	0.6
4-Am-DNT	0.3
1,3-DNB	0.3

WA-S13-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	0.5

WA-S14-0.0/2.0	
Analyte	Concentration
2,4-DNT	0.4

WA-S14-2.0/4.0	
Analyte	Concentration
2,4,6-TNT	0.3
1,3,5-TNB	0.4
2,4-DNT	0.3
3,4-DNT	0.5

WA-S18-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.9
2,4-DNT	0.7
1,3-DNB	0.3

WA-S18-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	0.9
2,4-DNT	0.3

WA-S20 Surface Soil Sample

MW-1 Overburden Monitoring Well

WA-S9 5 Foot Soil Boring

WA-S18 10 Foot Soil Boring

BED-MW14 Bedrock Monitoring Well

Concentrations are in mg/Kg

FILENAME: H:\CAD\COE-PLUM\PLOT\SLEXPRWS.DWG

FIGURE 5-4
WEST AREA RED WATER PONDS
SOIL BORING LOCATIONS AND
EXPLOSIVES RESIDUES CONCENTRATIONS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

TABLE 5-2

EXPLOSIVES RESIDUES CONCENTRATIONS IN SOIL SAMPLES
WEST AREA RED WATER PONDS

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Surface Soil Samples	WA-S1-0.0/0.5														
	WA-S2-0.0/0.5														
	WA-S3-0.0/0.5														
	WA-S4-0.0/0.5														
5-Foot Borings Around West Pond Perimeter	WA-S5-0.0/2.0		0.6		0.3										
	WA-S5-2.0/5.0	0.3	3.0		1.3				0.4						0.7
	WA-S6-0.0/2.0		0.3												
	WA-S6-2.0/5.0		4.2		3.0				0.6						2.4
	WA-S7-0.0/2.0														
	WA-S7-2.0/5.0		0.4						0.3						
	WA-S8-0.0/2.0														
	WA-S8-2.0/5.0														
	WA-S9-0.0/2.0														
	WA-S9-2.0/5.0														
Monitoring Well MW-2	WA-S10-3.0/5.0	0.4	5.5		5.1	0.3			0.7						2.3
	WA-S10-5.0/10.0		1.1					0.3							0.5

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., WA = West Area Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the West Area Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample WA-S5-0.0/2.0 is a split of QC sample WA-S21-0.0/2.0.
Sample WA-S8-2.0/5.0 is a split of QC sample WA-S22-2.0/5.0.

TABLE 5-2
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
5-Foot Borings Around East Pond Perimeter	WA-S11-0.0/2.0														
	WA-S11-2.0/5.0														
	WA-S12-0.0/2.0														
	WA-S12-2.0/5.0		0.6												
10-Foot Boring in East Pond	WA-S13-0.0/0.5														
	WA-S13-0.0/3.0														
	WA-S13-3.0/5.0		1.6		0.6				0.3						0.3
	WA-S13-5.0/10.0		0.5												
5-Foot Borings Around Perimeter of East Pond	WA-S14-0.0/2.0				0.4										
	WA-S14-2.0/5.0	0.3	0.4		0.3			0.5							
	WA-S15-0.0/2.0														
	WA-S15-2.0/5.0														
5-Foot Boring West Pond Perimeter	WA-S16-0.0/2.0														
	WA-S16-2.0/4.0														
10-Foot Borings in East Pond	WA-S17-0.0/0.5														
	WA-S17-0.0/3.0	0.3							0.3						
	WA-S17-3.0/5.0		0.5												

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., WA = West Area Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the West Area Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

TABLE 5-2
(Continued)

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
10-Foot Borings in East Pond (Continued)	WA-S17-5.0/10.0	2.1	4.2		3.3	0.3				0.5					1.9
	WA-S18-0.0/3.0														
	WA-S18-3.0/5.0		0.9		0.7										0.3
	WA-S18-5.0/10.0		0.9		0.3										
5-Foot Boring in East Pond	WA-S19-0.0/2.0														
	WA-S19-2.0/5.0														
Surface Soil Sample	WA-S20-0.0/0.5		0.7		0.4										0.3
QC Samples	WA-S21-0.0/2.0		0.5												
	WA-S22-2.0/5.0														
	WA-S23-0.0/0.5		0.5		0.4										
	WA-S24-5.0/10.0	3.0	3.1		3.8	0.3			0.3						1.5

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., WA = West Area Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the West Area Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample WA-S17-5.0/10.0 is a split of QC sample WA-S24-5.0/10.0.
QC sample WA-S21-0.0/2.0 is a split of WA-S5-0.0/2.0.
QC sample WA-S22-2.0/5.0 is a split of WA-S8-2.0/5.0.
QC sample WA-S23-0.0/0.5 is a split o WA-S20-0.0/0.5.
QC sample WA-S24-5.0/10.0 is a split of WA-S17-5.0/10.0.

began to pool in the bottom of the excavation at a depth of about 8 feet. A grab sample of the water was collected for laboratory analysis before the excavation was refilled. Analysis of this water sample is provided in Section 6.0. The soils in the area were mostly tight clays and several of the borings south of the ponds filled with water during augering.

In addition to the eleven 5-foot borings, two deeper soil samples were collected from the boring drilled for groundwater monitoring well MW-2. Samples from this boring, identified as WA-S10 and located south of the west pond, were collected from 3 to 5 feet and from 5 to 10 feet.

Surface soil samples were collected at five locations between the ponds and Pipe Creek. Two surface samples, WA-S2 and WA-S3, were collected on the stream bank of Pipe Creek at locations where red water was observed seeping from the stream bank in March 1994. Two additional surface samples, WA-S1 and WA-S4, were collected from breaches in the south banks of the ponds, one from the east pond and one from the west pond. Sample WA-S20 was collected from the area where the east pond berm was breached by NASA to drain the pond. Each surface soil sample was collected from 0.0 to 0.5 feet.

Low levels of nitroaromatics were detected in 5 of the 11 borings installed around the perimeter of the ponds. Concentrations were significantly less in the samples from the West Area Red Water Ponds soils than in the Pentolite Road Red Water Ponds soils discussed above. The greatest number of compounds and highest concentrations were present in the 2 to 5 foot interval.

Explosives residues concentrations detected in each sampling interval are discussed below.

5.2.1.1 Surface Soils

No explosives residues were detected in the four surface samples collected at locations where seeps were observed along the stream bank between the ponds and Pipe Creek. However, low levels of explosives were detected in surface soil sample WA-S20-0.0/0.5 which was collected in the area where the east pond was breached to allow it to drain into Pipe Creek. 1,3,5-TNB, 2,4-DNT, and 1,3-DNB were each detected at concentrations of less than 1 mg/Kg from this sample.

QC sample WA-S23-0.0/0.5 was a split of sample WA-S20-0.0/0.5. 1,3,5-TNB and 2,4-DNT were detected in each of the two split samples at comparable concentrations. 1,3-DNB was detected in one of the splits at a concentration of 0.3 mg/Kg but not in the other.

5.2.1.2 0 to 2 Foot Depth Interval

Low levels of explosives residues were detected in three of the 11 samples collected from the 0 to 2 foot interval around the perimeter of the ponds. Two compounds, 1,3,5-TNB and 2,4-DNT, were detected. 1,3,5-TNB was reported in borings WA-S5 and WA-S6 at concentrations of 0.55 mg/Kg (average of two split samples) and 0.3 mg/Kg, respectively. 2,4-DNT was reported at a concentration of 0.3 mg/Kg in one of the two split samples from boring WA-S5, but was not detected in the other of these two split samples. 2,4-DNT was also reported in the sample from boring WA-S14 at a concentration of 0.4 mg/Kg.

The three borings in which explosives residues were detected are all located on the downgradient side of the ponds in relation to surface water drainage to Pipe Creek. Borings WA-S5 and -S6 are located on the south side of the west pond between the pond and Pipe Creek. Boring WA-S14 is located on the southeast side of the east pond along the steepest portion of the bank between the south side of the east pond and Pipe Creek.

QC sample WA-S21-0.0/2.0 was a split of sample WA-S5-0.0/2.0. Low levels of 1,3,5-TNB were detected in both samples. As stated above, a low level of 2,4-DNT was detected in one of the two split samples but not in the other.

5.2.1.3 2 to 5 Foot Depth Interval

Seven nitroaromatics, 2,4,6-TNT, 1,3,5-TNB, 2,4-DNT, 2,6-DNT, 3,4-DNT, 4-Am-DNT, and 1,3-DNB, were detected in six of 12 samples collected from the 2 to 5 foot interval in the perimeter borings (or from 3 to 5 feet in boring WA-S10).

1,3,5-TNB was detected in samples collected from 2 to 5 feet in borings WA-S5, -S6, -S7, -S12, and -S14. It was also detected in the 3 to 5 foot sample from boring WA-S10. Concentrations ranged from 0.4 mg/Kg in each of borings WA-S7 and -S14 to 5.5 mg/Kg in boring WA-S10. 1,3,5-TNB concentrations were above the residential risk screening criteria of 3.9 mg/Kg in only two samples, from borings WA-S6 and -S10.

2,4-DNT was present in four samples. Concentrations ranged from 0.3 mg/Kg in boring WA-S14 to 5.1 mg/Kg in boring WA-S10.

1,3-DNB was reported in three samples. The highest concentrations, 2.4 mg/Kg and 2.3 mg/Kg, were reported in borings WA-S6 and -S10, respectively.

The other nitroaromatics were all present at concentrations below 1 mg/Kg including 4-Am-DNT, a biotransformation product of TNT, which was present in three samples.

QC sample WA-S22-2.0/5.0 was a split of sample WA-S8-2.0/5.0. No explosives residues were detected in either sample.

5.2.1.4 5 to 10 Foot Depth Interval

One sample was collected from the 5 to 10 foot interval outside the perimeter of the ponds. This sample was collected from boring WA-S10 which was later converted to a groundwater monitoring well. Three nitroaromatics, 1,3,5-TNB, 3,4-DNT, and 1,3-DNB, were detected at concentrations of 1.1 mg/Kg, 0.3 mg/Kg, and 0.5 mg/Kg, respectively.

5.2.2 Distribution of Explosives Residues Within the East Pond

Within the perimeter of the former east pond, a drill rig was used to advance three borings, WA-S13, -S17, and -S18, to a depth of 10 feet. As stated above, historical information indicated that the pond depth was less than 10 feet. The purpose of the borings was to attempt to establish the vertical depth of contamination, if any, inside the east pond. Three soil samples were collected from each boring from 0 to 3 feet, 3 to 5 feet, and from 5 to 10 feet. Two surface samples were collected adjacent to selected 10-foot borings WA-S13 and -S17.

Explosives residues were detected in all three of the borings. The greatest number of compounds and highest concentrations were detected in the 3 to 5 foot interval. However, nitroaromatics were also detected in the 5 to 10 foot interval. Explosives residues concentrations detected in each sampling interval are discussed below.

5.2.2.1 Surface Soils

No explosives residues were present in the surface soil samples collected from borings WA-S13 and WA-S17.

5.2.2.2 0 to 3 Foot Depth Interval

Low levels of nitroaromatics were detected in one of the three borings from the 0 to 3 foot interval in the east pond. 2,4,6-TNT and its biotransformation product, 4-Am-DNT, were each detected at concentrations of 0.3 mg/Kg in boring WA-S17.

5.2.2.3 3 to 5 Foot Depth Interval

Four explosives residues, 1,3,5-TNB, 2,4-DNT, 4-Am-DNT, and 1,3-DNB, were detected at low concentrations in the 3 to 5 foot interval of the east pond borings. 1,3,5-TNB was detected in each sample. Concentrations ranged from 0.5 mg/Kg to 1.6 mg/Kg. All other nitroaromatics concentrations were below 1 mg/Kg. Four compounds were detected in boring WA-S13; three in boring WA-S18, and one in boring WA-S17.

5.2.2.4 5 to 10 Foot Depth Interval

Low levels of nitroaromatics were present in the samples collected from the 5 to 10 foot interval. Seven compounds were detected: 2,4,6-TNT, 1,3,5-TNB, 2,4-DNT, 2,6-DNT, 4-Am-DNT, 2-Am-DNT, and 1,3-DNB. Each of the seven was reported in the sample from boring WA-S17. The average concentrations for the two split samples for WA-S17 for 2,4,6-TNT, 1,3,5-TNB, 2,4-DNT, and 1,3-DNB were 2.55 mg/Kg, 3.65 mg/Kg, 3.55 mg/Kg, and 1.7 mg/Kg, respectively. All other concentrations in the sample from boring WA-S17 and all concentrations in samples from borings WA-S13 and -S18 were below 1 mg/Kg. Two biotransformation products of TNT, 2-Am-DNT and 4-Am-DNT, were present at low concentrations in the sample from boring WA-S17. This was also the only sample where 2,4,6-TNT was detected.

In only one instance was a nitroaromatic detected at a concentration in excess of a risk screening criteria in the 5 to 10 foot interval. In boring WA-S17, the concentration of 1,3,5-TNB was above the residential criteria of 3.9 mg/Kg.

QC sample WA-S24-5.0/10.0 was a split of sample WA-S17-5.0/10.0. Generally, there was good agreement between the results for the two split samples. Low levels of the two TNT biotransformation products, 4-Am-DNT and 2-Am-DNT, were detected in one sample but not the other.

5.2.3 Summary of West Area Red Water Ponds Nitroaromatics Contamination

The results of the West Area Red Water Ponds soils investigation indicate that low levels of nitroaromatics are present in shallow soils, generally on the south and southeast sides of the ponds. Most of the borings where nitroaromatics were found are located in a narrow corridor of land between the ponds and Pipe Creek. The highest concentrations, greater than 5 mg/Kg, were detected in only one sample which was collected at a depth of 3 to 5 feet in boring WA-S10 on the south side of the west pond. Two compounds, 1,3,5-TNB and 2,4-DNT, were present in this sample at concentrations of 5.5 mg/Kg and 5.1 mg/Kg, respectively. In general, the horizontal extent of contamination can be considered satisfactorily delineated.

The vertical extent of contamination was apparently not delineated outside the perimeter of the ponds or inside the ponds. Low levels of nitroaromatics were detected in the deeper samples collected at the borings surrounding the ponds. Very low levels of nitroaromatics were detected in all of the samples collected inside the east pond perimeter where all concentrations were below 5 mg/Kg. It is possible that the contamination is limited to depths sampled for this investigation, 5 feet outside the perimeter of the ponds and 10 feet inside the east pond. However, since samples were composited over the target depth interval, it is not known whether contamination extends beyond the depths investigated. As with the Pentolite Road Red Water Ponds, because the water table is seasonally very shallow, further delineation of the vertical extent of contamination at the West Area Red Water Ponds may not be warranted.

5.3 BACKGROUND SOILS INVESTIGATION

Background soil borings were installed in areas of the site where contamination was least likely to be present based on known historical uses of the property. Locations of the background soil borings are shown on Figure 5-5. The areas where the borings were installed were screened using Drawing 1661-S-3 entitled "Key to Acquired Buildings on Plum Brook Ordnance Works Reservation" to try to identify areas where buildings were historically present. Additionally, no DoD or NASA environmental concerns had been identified in these areas.

Initially, seven soil borings were to be installed and two samples were to be collected from each boring for a total of 14 background soil samples. Samples were to be collected from each boring at depth intervals of approximately 0.5 to 3 feet and from 3 to 5 feet. Target depth intervals were only achieved for three borings (BG-S1, -S2, and -S5). Two of the borings, BG-S3 and -S6, reached auger refusal on shale at 4 feet and 4.5 feet, respectively. Samples were collected from the soil obtained to the point of refusal and the borings were terminated. The remaining two borings, BG-S4 and -S7, both reached auger refusal because of weathered shale at 3 feet and were terminated. Because only one sample was collected from each boring, an additional boring BG-S9 was installed. Both target depth intervals were achieved in boring BG-S9.

All background soil samples were analyzed for explosives residues, metals, SVOCs, and VOCs.

5.3.1 Explosives Residues in Background Soils

No explosives residues were detected in any of the 14 background soil samples.

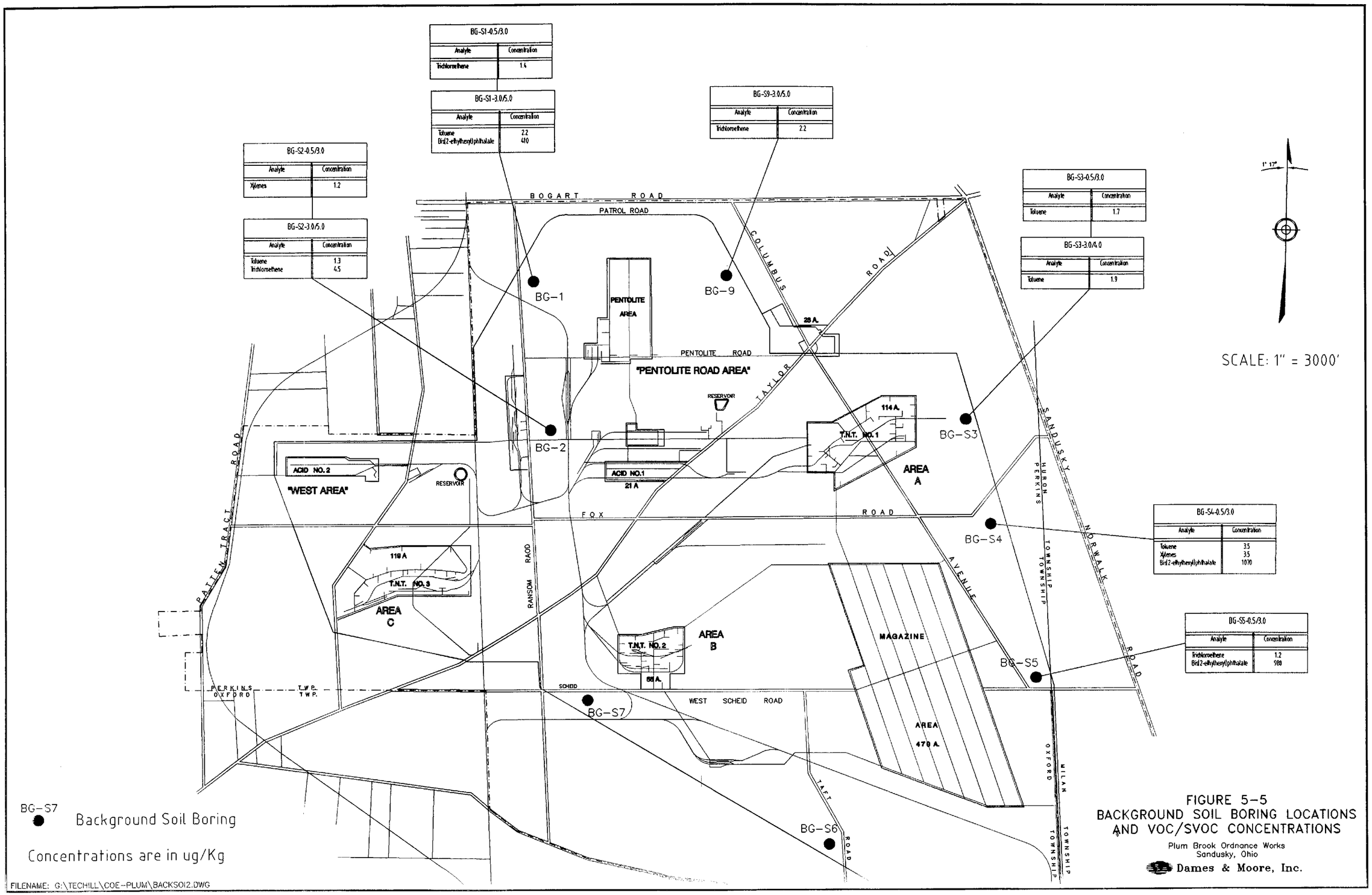


FIGURE 5-5
BACKGROUND SOIL BORING LOCATIONS
AND VOC/SVOC CONCENTRATIONS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

:PLUM\PLOT\BACKSOI2 THU APR 03 19:28:41 1997 Dallas, GA

5.3.2 VOC and SVOC Concentrations in Background Soils

The VOC and SVOC concentrations detected in the background soil samples are listed on Table 5-3 and illustrated on Figure 5-5.

Four VOCs, cis-1,2-dichloroethene, toluene, trichloroethene, and xylenes were detected, all at concentrations below 5 micrograms per kilogram (*u*g/Kg). Toluene and trichloroethene were each detected in five samples. Xylenes were reported in two samples. Cis-1,2-dichloroethene was only detected once, in a sample which also contained trichloroethene. (Cis-1,2-dichloroethene is a daughter product of trichloroethene.) The background samples were generally collected in areas adjacent to site roads. The VOCs reported in the background samples are indicative of moderate but ubiquitous soil contamination that would be expected along roadways.

VOCs were detected in a number of soil samples collected during previous investigations. Acetone, toluene, and xylenes were among the compounds previously reported.

Bis(2-ethylhexyl)phthalate, an SVOC, was reported in three samples. This compound was also reported in soil samples collected during previous investigations.

QC sample BG-S8-0.5/3.0 was a split of sample BG-S4-0.5/3.0. Two different VOCs were reported in each of the split samples. Toluene and xylenes were present in sample BG-S4-0.5/3.0. Trichloroethene and its daughter product, cis-1,2-dichloroethene, were present in sample BG-S8-0.5/3.0.

5.3.3 Metals Concentrations in Background Soils

Thirteen priority pollutant metals plus manganese were analyzed for each background soil sample. Beryllium, cadmium, mercury, selenium, silver, and thallium were not detected in any of the samples. The results for the metals that were detected in the background soil samples are discussed in Section 5.4 with the metals results for the red water ponds areas.

TABLE 5-3

VOC AND SVOC CONCENTRATIONS IN BACKGROUND SOILS

Sample Location	VOCs					SVOCs
	Sample ID	Toluene	Trichloroethane	Xylenes	Cis-1,2-dichloroethene	Bis(2-ethylhexyl)phthalate
Ranson Road/Patrol Road (North)	BG-S1-0.5/3.0		1.4			
	BG-S1-3.0/5.0	2.2				410
Ranson Road/ Pentolite Road	BG-S2-0.5/3.0			1.2		
	BG-S2-3.0/5.0	1.3	4.5			
Patrol Road (Northeast)	BG-S3-0.5/3.0	1.7				
	BG-S3-3.0/4.0	1.9				
Patrol Road South of Fox Road	BG-S4-0.5/3.0	3.5		3.5		1070
Patrol Road/ Columbus Road	BG-S5-0.5/3.0		1.2			980
	BG-S5-3.0/5.0					
Patrol Road/ Taft Road	BG-S6-0.5/3.0					
	BG-S6-3.0/4.5					
Ranson Road/ W. Scheid Road	BG-S7-0.5/3.0					
Patrol Road (North)	BG-S9-0.5/3.0					
	BG-S9-3.0/5.0		2.2			
QC sample	BG-S8-0.5/3.0		4.6		1.3	

VOCs = Volatile organic compounds
SVOCs = semivolatile organic compounds

Concentrations are listed in µg/kg or ppb.

All samples listed in the Sample ID column (column 2) were analyzed for all analytes on the VOC and SVOC method analysis lists. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., BG = Background Location); the soil boring number (e.g., S1 = background soil boring 1); and the depth interval over which the sample was collected (e.g., 0.5/3.0 = soils from 0.5 to 3.0 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

QC sample BG-S8-0.5/3.0 is a split sample of BG-S4-0.5/3.0.

5.4 ANALYSIS OF METALS CONCENTRATIONS

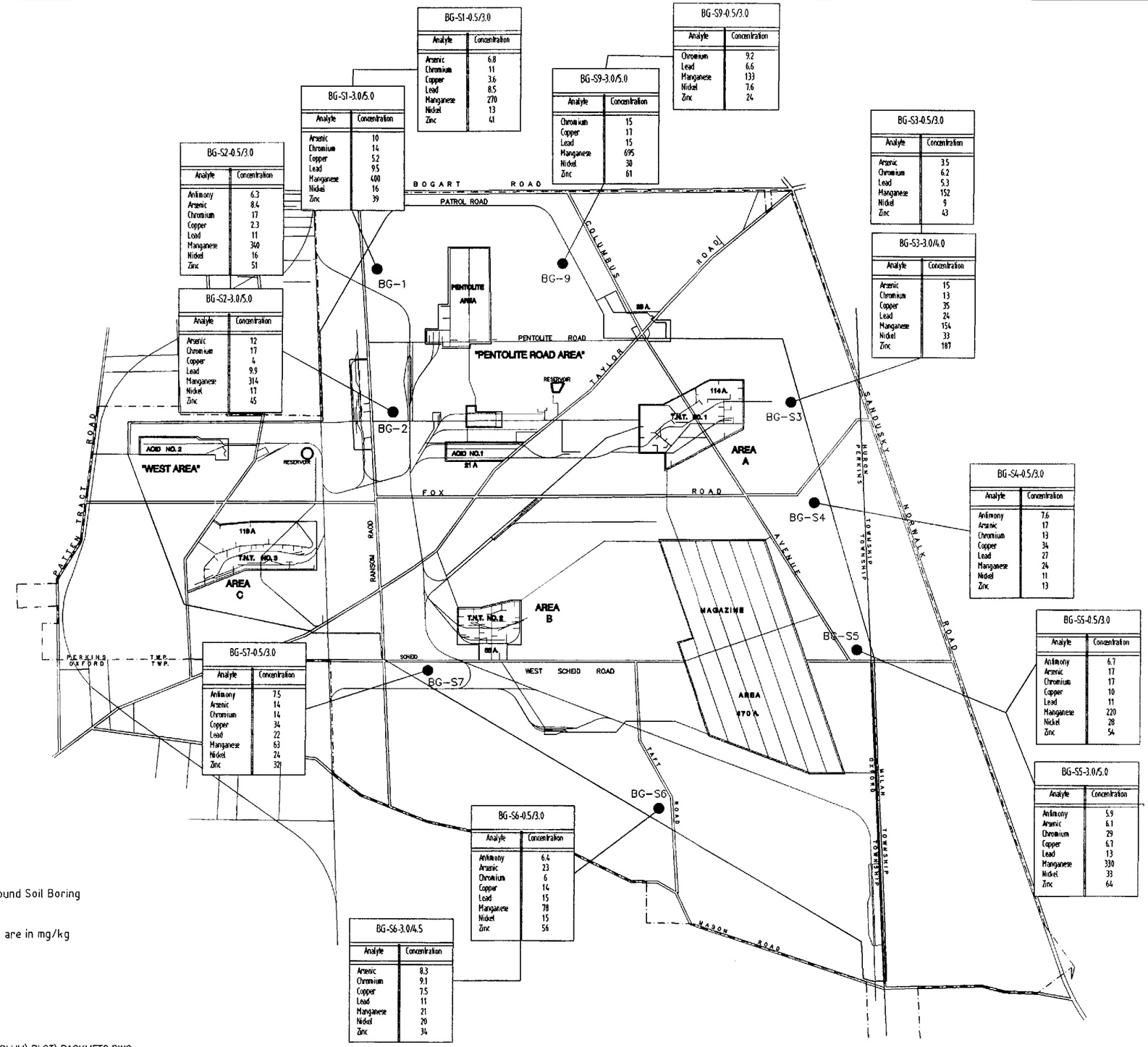
The analysis of the soil metals data involved comparison of metals concentrations in potentially impacted soil to concentrations in background soil. Background soil samples were collected in areas judged to be uninfluenced by practices at the time the site was used for explosives manufacturing. A comparison was necessary because metals are common, natural soil constituents and concentrations would have to be above background levels to be considered contamination.

Section 5.4.1 describes and compares the metals concentrations detected in the soils in the red water ponds areas and in the background samples. Section 5.4.2 presents the statistical comparison of metals concentrations in background soils to concentrations in the two red water ponds areas. A summary of metals analysis is provided in Section 5.4.3.

5.4.1 Occurrence of Metals in Soils

As stated previously, the 13 priority pollutant metals plus manganese were analyzed in the soil samples. Metals concentrations in the background soils are listed on Table 5-4 and illustrated on Figure 5-6. The metals concentrations detected in Pentolite Road Red Water Ponds and the West Area Red Water Ponds are listed in Tables 5-5 and 5-6, respectively. They are also illustrated on Figures 5-7 and 5-8.

Descriptive statistics of the metals concentrations in the soils were developed using SAS for the PC, a software system for statistics, data storage, and data handling. Dames & Moore received 61 electronically stored files (in dBase format) from the analytical laboratory which were read directly into SAS. The Dbase files included chemical data for all sampled media. Values for alphanumeric variables in the SAS dataset were checked for consistency, and some analyte names were corrected. A soil dataset was then created which excluded other media, limited analytes to explosives and metals, had "background" and "potentially impacted" categories assigned, and specified area designations (e.g., PR for Pentolite Road). In order to have all sample



BG-S1-0.5/3.0	
Analyte	Concentration
Arsenic	6.8
Chromium	11
Copper	3.6
Lead	8.5
Manganese	270
Nickel	13
Zinc	41

BG-S1-3.0/5.0	
Analyte	Concentration
Arsenic	10
Chromium	14
Copper	5.2
Lead	9.5
Manganese	400
Nickel	16
Zinc	39

BG-S2-0.5/3.0	
Analyte	Concentration
Antimony	6.3
Arsenic	8.4
Chromium	17
Copper	2.3
Lead	11
Manganese	340
Nickel	16
Zinc	51

BG-S2-3.0/5.0	
Analyte	Concentration
Arsenic	12
Chromium	17
Copper	4
Lead	9.9
Manganese	314
Nickel	17
Zinc	45

BG-S9-3.0/5.0	
Analyte	Concentration
Chromium	15
Copper	17
Lead	15
Manganese	695
Nickel	30
Zinc	61

BG-S9-0.5/3.0	
Analyte	Concentration
Chromium	9.2
Lead	6.6
Manganese	133
Nickel	7.6
Zinc	24

BG-S3-0.5/3.0	
Analyte	Concentration
Arsenic	3.5
Chromium	6.2
Lead	5.3
Manganese	152
Nickel	9
Zinc	43

BG-S3-3.0/4.0	
Analyte	Concentration
Arsenic	15
Chromium	13
Copper	35
Lead	24
Manganese	154
Nickel	33
Zinc	187

BG-S4-0.5/3.0	
Analyte	Concentration
Antimony	7.6
Arsenic	17
Chromium	13
Copper	34
Lead	27
Manganese	24
Nickel	11
Zinc	13

BG-S5-0.5/3.0	
Analyte	Concentration
Antimony	6.7
Arsenic	17
Chromium	17
Copper	10
Lead	11
Manganese	220
Nickel	28
Zinc	54

BG-S5-3.0/5.0	
Analyte	Concentration
Antimony	5.9
Arsenic	6.1
Chromium	29
Copper	6.7
Lead	13
Manganese	330
Nickel	33
Zinc	64

BG-S7-0.5/3.0	
Analyte	Concentration
Antimony	7.5
Arsenic	14
Chromium	14
Copper	34
Lead	22
Manganese	63
Nickel	24
Zinc	32

BG-S6-0.5/3.0	
Analyte	Concentration
Antimony	6.4
Arsenic	23
Chromium	6
Copper	14
Lead	15
Manganese	78
Nickel	15
Zinc	56

BG-S6-3.0/4.5	
Analyte	Concentration
Arsenic	8.3
Chromium	9.1
Copper	7.5
Lead	11
Manganese	21
Nickel	20
Zinc	34

SCALE: 1" = 3000'

● BG-S7 Background Soil Boring

Concentrations are in mg/kg

FIGURE 5-6
METALS CONCENTRATION
IN BACKGROUND SOIL BORINGS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

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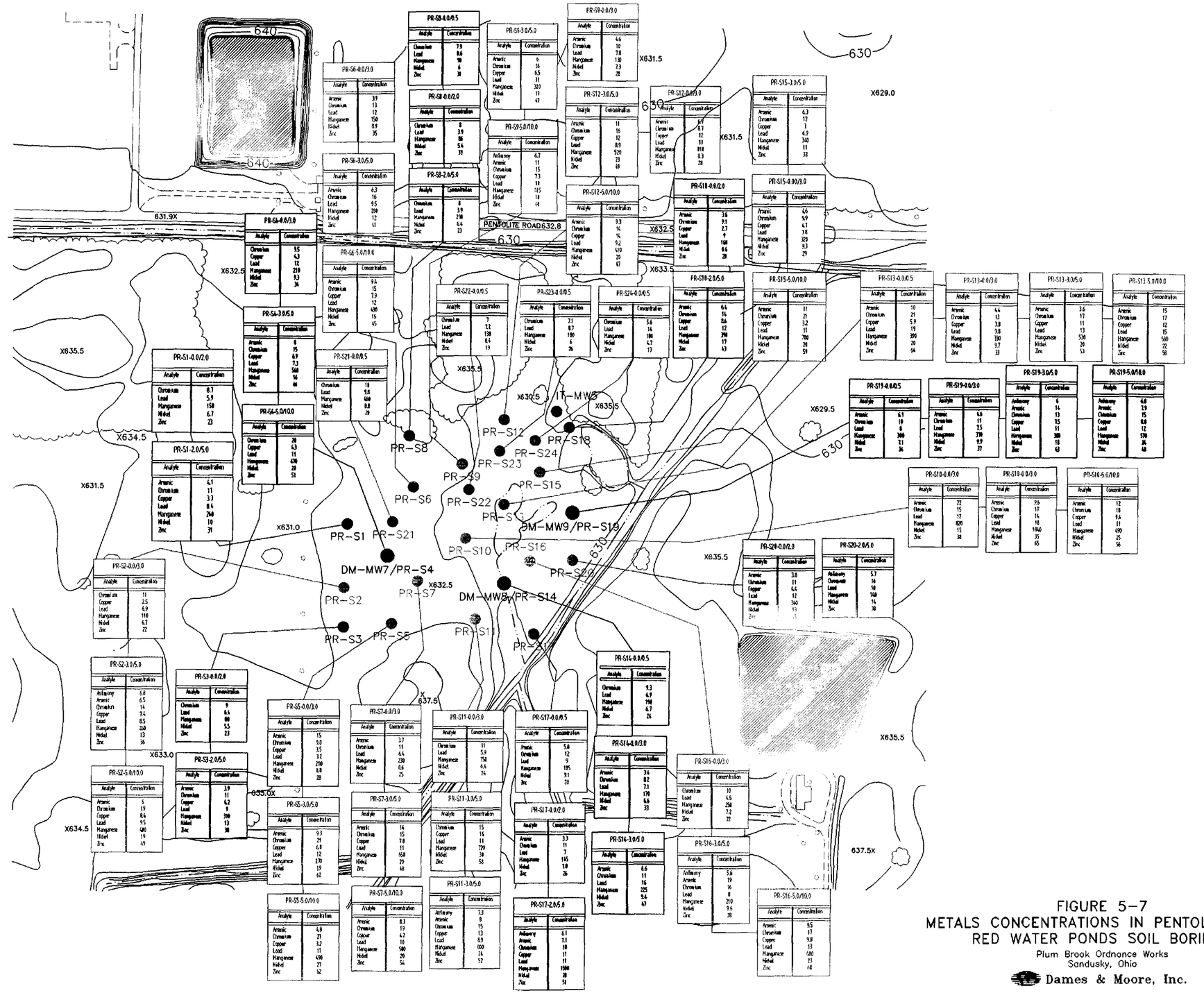

PR-S1 — 5-Foot Soil Boring Location

PR-S21 — Surface Soil Sampling Location

DM-MW7/PR-S4 — Groundwater Monitoring Well Location

PR-S2 — 10-Foot Soil Boring Location

Concentrations are in mg/kg

FIGURE 5-7
METALS CONCENTRATIONS IN PENTOLITE ROAD
RED WATER PONDS SOIL BORINGS

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

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TABLE 5-4

METALS CONCENTRATIONS IN BACKGROUND SOIL SAMPLES

Sample Location	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Ranson Road/Patrol Road (North)	BG-S1-0.5/3.0		6.8			11	3.6	8.5	270		13				41
	BG-S1-3.0/5.0		10			14	5.2	9.5	400		16				39
Ranson Road/ Pentolite Road	BG-S2-0.5/3.0	6.3	8.4			17	2.3	11	340		16				51
	BG-S2-3.0/5.0		12			17	4.0	9.9	314		17				45
Patrol Road (Northeast)	BG-S3-0.5/3.0		3.5			6.2		5.3	152		9.0				43
	BG-S3-3.0/4.0		15			13	35	24	154		33				187
Patrol Road South of Fox Road	BG-S4-0.5/3.0	7.6	17			13	34	27	24		11				13
Patrol Road/ Columbus Road	BG-S5-0.5/3.0	6.7	17			17	10	11	220		28				54
	BG-S5-3.0/5.0	5.9	6.1			29	6.7	13	330		33				64
Patrol Road/Taft Road	BG-S6-0.5/3.0	6.4	23			6.0	14	15	78		15				56
	BG-S6-3.0/4.5		8.3			9.1	7.5	11	21		20				34
Ranson Road/W. Scheid Road	BG-S7-0.5/3.0	7.5	14			14	34	22	63		24				32
QC Sample	BG-S8-0.5/3.0	6.4	19			10	27	23	8.7		9.4				10
Patrol Road (North)	BG-S9-0.5/3.0					9.2		6.6	133		7.6				24
	BG-S9-3.0/5.0					15	17	15	695		30				61

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., BG = Background Location); the soil boring number (e.g., S1 = background soil boring 1); and the depth interval over which the sample was collected (e.g., 0.5/3.0 = soils from 0.5 to 3.0 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

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QC sample BG-S8-0.5/3.0 is a split of sample BG-S4-0.5/3.0.

TABLE 5-5

METALS CONCENTRATIONS IN SOIL SAMPLES
PENTOLITE ROAD RED WATER PONDS

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
5-Foot Boring	PR-S1-0.0/2.0					8.7		5.9	150		6.7				23
	PR-S1-2.0/5.0		4.1			11	3.3	8.4	260		10				31
10-Foot Boring	PR-S2-0.0/3.0					11	2.5	6.9	110		6.7				22
	PR-S2-3.0/5.0	6.8	6.5			14	7.4	8.5	280		13				36
	PR-S2-5.0/10.0		6.0			19	8.4	9.5	400		19				49
5-Foot Boring	PR-S3-0.0/2.0					9.0		6.4	88		5.5				23
	PR-S3-2.0/5.0		3.9			11	6.2	9.0	310		13				38
10-Foot Borings	PR-S4-0.0/3.0					9.5	4.3	12	210		9.3				34
	PR-S4-3.0/5.0		8.0			15	6.9	7.3	560		16				46
	PR-S4-5.0/10.0					20	6.3	11	470		20				51
	PR-S5-0.0/3.0		15			9.8	3.5	7.2	200		8.8				28
	PR-S5-3.0/5.0		9.3			21	6.8	12	270		19				62
	PR-S5-5.0/10.0		4.8			27	3.2	11	490		27				62
	PR-S6-0.0/3.0		3.9			13		12	150		8.9				35
	PR-S6-3.0/5.0		6.3			16		9.5	280		12				41
	PR-S6-5.0/10.0		9.4			15	7.9	12	490		16				45
	PR-S7-0.0/3.0		3.7			11		6.4	230		8.6				25

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

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TABLE 5-5
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
10-Foot Borings	PR-S7-3.0/5.0		14			15	7.8	11	650		20				48
(Continued)	PR-S7-5.0/10.0		8.3			19	4.2	10	500		20				54
5-Foot Boring	PR-S8-0.0/0.5					7.9		8.6	90		6.0				31
	PR-S8-0.0/2.0					8.0		3.9	86		5.4				33
	PR-S8-2.0/5.0					8.0		3.9	230		6.4				23
10-Foot Borings	PR-S9-0.0/3.0		4.6			10		7.8	130		7.3				28
	PR-S9-3.0/5.0		6.0			16	6.5	11	320		17				47
	PR-S9-5.0/10.0	6.7	11			15	7.3	10	415		18				48
	PR-S10-0.0/3.0		22			15		12	820		15				38
	PR-S10-3.0/5.0		9.6			17	14	18	1,040		35				65
	PR-S10-5.0/10.0		12			18	9.4	11	490		25				56
	PR-S11-0.0/3.0					11		5.9	150		6.4				24
	PR-S11-3.0/5.0	7.3	8.0			15	13	8.9	800		24				52
	PR-S11-5.0/10.0					15	16	11	720		30				58
	PR-S12-0.0/3.0		6.7			8.7	12	18	810		8.3				28
	PR-S12-3.0/5.0		11			16	12	8.9	520		23				49
	PR-S12-5.0/10.0		9.3			14	14	9.2	410		20				47
	PR-S13-0.0/0.5		10			21	5.9	19	390		20				64

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample PR-S10-5.0/10.0 is a split of QC sample PR-S26-5.0/10.0.
Sample PR-S11-5.0/10.0 is a split of QC sample PR-S25-5.0/10.0.
Sample PR-S12-5.0/10.0 is a split of QC sample PR-S27-5.0/10.0.

TABLE 5-5
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
10-Foot Borings	PR-S13-0.0/3.0		4.4			13	3.8	9.8	330		9.7				33
(Continued)	PR-S13-3.0/5.0		3.6			17	11	13	530		20				53
	PR-S13-5.0/10.0		15			17	12	15	580		22				58
	PR-S14-0.0/0.5					9.3		6.9	190		6.7				24
	PR-S14-0.0/3.0		3.4			8.2		7.1	170		6.6				33
	PR-S14-3.0/5.0		6.6			11		16	225		9.4				47
	PR-S14-5.0/10.0		4.3			15	7.0	11	260		21				85
	PR-S15-0.0/3.0		4.6			9.9	4.1	7.8	320		9.3				29
	PR-S15-3.0/5.0		6.3			12	3.0	6.9	340		11				33
	PR-S15-5.0/10.0		11			21	3.2	11	780		20				59
	PR-S16-0.0/3.0					10		4.6	250		7.2				22
	PR-S16-3.0/5.0	5.6	19			16		8.0	210		9.6				28
	PR-S16-5.0/10.0		9.5			17	9.8	13	480		23				60
2-Foot Borings	PR-S17-0.0/0.5		5.8			12		9.0	185		9.1				28
	PR-S17-0.0/2.0		3.3			11		7.0	165		7.8				26
	PR-S17-2.0/5.0	6.1	7.1			18	11	11	1,500		28				51
	PR-S18-0.0/2.0		3.6			9.1	2.7	9.0	160		8.6				28
	PR-S18-2.0/5.0		6.4			14	8.6	12	390		17				43

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample PR-S14-5.0/10.0 is a split of QC sample PR-S28-5.0/10.0.
Sample PR-S18-2.0/5.0 is a split of QC sample PR-S29-2.0/5.0.

TABLE 5-5
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
10-Foot Boring	PR-S19-0.0/0.5		6.1			10		8.0	300		7.1				24
	PR-S19-0.0/3.0		4.6			11		7.5	370		9.9				37
	PR-S19-3.0/5.0	6.0	14			13	7.5	11	380		18				43
	PR-S19-5.0/10.0	6.8	7.9			15	8.8	12	570		24				48
5-Foot Boring	PR-S20-0.0/2.0		3.8			11	4.4	12	340		13				35
	PR-S20-2.0/5.0	5.7				16		10	140		14				38
Surface Soil Samples	PR-S21-0.0/0.5					10		9.8	460		8.8				20
	PR-S22-0.0/0.5					7.0		7.2	130		8.4				19
	PR-S23-0.0/0.5					7.1		8.7	180		6.0				26
	PR-S24-0.0/0.5					5.6		14	180		4.7				17
QC Samples	PR-S25-5.0/10.0		9.8			15	13	13	1,100		40				52
	PR-S26-5.0/10.0	6.7	13			19	7.7	10	420		29				62
	PR-S27-5.0/10.0		12			16	11	12	530		26				59
	PR-S28-5.0/10.0		5.6			20	3.6	9.5	570		20				54
	PR-S29-2.0/5.0		6.2			13	13	10	380		15				44
	PR-S30-0.0/0.5					8.3		8.5	150		5.9				24

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., PR = Pentolite Road Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the Pentolite Road Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (Column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

QC sample PR-S25-5.0/10.0 is a split of PR-S11-5.0/10.0.
QC sample PR-S26-5.0/10.0 is a split of PR-S10-5.0/10.0.
QC sample PR-S27-5.0/10.0 is a split of PR-S12-5.0/10.0.
QC sample PR-S28-5.0/10.0 is a split of PR-S14-5.0/10.0.
QC sample PR-S29-2.0/5.0 is a split of PR-S18-2.0/5.0.
QC sample PR-S30-0.0/0.5 is a split of PR-S23-0.0/0.5.

TABLE 5-6

METALS CONCENTRATIONS IN SOIL SAMPLES
WEST AREA RED WATER PONDS

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Surface Soil Samples	WA-S1-0.0/0.5		6.0			23		16	366		23				73
	WA-S2-0.0/0.5		5.7			10.8	7.6	10.0	329		20				52
	WA-S3-0.0/0.5		6.5			16	11.3	16	841		29				78
	WA-S4-0.0/0.5					12	2.4	12	350		15				49
5-Foot Borings Around West Pond Perimeter	WA-S5-0.0/2.0		4.7			35		19	1,012		35				91
	WA-S5-2.0/5.0		4.8			17	7.1	11.7	305		26				62
	WA-S6-0.0/2.0					16	3.3	15	268		21				66
	WA-S6-2.0/5.0		5.6			12.7	7.8	11.5	282		22				56
	WA-S7-0.0/2.0		4.4			14	3.6	16	300		16				64
	WA-S7-2.0/5.0		5.1			16	14	20	1,011		31				60
	WA-S8-0.0/2.0		4.5			14		13	702		17				57
	WA-S8-2.0/5.0		5.3		1.4	13	2.4	7.4	621		16				34
	WA-S9-0.0/2.0		6.2			30	2.6	7.8	163		10.3				33
	WA-S9-2.0/5.0		3.9			23		7.9	156		9.4				34
Monitoring Well MW-2	WA-S10-3.0/5.0		5.8			26	3.4	10.0	455		23				60
	WA-S10-5.0/10.0		14			25		10.9	392		25				68

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., WA = West Area Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the West Area Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample WA-S5-0.0/2.0 is a split of QC sample WA-S21-0.0/2.0.
Sample WA-S8-2.0/5.0 is a split of QC sample WA-S22-2.0/5.0.

TABLE 5-6
(Continued)

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
5-Foot Borings Around East Pond Perimeter	WA-S11-0.0/2.0		5.1			16	6.8	18	466		27				76
	WA-S11-2.0/5.0		4.3			10.6	6.4	13	267		19				51
	WA-S12-0.0/2.0		4.8			15		10.6	216		16				41
	WA-S12-2.0/5.0		7.2			29	3.5	16	373		29				58
10-Foot Boring in East Pond	WA-S13-0.0/0.5		6.4			14	3.2	17	200		17				57
	WA-S13-0.0/3.0					16	7.4	15	184		20				55
	WA-S13-3.0/5.0					11	8.8	11.1	220		22				54
	WA-S13-5.0/10.0					23	12	18	434		35				59
5-Foot Borings Around Perimeter of East Pond	WA-S14-0.0/2.0		5.6			9.2	5.1	10.3	398		17				45
	WA-S14-2.0/5.0		5.5			9.9	7.4	8.4	198		19				46
	WA-S15-0.0/2.0		6.1			16	7.1	17	433		21				64
	WA-S15-2.0/5.0		4.8			13	7.1	12	413		23				62
5-Foot Boring West Pond Perimeter	WA-S16-0.0/2.0		4.4			21	2.8	8.4	165		10.1				32
	WA-S16-2.0/4.0		6.9			19	5.3	8.9	185		9.5				33
10-Foot Borings in East Pond	WA-S17-0.0/0.5	7.4	8.5			19	3.7	22	270		18				69
	WA-S17-0.0/3.0					17	8.5	23	1,023		31				80
	WA-S17-3.0/5.0		8.5			16	8.2	16	398		22				64

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., WA = West Area Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the West Area Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

TABLE 5-6
(Continued)

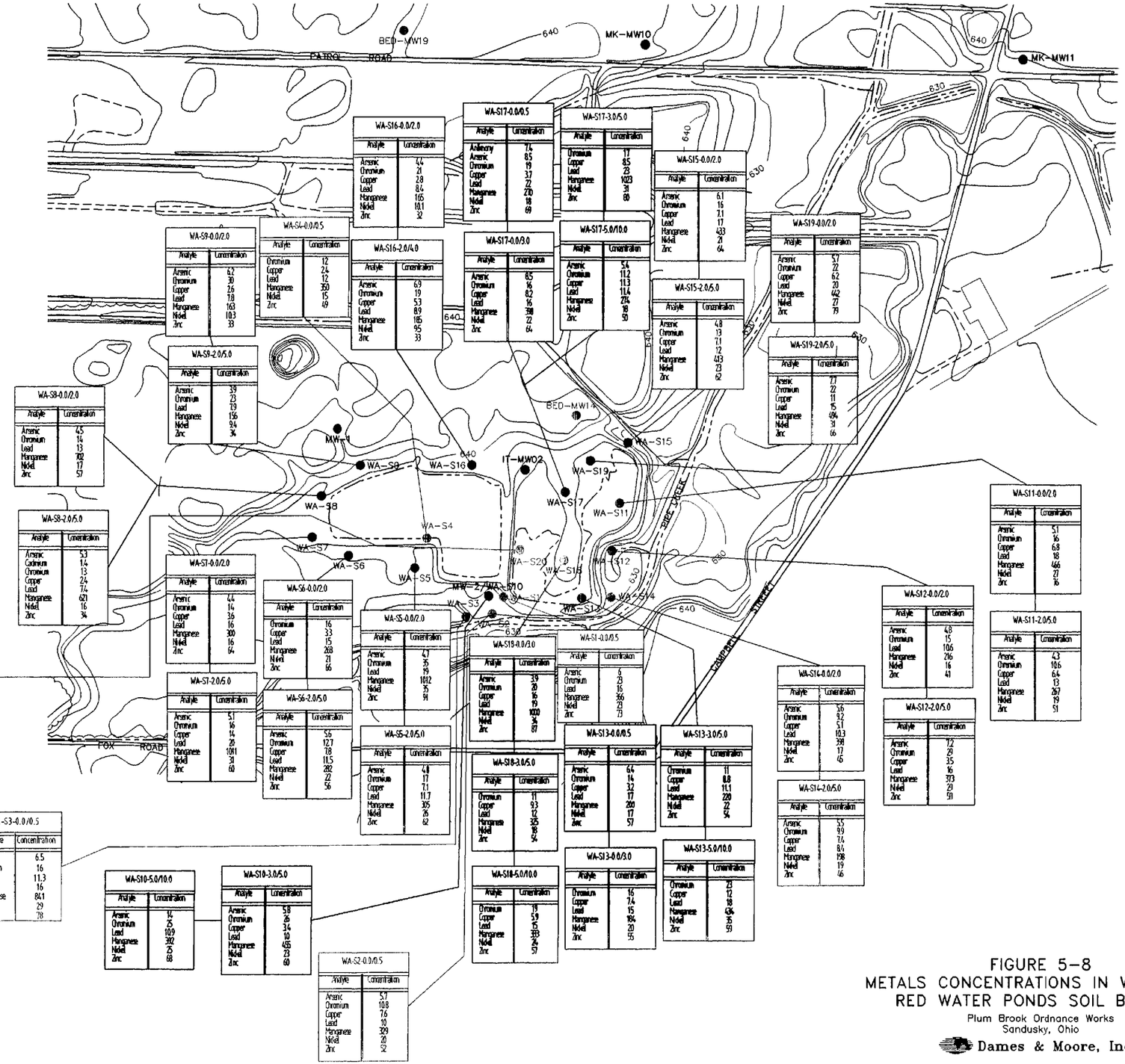
	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
10-Foot Borings in East Pond (Continued)	WA-S17-5.0/10.0		5.4			11.2	11.3	11.4	274		18				50
	WA-S18-0.0/3.0		3.9			20	16	19	1,000		34				87
	WA-S18-3.0/5.0					11.0	9.3	12	325		18				54
	WA-S18-5.0/10.0					19	5.9	15	333		24				57
5-Foot Boring in East Pond	WA-S19-0.0/2.0		5.7			22	6.2	20	442		27				79
	WA-S19-2.0/5.0		7.7			22	11	15	494		31				66
Surface Soil Sample	WA-S20-0.0/0.5		4.6			16	2.9	12	190		16				45
QC Samples	WA-S21-0.0/2.0		5.2			16	6.0	15	695		29				72
	WA-S22-2.0/5.0		5.0		1.6	12	14	8.5	3,300		52				37
	WA-S23-0.0/0.5		5.0			18	3.1	13	290		18				51
	WA-S24-5.0/10.0					11.2	5.3	11.0	198		15				43

Concentrations are listed in mg/Kg or ppm.

The sample IDs used in this table are composed of three parts. The investigation area (e.g., WA = West Area Red Water Ponds); the soil boring number (e.g., S1 = soil boring 1 in the West Area Red Water Ponds); and the depth interval over which the sample was collected (e.g., 0.0/1.5 = soils from 0.0 to 1.5 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

Sample WA-S17-5.0/10.0 is a split of QC sample WA-S24-5.0/10.0.
QC sample WA-S21-0.0/2.0 is a split of WA-S5-0.0/2.0.
QC sample WA-S22-2.0/5.0 is a split of WA-S8-2.0/5.0.
QC sample WA-S23-0.0/0.5 is a split o WA-S20-0.0/0.5.
QC sample WA-S24-5.0/10.0 is a split of WA-S17-5.0/10.0.



Scale: 1" = 350'

WA-S16-0.0/2.0	
Analyte	Concentration
Arsenic	4.4
Chromium	21
Copper	2.8
Lead	8.4
Manganese	165
Nickel	10.1
Zinc	32

WA-S17-0.0/0.5	
Analyte	Concentration
Antimony	7.4
Arsenic	8.5
Chromium	19
Copper	3.7
Lead	22
Manganese	270
Nickel	18
Zinc	69

WA-S17-3.0/5.0	
Analyte	Concentration
Chromium	17
Copper	8.5
Lead	23
Manganese	1023
Nickel	31
Zinc	80

WA-S15-0.0/2.0	
Analyte	Concentration
Arsenic	6.1
Chromium	16
Copper	7.1
Lead	17
Manganese	433
Nickel	21
Zinc	64

WA-S19-0.0/2.0	
Analyte	Concentration
Arsenic	5.7
Chromium	22
Copper	6.2
Lead	20
Manganese	492
Nickel	27
Zinc	79

WA-S9-0.0/2.0	
Analyte	Concentration
Arsenic	4.2
Chromium	30
Copper	2.6
Lead	7.8
Manganese	163
Nickel	10.3
Zinc	33

WA-S4-0.0/0.5	
Analyte	Concentration
Chromium	12
Copper	2.4
Lead	12
Manganese	350
Nickel	15
Zinc	49

WA-S16-2.0/4.0	
Analyte	Concentration
Arsenic	6.9
Chromium	19
Copper	5.3
Lead	8.9
Manganese	185
Nickel	95
Zinc	33

WA-S17-0.0/3.0	
Analyte	Concentration
Arsenic	8.5
Chromium	16
Copper	8.2
Lead	16
Manganese	398
Nickel	22
Zinc	64

WA-S17-5.0/10.0	
Analyte	Concentration
Arsenic	5.4
Chromium	11.2
Copper	11.3
Lead	11.4
Manganese	274
Nickel	18
Zinc	50

WA-S15-2.0/5.0	
Analyte	Concentration
Arsenic	4.8
Chromium	13
Copper	7.1
Lead	12
Manganese	413
Nickel	23
Zinc	62

WA-S19-2.0/5.0	
Analyte	Concentration
Arsenic	7.7
Chromium	22
Copper	11
Lead	15
Manganese	494
Nickel	31
Zinc	66

WA-S9-2.0/5.0	
Analyte	Concentration
Arsenic	3.9
Chromium	23
Lead	7.9
Manganese	156
Nickel	9.4
Zinc	34

WA-S8-0.0/2.0	
Analyte	Concentration
Arsenic	4.5
Chromium	14
Lead	13
Manganese	702
Nickel	17
Zinc	57

WA-S8-2.0/5.0	
Analyte	Concentration
Arsenic	5.3
Cadmium	1.4
Chromium	13
Copper	2.4
Lead	7.4
Manganese	621
Nickel	16
Zinc	34

WA-S7-0.0/2.0	
Analyte	Concentration
Arsenic	4.4
Chromium	14
Copper	3.6
Lead	16
Manganese	300
Nickel	16
Zinc	64

WA-S6-0.0/2.0	
Analyte	Concentration
Chromium	16
Copper	3.3
Lead	15
Manganese	268
Nickel	21
Zinc	66

WA-S5-0.0/2.0	
Analyte	Concentration
Arsenic	4.7
Chromium	35
Lead	19
Manganese	1812
Nickel	35
Zinc	91

WA-S19-0.0/3.0	
Analyte	Concentration
Arsenic	3.9
Chromium	20
Copper	16
Lead	19
Manganese	1000
Nickel	34
Zinc	87

WA-S1-0.0/0.5	
Analyte	Concentration
Arsenic	6
Chromium	23
Lead	16
Manganese	366
Nickel	23
Zinc	73

WA-S11-0.0/2.0	
Analyte	Concentration
Arsenic	5.1
Chromium	16
Copper	6.8
Lead	18
Manganese	466
Nickel	27
Zinc	76

WA-S11-2.0/5.0	
Analyte	Concentration
Arsenic	4.3
Chromium	10.6
Copper	6.4
Lead	13
Manganese	267
Nickel	19
Zinc	51

WA-S12-0.0/2.0	
Analyte	Concentration
Arsenic	4.8
Chromium	15
Lead	10.6
Manganese	216
Nickel	16
Zinc	41

WA-S12-2.0/5.0	
Analyte	Concentration
Arsenic	7.2
Chromium	29
Copper	3.5
Lead	16
Manganese	373
Nickel	29
Zinc	51

WA-S14-0.0/2.0	
Analyte	Concentration
Arsenic	3.6
Chromium	9.2
Copper	5.1
Lead	10.3
Manganese	398
Nickel	17
Zinc	46

WA-S14-2.0/5.0	
Analyte	Concentration
Arsenic	5.5
Chromium	39
Copper	7.4
Lead	8.4
Manganese	198
Nickel	19
Zinc	46

WA-S13-3.0/5.0	
Analyte	Concentration
Chromium	11
Copper	8.8
Lead	11.1
Manganese	220
Nickel	22
Zinc	54

WA-S13-5.0/10.0	
Analyte	Concentration
Chromium	23
Copper	12
Lead	18
Manganese	434
Nickel	35
Zinc	59

WA-S13-0.0/0.5	
Analyte	Concentration
Arsenic	6.4
Chromium	14
Copper	3.2
Lead	17
Manganese	200
Nickel	17
Zinc	57

WA-S13-0.0/3.0	
Analyte	Concentration
Chromium	16
Copper	7.4
Lead	15
Manganese	194
Nickel	20
Zinc	55

WA-S18-3.0/5.0	
Analyte	Concentration
Chromium	11
Copper	9.3
Lead	12
Manganese	325
Nickel	18
Zinc	54

WA-S18-5.0/10.0	
Analyte	Concentration
Chromium	19
Copper	5.9
Lead	15
Manganese	333
Nickel	24
Zinc	57

WA-S5-2.0/5.0	
Analyte	Concentration
Arsenic	4.8
Chromium	17
Copper	7.1
Lead	11.7
Manganese	305
Nickel	26
Zinc	62

WA-S6-2.0/5.0	
Analyte	Concentration
Arsenic	5.6
Chromium	12.7
Copper	7.8
Lead	11.5
Manganese	292
Nickel	22
Zinc	56

WA-S7-2.0/5.0	
Analyte	Concentration
Arsenic	5.1
Chromium	16
Copper	14
Lead	20
Manganese	1011
Nickel	31
Zinc	60

WA-S20-0.0/0.5	
Analyte	Concentration
Arsenic	4.6
Chromium	16
Copper	2.9
Lead	12
Manganese	190
Nickel	16
Zinc	45

WA-S3-0.0/0.5	
Analyte	Concentration
Arsenic	6.5
Chromium	16
Copper	11.3
Lead	16
Manganese	841
Nickel	29
Zinc	78

WA-S10-5.0/10.0	
Analyte	Concentration
Arsenic	14
Chromium	25
Lead	10.9
Manganese	392
Nickel	25
Zinc	68

WA-S10-3.0/5.0	
Analyte	Concentration
Arsenic	5.8
Chromium	26
Copper	3.4
Lead	10
Manganese	435
Nickel	23
Zinc	60

WA-S2-0.0/0.5	
Analyte	Concentration
Arsenic	5.7
Chromium	10.8
Copper	7.6
Lead	10
Manganese	329
Nickel	20
Zinc	52

WA-S20 — Surface Soil Sample

BED-MW14 — Bedrock Groundwater Monitoring Well

MW-1 — Overburden Groundwater Monitoring Well

WA-S8 — 5 Foot Soil Boring

WA-S18 — 10 Foot Soil Boring

Concentrations are in mg/Kg

FIGURE 5-8
METALS CONCENTRATIONS IN WEST AREA
RED WATER PONDS SOIL BORINGS

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Sandusky, Ohio

Dames & Moore, Inc.

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values available for calculations, concentrations reported as "less than the detection limit" were made equal to one half of the detection limit value. Split sample results were averaged to avoid bias in the statistical analysis. Following these data preparation steps, descriptive statistics for each metal were calculated in background and potentially impacted categories. The descriptive statistics for background soils and for soils in the red water ponds areas are provided on Table 5-7.

Beryllium, mercury, selenium, silver, and thallium were not detected in any of the samples. Concentrations of the other nine metals are discussed below.

5.4.1.1 Antimony

Antimony was detected in six of the 14 background soil samples. Concentrations in samples where antimony was detected ranged from 5.9 mg/Kg to 7.6 mg/Kg. The common range of antimony in soils is 2 mg/Kg to 10 mg/Kg (Shields, 1985). All background antimony concentrations are within this range.

Antimony was detected in nine soil samples in the red water ponds areas. Concentrations in the eight samples containing antimony at the Pentolite Road Red Water Ponds ranged from 5.6 mg/Kg to 7.3 mg/Kg. At the West Area Red Water Ponds, antimony was detected in only one surface soil sample inside the east pond at a concentration of 7.4 mg/Kg. All of these antimony concentrations are within the range for soils in the United States.

Antimony concentrations in soils in the two red water ponds areas are consistent with the median and average antimony concentrations in the background soils.

5.4.1.2 Arsenic

Arsenic was detected in 12 of the 14 background soil samples. Concentrations in samples where arsenic was detected ranged from 3.5 mg/Kg to 23 mg/Kg. The

common range of arsenic in soils is from 1 mg/Kg to 50 mg/Kg, with an average of 5 mg/Kg (Shields, 1985). All background arsenic concentrations are within this range.

Arsenic was detected in 32 of the 40 soil samples from the West Area Red Water Ponds and in 47 of 63 samples from the Pentolite Road Red Water Ponds, or about 75 percent of the samples from each red water ponds area. Concentrations in the Pentolite Road Red Water Ponds samples ranged from 3.3 mg/Kg to 22 mg/Kg. At the West Area Red Water Ponds, concentrations ranged from 3.9 mg/Kg to 8.5 mg/Kg. All of these arsenic concentrations are within the range for soils in the United States.

Arsenic concentrations in soils in the two red water pond areas are somewhat lower than the median and average values in the background soils.

5.4.1.3 Cadmium

Cadmium was not detected in any of the background area samples or any samples from the Pentolite Road Red Water Ponds. However, an average concentration of 1.5 mg/Kg was detected in the two split samples collected from sample WA-S8-2.0/5.0. The common range for cadmium in soils is 0.01 to 0.7 mg/Kg, with an average of 0.06 mg/Kg (Shields, 1985). This cadmium concentration in one sample from the West Area Red Water Ponds is higher than the average concentrations observed in soils in the United States.

5.4.1.4 Chromium

Chromium was detected in all of the background soil samples. Concentrations ranged from 6 mg/Kg to 29 mg/Kg. The common range for chromium in soils is 1 mg/Kg to 1,000 mg/Kg, with an average of 100 mg/Kg (Shields, 1985). Chromium concentrations in the background soils are within this range.

As with the background soil samples, chromium was detected in all of the soil samples collected from the two red water ponds areas. Chromium concentrations in the

Pentolite Road Red Water Ponds ranged from 5.6 mg/Kg to 27 mg/Kg. Concentrations at the West Area Red Water Ponds ranged from 9.2 mg/Kg to 30 mg/Kg. All of these concentrations are within the common range for U.S. soils.

Chromium concentrations in soils in the two red water pond areas are consistent with the median and average chromium concentrations in the background soils.

5.4.1.5 Copper

Copper was detected in 12 of the 14 background soil samples. Concentrations in samples where copper was detected ranged from 2.3 mg/Kg to 35 mg/Kg. The common range of copper in soils is 2 mg/Kg to 100 mg/Kg, with an average of 30 mg/Kg (Shields, 1985). Copper concentrations in background soils are within this range.

Copper was detected in about 60 percent of the samples collected (38 of 63) from the Pentolite Road Red Water Ponds and from almost 90 percent (35 of 40) of the samples collected from the West Area Red Water Ponds. In the Pentolite Road Red Water Ponds, concentrations in samples where copper was detected ranged from 2.5 mg/Kg to 16 mg/Kg. Concentrations at the West Area Red Water Ponds ranged from 2.4 mg/Kg to 11.3 mg/Kg. Copper concentrations are all within the common range for U.S. soils.

Copper concentrations in soils in the two red water pond areas are somewhat lower than the median and average values in the background soils.

5.4.1.6 Lead

Lead was detected in all of the background soil samples. Concentrations ranged from 5.3 mg/Kg to 27 mg/Kg. The common range of lead in soils is 2 mg/Kg to 200 mg/Kg, with an average of 10 mg/Kg (Shields, 1985). Lead concentrations are within this range in background soils.

Lead was detected in all of the soil samples collected from the two red water ponds areas. Concentrations in the Pentolite Road Red Water Ponds ranged from 3.9 mg/Kg to 19 mg/Kg. Concentrations at the West Area Red Water Ponds ranged from 7.8 mg/Kg to 23 mg/Kg. All of these concentrations are within the common range for U.S. soils.

Lead concentrations in soils in the two red water pond areas are consistent with the median and average lead concentrations in the background soils.

5.4.1.7 Manganese

Manganese was also detected in all of the background soil samples. Concentrations ranged from 8.7 mg/Kg to 695 mg/Kg. The common range of manganese in soils is 20 mg/Kg to 3,000 mg/Kg with an average of 600 mg/Kg (Shields, 1985). All manganese concentrations are within this range.

Manganese was also detected in all of the soil samples collected from the two red water ponds areas. At the Pentolite Road Red Water Ponds concentrations ranged from 86 mg/Kg to 1,500 mg/Kg. Concentrations at the West Area Red Water Ponds ranged from 156 mg/Kg to 1960.5 mg/Kg (average of two split samples). Many of the manganese levels were above the common range for U.S. soils, particularly at the West Area Red Water Ponds.

The median and average manganese concentrations in the red water ponds areas are significantly above background levels.

5.4.1.8 Nickel

Nickel was detected in all background soil samples. Concentrations ranged from 7.6 mg/Kg to 33 mg/Kg. The common range of nickel in soils is 5 mg/Kg to 500 mg/Kg with an average of 40 mg/Kg (Shields, 1985). All nickel concentrations are within this range.

Nickel was present in all of the soil samples collected from the two red water ponds areas. At the Pentolite Road Red Water Ponds concentrations ranged from 4.7 mg/Kg to 35 mg/Kg. Concentrations at the West Area Red Water Ponds ranged from 9.4 mg/Kg to 35 mg/Kg (average of two split samples). All of the nickel concentrations were within the common range for U.S. soils.

Nickel concentrations in soils in the two red water pond areas are consistent with the median and average nickel concentrations in the background soils.

5.4.1.9 Zinc

Zinc was detected in all of the background soil samples. Concentrations ranged from 10 mg/Kg to 187 mg/Kg. The common range of zinc in soils is 10 mg/Kg to 300 mg/Kg with an average of 50 mg/Kg (Shields, 1985). All zinc concentrations are within this range.

Zinc was also detected in all of the soil samples collected from the two red water ponds areas. At the Pentolite Road Red Water Ponds concentrations ranged from 17 mg/Kg to 69.5 mg/Kg (average for two split samples). Concentrations at the West Area Red Water Ponds ranged from 32 mg/Kg to 87 mg/Kg. All of the zinc concentrations are within the common range for U.S. soils.

Zinc concentrations in soils in the two red water pond areas are consistent with the median and average zinc concentrations in the background soils.

5.4.2 Statistical Analysis of Metals in Soils

In order to evaluate the likelihood of metal contamination, the relative frequency of values greater than the maximum background concentration and greater than the maximum detection limit was determined in both of the Red Water Pond areas. Frequencies greater than 10 percent were regarded as indicating potential contamination and were correlated with detections of explosives residues.

Using data for metals suspected of being contaminants, correlation coefficients were calculated for metal and explosive concentrations in each area. Correlation coefficients were calculated only for the areas where potential contamination was observed, and all explosives data were used. The Type I error level for the coefficients (referred to as "p") was set at 0.005; a Type I error occurs when a correlation is considered significant when it actually is not. The error level was set low because 134 correlation coefficients were determined for the Plum Brook site, and spurious findings of significance would be likely at higher error levels. Scatter plots were viewed to better understand relationships between metals and explosives concentrations. Also, coincidences of high metals and explosives concentrations were evaluated by comparing results tabulated by sampling location.

There was no beryllium, mercury, selenium, silver, or thallium detected in any red water pond soil sample (Table 5-7), and cadmium was detected only once. None of these metals were considered to be potential contaminants. Of the metals that were detected frequently, only manganese had concentrations in red water pond area soils that were clearly above the background levels (Table 5-7).

Potential contamination was investigated for each area using the percent occurrence of values greater than both the maximum background concentration and the maximum detection limit. Manganese concentrations exceeded the maxima with greater than 10 percent frequency in both areas; no other metal exceeded the 10 percent frequency in either area (Table 5-8). Therefore, only manganese was considered to be a potential contaminant for the red water pond soils.

Correlations between metals and explosives concentrations were studied as indications that potential metals contamination was related to the TNT manufacturing process. In other words, if explosives levels were related to metals values in areas were metal contamination was suspected, then soil contamination with metals was corroborated. Also, significant relationships may be useful for predicting explosives concentrations from metals levels (metals analyses are easier and cheaper). Significant ($p = 0.005$) correlations were not seen for any metals in the red water pond areas.

TABLE 5-7

DESCRIPTIVE STATISTICS FOR SOIL METALS

Analyte	Category	Frequency of Detection (%)	Total No. Obs.	Min	Median	Average	Standard Deviation	Max DL*	75th %ile	95th %ile	Max	Units
Antimony	BACKGROUND	42.86	14	2.7	2.975	4.45714	1.98870	6.10000	6.4	7.5	7.5	mg/kg
	RED WATER PONDS	8.74	103	2.6	3.000	3.26464	1.04324	8.66667	3.1	6.1	7.4	mg/kg
Arsenic	BACKGROUND	85.71	14	1.65	9.2	10.4000	6.40946	3.70	15.0	23	23	mg/kg
	RED WATER PONDS	74.76	103	1.55	5.1	5.8197	3.89512	11.65	7.1	14	22	mg/kg
Beryllium	BACKGROUND		14	0.55	0.55	0.56429	0.023440	1.2	0.6	0.60	0.6	mg/kg
	RED WATER PONDS		103	0.50	0.60	0.58430	0.036142	1.4	0.6	0.65	0.7	mg/kg
Cadmium	BACKGROUND		14	0.55	0.55	0.56429	0.023440	1.2	0.6	0.60	0.6	mg/kg
	RED WATER PONDS	0.97	103	0.50	0.60	0.59353	0.097105	1.4	0.6	0.65	1.5	mg/kg
Chromium	BACKGROUND	100.0	14	6.0	13.5	13.5000	5.80212		17	29	29	mg/kg
	RED WATER PONDS	100.0	103	5.6	15.0	14.8654	5.08641		17	25	30	mg/kg
Copper	BACKGROUND	85.71	14	1.10	7.1	12.2857	12.2410	2.20	17.0	35.0	35	mg/kg
	RED WATER PONDS	69.90	103	1.05	4.3	5.3850	3.9681	7.25	7.9	12.5	16	mg/kg
Lead	BACKGROUND	100.0	14	5.3	11	13.3429	6.24324		15	25	25	mg/kg
	RED WATER PONDS	100.0	103	3.9	11	11.3958	3.99665		13	19	23	mg/kg
Manganese	BACKGROUND	100.0	14	16.53	187	227.596	183.448		330	695	695.0	mg/kg
	RED WATER PONDS	100.0	103	86.00	330	404.298	294.797		470	1000	1960.5	mg/kg

* = Detection Limit

TABLE 5-7
(Continued)

Analyte	Category	Frequency of Detection (%)	Total No. Obs.	Min	Median	Average	Standard Deviation	Max DL*	75th %ile	95th %ile	Max	Units
Mercury	BACKGROUND		14	0.135	0.1400	0.14179	.0050410	0.30	0.1450	0.15	0.15	mg/kg
	RED WATER PONDS		103	0.130	0.1475	0.14674	.0088247	0.36	0.1525	0.16	0.18	mg/kg
Nickel	BACKGROUND	100.00	14	7.6	16.5	19.4143	8.76618		28	33	33	mg/kg
	RED WATER PONDS	100.00	103	4.7	17.0	17.1921	8.20062		23	32	35	mg/kg
Selenium	BACKGROUND		14	2.15	2.250	2.26786	0.09325	4.9	2.35	2.45	2.45	mg/kg
	RED WATER PONDS		103	2.05	2.375	2.35194	0.14283	5.8	2.45	2.55	2.90	mg/kg
Silver	BACKGROUND		14	0.55	0.55	0.56429	0.023440	1.2	0.6	0.60	0.6	mg/kg
	RED WATER PONDS		103	0.50	0.60	0.58430	0.036142	1.4	0.6	0.65	0.7	mg/kg
Thallium	BACKGROUND		14	2.7	2.850	2.84643	0.10278	6.1	2.900	3.05	3.05	mg/kg
	RED WATER PONDS		103	2.6	2.975	2.94490	0.17765	7.2	3.075	3.20	3.60	mg/kg
Zinc	BACKGROUND	100.0	14	11.5	44	53.0357	41.1603		56	187	187	mg/kg
	RED WATER PONDS	100.0	103	17.0	48	46.5291	16.5726		59	76	87	mg/kg

* = Detection Limit

TABLE 5-8

PERCENT OCCURRENCE OF SOIL METALS CONCENTRATIONS EXCEEDING BOTH THE MAXIMUM BACKGROUND LEVEL AND THE MAXIMUM DETECTION LIMIT BY SAMPLING AREA

	AREA		
Metal	Pentolite Road Red Water Ponds	West Area Red Water Ponds	Overall
Chromium	0	2.5	1.0
Manganese	11.1*	17.5*	13.6
Nickel	3.2	7.5	4.9

* Occurrences > 10% are considered to indicate potential contamination in the area relative to background.

Antimony, arsenic, beryllium, cadmium, copper, lead, selenium, silver, thallium, and zinc did not have any values greater than both the maximum background level and the maximum detection limit.

Coincidences of high manganese and explosives concentrations were evaluated by comparing manganese data tabulated by sampling location with explosives data similarly presented. Elevated manganese and explosives residues were coincident at two locations in West Area red Water Ponds. There was no coincidence at the Pentolite Road Red Water Ponds.

5.4.3 Summary of Metals in Soils

In the background soils eight metals, antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc, were detected. These eight metals, plus cadmium, were detected in the soils from the red water ponds areas. Cadmium was detected only once at the West Area Red Water Ponds. Chromium. lead, manganese, nickel, and zinc were each detected in all of the background and red water ponds areas soil samples.

Although not usually coincident with elevated explosives concentrations, manganese levels were obviously above background.

5.5 BIOLOGICAL ACTIVITY ANALYSIS

Three soil samples, two from the Pentolite Road Red Water Ponds and one from the West Area Red Water Ponds, were collected for analysis of biological activity. Soils were collected from 3 to 10 feet from boring PR-S7 and -S13 at the Pentolite Road Red Water Ponds and from 3 to 5 feet in boring WA-S17 at the West Area Red Water Ponds. Samples were analyzed by BioRenewal Technologies, Inc. for suitability for passive bioremediation, microbial content, nutrient content, and selected soil physical conditions. The laboratory reports of the analysis are presented in Appendix K.

The laboratory results indicate that TNT microbial degrader populations are virtually nonexistent in the soils in both red water ponds areas. Low levels of TNT microbial biotransformation products were found in the soil samples in these two borings. 4-Am-DNT was detected at a concentration of 0.3 mg/Kg in sample PR-S7-3.0/5.0 and

at a concentration of 0.7 mg/Kg in sample PR-S13-5.0/10.0. At the West Area Red Water Ponds, 0.3 mg/Kg of 4-Am-DNT was reported in sample WA-S17-0.0/3.0 which was above the interval collected for biological activity analysis.

Nutrient conditions, however, were generally favorable for biodegradation. Phosphate augmentation would probably be required, but abundant nitrogen is available and soil pH conditions are favorable.

At the time the analysis was requested, the nature of nitroaromatics present in the soils in the red water ponds areas was not known. TNT was used as the sole carbon source for enumerating biological "degrader" populations in the analysis performed for this investigation. The results of the Focused Remedial Investigation indicate that 2,4,6-TNT is not widely distributed throughout the soils in the red water ponds areas. Additional analysis for bioremediation of soils may be appropriate for nitroaromatics that are widely distributed in the pond areas, such as 1,3,5-TNB and 2,4-DNT.

5.6 GENERAL CHEMICAL ANALYSIS

Soil sample PR-S13-3.0/10.0 was analyzed for extractable sulfate, pH, extractable TOC, extractable alkalinity, extractable nitrate, total Kjeldahl nitrogen, extractable phosphorous, potassium, cation exchange capacity, and moisture content. Concentrations detected are provided in the laboratory reports in Appendix J and are available for use in assessing potential remediation methodologies.

6.0 GROUNDWATER INVESTIGATION

Groundwater at the site occurs in two basic hydrostratigraphic units: the overburden and the bedrock. The overburden is composed of glacial outwash materials, and varies in thickness from a few feet to over 40 feet. The bedrock consists of both limestone and shale. The hydrostratigraphic units were previously described in Section 2.0.

The groundwater portion of the Focused Remedial Investigation of the Red Water Ponds utilized data and groundwater sampling results from wells installed for this investigation in the overburden at the TNT areas and the red water ponds areas. It also utilized data for wells installed for this investigation in the bedrock across the site. Finally, selected wells that were installed during previous investigations and located in the red water ponds areas were utilized. The locations of all these wells are illustrated on Figure 6-1.

At the former Pentolite Road Red Water Ponds, three overburden wells installed for this investigation and one well installed during the previous IT investigation were utilized.

- Well DM-MW7 was installed in the southwest portion of the former ponds area. It is within the boundary of the westernmost of the two ponds that composed the Pentolite Road Red Water Ponds. The borehole for well DM-MW7 was created by continuing the advance soil boring PR-S4 beyond the 10 foot target depth for the soils investigation.

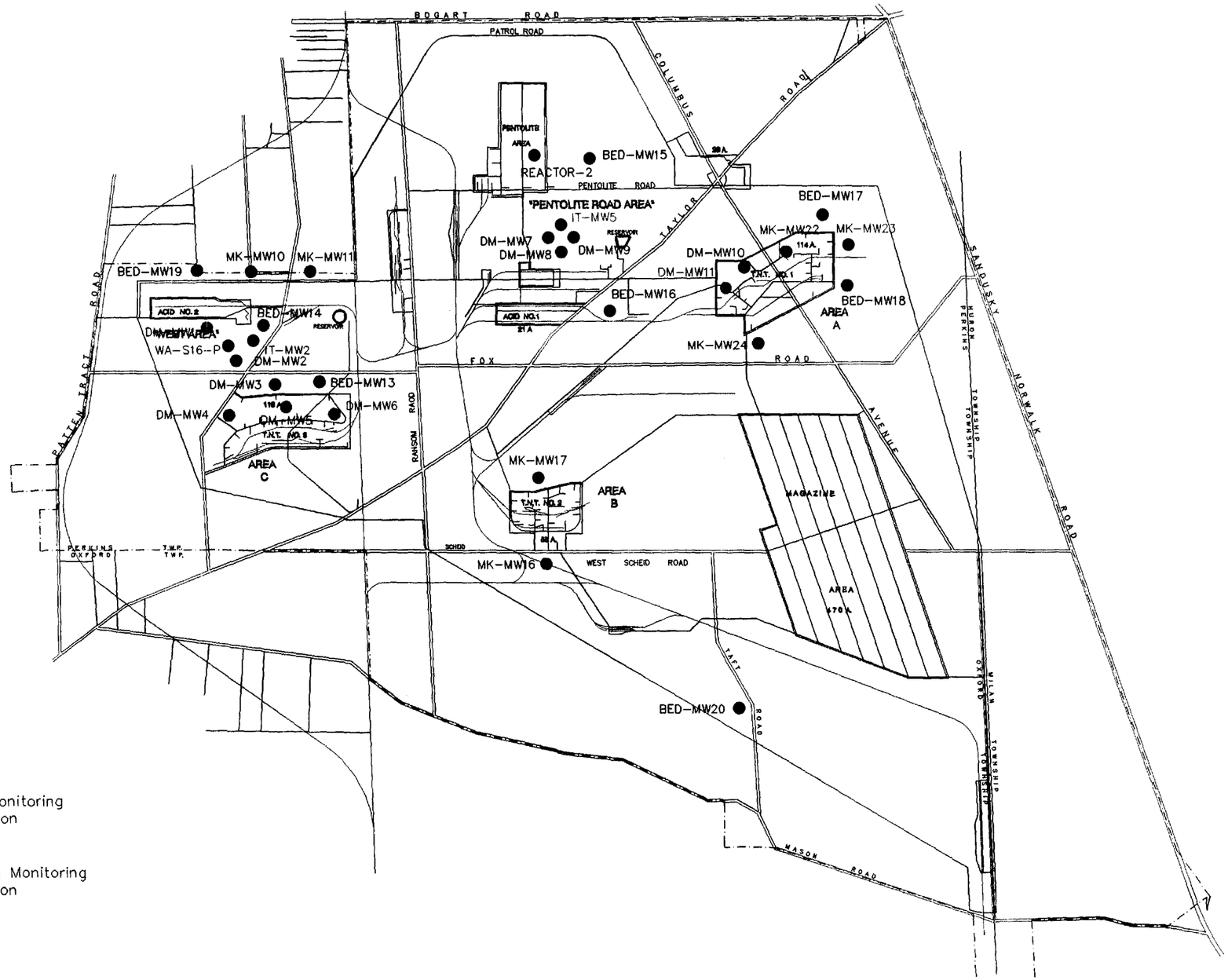
- Well DM-MW8 was installed in the southern portion of what was the easternmost of the two ponds. Soil boring PR-S14 was converted into well DM-MW8.

- Well DM-MW9 was installed in soil boring PR-S19 which was drilled on the eastern edge of the easternmost pond.

- Well IT-MW5 is located on the northeast corner of the former pond area.

One bedrock well was installed for this investigation and one of the four NASA Reactor Area wells was sampled.

- Well BED-MW15 was installed downgradient of the Pentolite Road Red Water Ponds on the north side of Pentolite Road.



1" = 3000'

● BED-MW13 Bedrock Monitoring Well Location

● DM-MW6 Overburden Monitoring Well Location

FIGURE 6-1
SITEWIDE WELL LOCATION MAP

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

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- PBS Reactor Well 2 is located downgradient of the Pentolite Road Red Water Ponds, on the north side of Pentolite Road within the reactor compound.

At the West Area Red Water Ponds two new overburden wells were installed and two wells installed during previous investigations were utilized.

- Well DM-MW1 was installed on the northwest side of the west pond. It is located at the edge of the cleared area surrounding the north side of the ponds.
- Well DM-MW2 was installed on the south side of the ponds. It is located in a relatively flat area at the base of an embankment south of the western pond and just west of the dike that separated the two pond. Pipe Creek is located immediately south of the well. Two soil samples were collected from the boring which was converted into well DM-MW2 as was discussed in Section 5.
- Well IT-MW2 is located on the northwest corner of the former east pond.
- Well MK-MW11 is located north of the east pond on the north side of Patrol Road. It is one of three overburden wells installed along Patrol Road on the north side of the West Area Red Water Ponds and Acid Area No. 2.

Two other overburden wells installed by MK Ferguson are located along Patrol Road on the north side of the West Area Red Water Ponds. These wells were dry in December 1994 and, thus, were not sampled.

Two bedrock wells were installed downgradient of the West Area Red Water Ponds.

- Well BED-MW14 is located immediately downgradient of the east pond.
- Well BED-MW19 is located on the north side of Patrol Road along the northern property boundary. This well was installed to evaluate whether contamination was moving off site from this portion of the property.

A total of eight bedrock wells were installed as part of the Sitewide Groundwater Investigation. The locations of all the bedrock wells are illustrated on Figure 6-1.

The groundwater investigation includes assessment of the groundwater flow regime and interpretation of the laboratory analysis of the groundwater samples. The

groundwater flow conditions are described in Section 6.1. Section 6.2 presents the groundwater quality assessment.

6.1 GROUNDWATER FLOW REGIME

Section 6.1.1 provides a characterization of the sitewide groundwater flow regime in both the overburden and the bedrock hydrostratigraphic units using information developed for the Red Water Ponds Focused Remedial Investigation and the Area Site Investigation and for the Sitewide Groundwater Investigation which were performed concurrently. Then, Section 6.1.2 assesses the overburden groundwater flow patterns in each of the three TNT areas.

6.1.1 Sitewide Groundwater Flow Characterization

Groundwater flow patterns are characterized on a sitewide basis for both the overburden and the bedrock hydrostratigraphic units using groundwater level measurements obtained from nine bedrock wells and the 19 overburden wells installed at the PBS. These patterns are evaluated from the two rounds of groundwater level measurements performed in December 1994 and March 1995 and data from earlier studies. Groundwater monitoring wells are clustered around areas of the site where environmental investigations have been performed. Large areas of the site have no well data. The available information was synthesized to evaluate the elevation of the bedrock surface and the thickness of the overburden since both depth to bedrock and thickness of the overburden impact groundwater flow patterns. The available data was also used to characterize the groundwater flow patterns for both hydrogeolgoical regimes.

In order to create contour maps of the bedrock surface, overburden thickness, and water table elevations, it was necessary to create continuous fields from the data collected from point observations through an interpolation method. Several interpolation methods were tested, including inverse distance, minimum curvature, kriging using a linear covariance structure, and hand contouring. Except for the hand

contouring, the interpolations were performed using the commercially available SURFER software (Golden Software).

Kriging uses a statistical method to calculate the autocorrelation between data points and produce a minimum variance unbiased estimate. It honors the original data points, and interpolates between the data points. In theory, no other method of grid generation can produce better estimates of the form of a mapped surface than kriging. In practice, the effectiveness of the techniques depends on the correct specification of several parameters that describe the semivariogram and the model of the drift. However, because kriging is robust, even with a naive selection of parameters the method will do no worse than conventional grid estimation procedures. The price that must be paid for optimality in estimation is computational complexity.

For the site-wide maps, the inverse distance method did not perform well, because the distribution of the data resulted in a "bulls-eye" pattern for some of the surfaces. The kriging, minimum curvature, and hand contouring methods all resulted in similar surfaces. For the maps presented in the report, kriging was used an the interpolation method. Default SURFER kriging parameters were used, which assume ordinary kriging with a linear variogram.

The only purpose of the kriging was to develop maps of the surfaces that made sense, and were consistent with the data. A detailed geostatistical and variogram analysis of the site-side data was not performed for the site-side maps. The sparsity of data, coupled with the irregular distribution of the data points, made a detailed variogram analysis inappropriate. Performing a detailed variogram analysis for the sole purpose of developing generalized site-side maps of the various surfaces would have also been inappropriate.

6.1.1.1 Top of Bedrock and Thickness of the Overburden Aquifer

In order to adequately assess the groundwater flow patterns in the overburden unit, both the top of bedrock elevations and the thickness of the overburden unit were established. In addition to the 19 wells installed for this investigation, 41 wells have

been installed previously, 13 during the MK Ferguson investigation, four during the IT investigation, four during the H^{+}GCL investigation and 20 during the Ebasco Environmental investigation. The drilling logs for all of the wells were analyzed to evaluate the surface elevations, thickness of overburden, depth to bedrock, and type of bedrock. This information is summarized in Table 6-1 for all wells.

Some of the information from the boring logs is incomplete. For instance, ground surface elevations and/or well coordinates are not available for some of the borings. Some of the borings did not extend to the top of the bedrock, therefore the depth to bedrock and the type of bedrock are unknown. However, most of the boring logs contain sufficient information to evaluate the thickness of the overburden and the elevation of the top of bedrock.

The information contained in Table 6-1 is used to construct two contour maps:

- Figure 6-2 provides a map of the top of bedrock elevations throughout PBS; and

- Figure 6-3 provides a map of the overburden thickness throughout PBS.

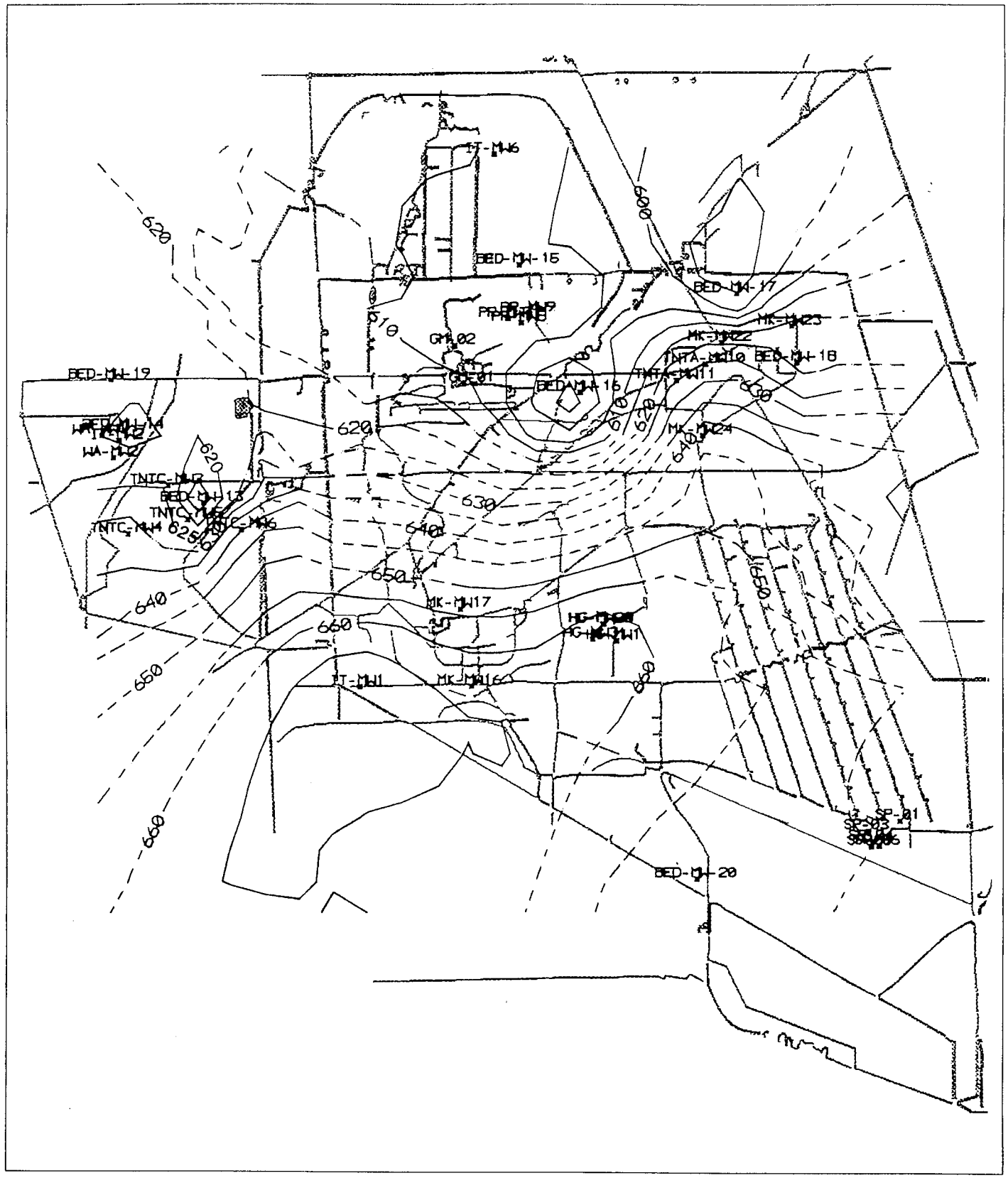
Only those wells which had sufficient information to establish the thickness of the overburden were used to construct these contour maps. Thirty-eight wells fit this criteria. For reference, the locations of the wells used to construct the contour maps are plotted on the maps.

Before interpreting these contour maps, it is important to note that the data are mainly clustered around specific investigation areas, and large portions of the site have no data available. The contour maps were constructed by kriging using the available data, and represent the best fit kriged surface to the data. The contours in the regions which have no data available should be considered speculative. However, enough data is present and the data is distributed such that general conclusions can be drawn from these maps.

TABLE 6-1

SUMMARY OF WELL INFORMATION

Monitoring Well ID	General Area	Type of Well	Top of Casing Elevation (ft)	Ground Surface Elevation (ft)	Well Depth (ft bgs)	Easting	Northing	Depth to Top of Bedrock (ft)	Top of Bedrock Elevation (ft)	Bedrock Type
MK WELLS										
MK-MW09		Overburden	645.91					no	N/A	none
MK-MW10	WA RWP	Overburden	640.89	638.06	15.0	14646.65	31784.09	no	N/A	none
MK-MW11	WA RWP	Overburden	637.69	634.71	14.0	15926.81	31782.65	no	N/A	none
MK-MW12		Overburden	641.73					13.0	628.7	LS
MK-MW14		Overburden	681.93					11.5	670.4	?
MK-MW15		Overburden	681.45					9.0	672.5	?
MK-MW16	TNT B	Overburden	674.32	671.33	5.5	22260.12	24938.51	8.0	663.3	SH
MK-MW17	TNT B	Overburden	664.64	660.97	8.0	22019.82	26670.71	6.0	655.0	SH
MK-MW19		Overburden	639.85					no	N/A	none
MK-MW20		Overburden	637.86					no	N/A	none
MK-MW22	TNT A	Overburden	638.05	635.56	9.5	27844.34	32580.36	9.5	626.1	?
MK-MW23	TNT A	Overburden	639.07	636.95	16.0	29414.52	32934.09	16.0	621.0	?
MK-MW24	TNT A	Overburden	657.12	654.44	9.5	27420.48	30494.71	9.5	644.9	?
IT WELLS										
IT-MW1		Overburden	678.24	674.52	9.0	19783.00	24944.00	3.0	671.5	SH
IT-MW2	WA RWP	Overburden	639.63	636.53	18.3	14437.00	30425.00	18.3	618.2	LS
IT-MW5	PR RWP	Overburden	634.99	631.91	21.0	23518.73	33481.14	no	N/A	none
IT-MW6		Overburden	632.97	628.90	18.5	22732.00	36752.00	18.5	610.4	?
DM WELLS										
TNTA-MW10	TNT A	Overburden	640.18	637.50	11.0	27478.66	32093.12	11.0	626.5	SH
TNTA-MW11	TNT A	Overburden	640.50	637.86	11.4	26832.65	31731.51	11.4	626.5	SH
TNTC-MW3	TNT C	Overburden	645.41	642.57	14.0	15532.75	29408.88	14.5	628.1	SH
TNTC-MW4	TNT C	Overburden	654.43	651.89	18.8	14634.99	28332.11	18.0	633.9	SH
TNTC-MW5	TNT C	Overburden	651.81	649.07	29.7	15972.14	28645.94	29.5	619.6	SH
TNTC-MW6	TNT C	Overburden	659.40	656.82	12.2	17169.56	28413.03	12.0	644.8	SH
WA-MW1	WA RWP	Overburden	644.43	642.32	22.3	14060.58	30549.40	22.3	620.0	LS
WA-MW2	WA RWP	Overburden	633.65	631.16	13.0	14301.25	30038.91	12.0	619.2	SH
PR-MW7	PR RWP	Overburden	633.99	631.50	22.3	23074.69	33122.14	22.3	609.2	SH
PR-MW8	PR RWP	Overburden	635.02	632.50	27.5	23364.70	33022.17	27.5	605.0	SH
PR-MW9	PR RWP	Overburden	633.70	630.70	19.0	23564.68	33227.19	19.0	611.7	SH
BED-MW-13	TNT C	Bedrock	648.27	645.81	75.5	16324.84	29004.74	40.7	605.1	
BED-MW-14	WA RWP	Bedrock	646.04	643.05	52.2	14564.93	30640.67	24.5	618.6	
BED-MW-15	PR RWP	Bedrock	631.64	629.08	74.4	23310.10	34311.28	24.3	604.8	
BED-MW-16		Bedrock	636.02	633.68	74.0	24688.03	31461.03	44.2	589.5	
BED-MW-17	TNT A	Bedrock	629.97	627.37	64.4	28164.75	33667.92	37.3	590.1	
BED-MW-18	TNT A	Bedrock	651.50	648.83	75.4	29536.00	32128.05	30.8	618.0	
BED-MW-19	WA RWP	Bedrock	643.07	640.51	49.5	14256.32	31780.91	19.1	621.4	
BED-MW-20	Background	Bedrock	676.33	673.57	49.5	27305.63	20645.12	21.5	652.1	
REACTOR-2		Bedrock	630.68	630.72		22017.22	34762.68	unknown	N/A	
HGCL WELLS										
HG-MW1	Snake Rd BG	Overburden	674.74	671.31		25489.00	25945.00	9.5	661.8	SH
HG-MW2A	Snake Rd BG	Overburden	672.66	669.68		25186.00	26316.00	7.0	662.7	SH
HG-MW2B	Snake Rd BG	Overburden	673.07	669.60		25208.00	26321.00	6.0	663.6	SH
HG-MW3	Snake Rd BG	Overburden	671.52	668.67		24970.00	25984.00	6.0	662.7	SH
EB WELLS		Overburden								
GM-01	GM Area	Overburden		638.49		22328.00	31667.00	27.0	611.5	SH
GM-02		Overburden		635.80		21889.00	32525.00	29.0	606.8	SH
GM-03		Overburden		636.69	18.0	21849.00	32220.00	no	N/A	none
GM-04		Overburden		634.49	16.0	21517.00	32132.00	no	N/A	none
GM-05		Overburden		637.79	18.0	21882.00	31961.00	no	N/A	none
GM-06		Overburden		637.80	18.0	21884.00	31813.00	no	N/A	none
SP-01		Overburden		654.29		31880.00	21936.00	9.0	645.3	SH
SP-03		Overburden		657.29		31172.00	21716.00	7.0	650.3	SH
SP-04		Overburden		657.25		31279.00	21483.00	7.0	650.3	SH
SP-05		Overburden		656.87		31242.00	21371.00	7.0	649.9	SH
SP-06		Overburden		657.70		31418.00	21381.00	8.0	649.7	SH
PS-02		Overburden		636.48	18.0	24134.00	32492.00	no	N/A	none
PS-03		Overburden		635.13	18.0	24261.00	32476.00	no	N/A	none
PS-04		Overburden		636.07	16.0	24334.00	32452.00	no	N/A	none
RA-01		Overburden		632.30	16.0	21813.00	34061.00	no	N/A	none
RA-02		Overburden		632.06	20.0	22289.00	35053.00	no	N/A	none
RA-03		Overburden		631.73	22.0	22357.00	34898.00	no	N/A	none
RA-04		Overburden		631.65	10.0	22402.00	34842.00	no	N/A	none
RA-05		Overburden		631.41	10.0	22504.00	34831.00	no	N/A	none
RA-06		Overburden		630.72	10.0	22761.00	34868.00	no	N/A	none



3000 1500 0 3000 6000 FEET

Approximate Scale

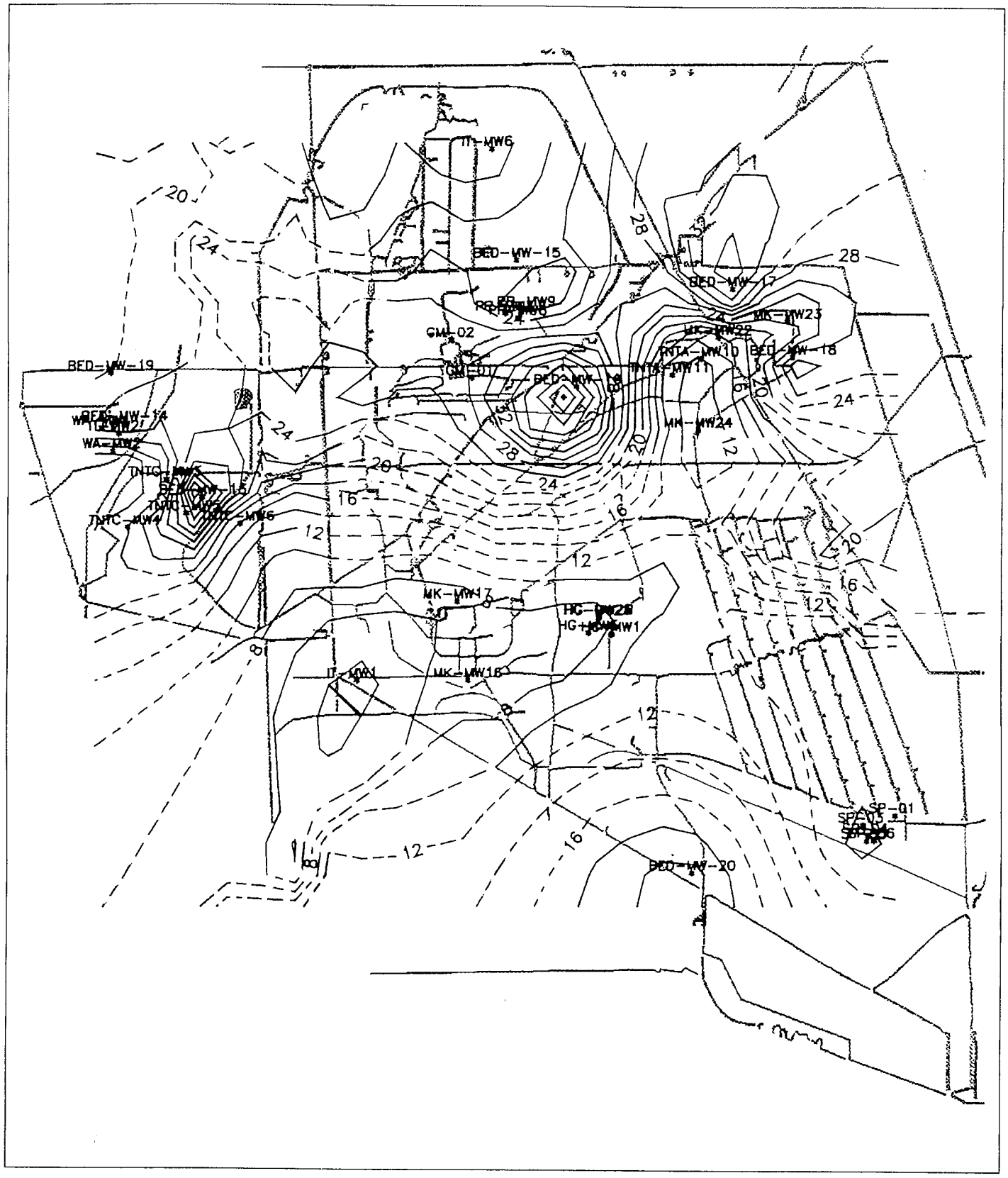
N

Figure 6-2

TOP OF BEDROCK ELEVATION CONTOUR MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-3

OVERBURDEN THICKNESS CONTOUR MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

The top of bedrock elevations are presented in Figure 6-2. The bedrock surface is highest in the south, and slopes towards the north at an average gradient of 0.0046 ft/ft (25 ft/mile) across the site. A local bedrock high occurs just to the southwest of the TNT Area B, at an elevation of approximately 667 feet. From this local high, bedrock elevations decrease gradually to the east and more steeply to the north. Insufficient data is available to assess the bedrock surface to the south and west of this bedrock high.

In the western portion of the site, top of bedrock elevations decrease uniformly toward the north until the TNT Area C, where a local bedrock low is present at an elevation of approximately 605 feet. North of TNT Area C, the top of bedrock elevations are relatively uniform at approximately 620 feet to the site boundary. In the eastern portion of the site, a top of bedrock trough is present between well BED-MW-16 (near the intersection of Taylor and Maintenance Roads) and well BED-MW-17. This trough is slightly south of and approximately parallel to Taylor Road. The elevation of this bedrock trough is approximately 590 feet. North of this trough, near the Pentolite Road area, top of bedrock elevations are approximately 605 feet.

Figure 6-3 shows a contour map of overburden thickness throughout the PBS site. This map is based on the 38 borings that went to bedrock. The patterns observed in the thickness of overburden map generally mirror the patterns noted in the top of bedrock elevations. In general, the overburden is thinnest in the southern portion of the site, and increases in thickness to the north.

Using information obtained during drilling of the background well, BED-MW-20, the overburden thickness is 20 feet at the southeastern edge of the site. Immediately northwest and northeast of this well, however, overburden thicknesses are generally much thinner. The overburden is thinnest near the bedrock high southwest of TNT Area B, with a thickness of less than 3 feet in places. In this area, shale outcrops can be seen at the surface.

A line between TNT Area B and TNT Area A areas seems to mark a transition in overburden thickness. South and east of this line, the overburden is relatively thin, with a thickness of less than 10 feet. North and west of this line, overburden thickness

increases dramatically. The areas where local top of bedrock lows are present show the greatest thickness of overburden materials, up to 45 feet at well BED-MW-16. North of this wedge of thick overburden materials, overburden thickness is relatively constant at about 20 to 25 feet thick.

6.1.1.2 Groundwater Flow within the Overburden

Two rounds of groundwater level measurements were taken in 19 overburden wells, one on December 5 to 9, 1994, and the second on March 14, 1995. The groundwater level measurements are summarized in Table 6-2.

Contour maps of the groundwater elevations in the overburden hydrostratigraphic unit were constructed for each of the measurement dates. Figure 6-4 is a contour map of the groundwater elevations in the overburden on December 5 to 9, 1994. Figure 6-5 is a contour map of the groundwater elevations in the overburden on March 14, 1995.

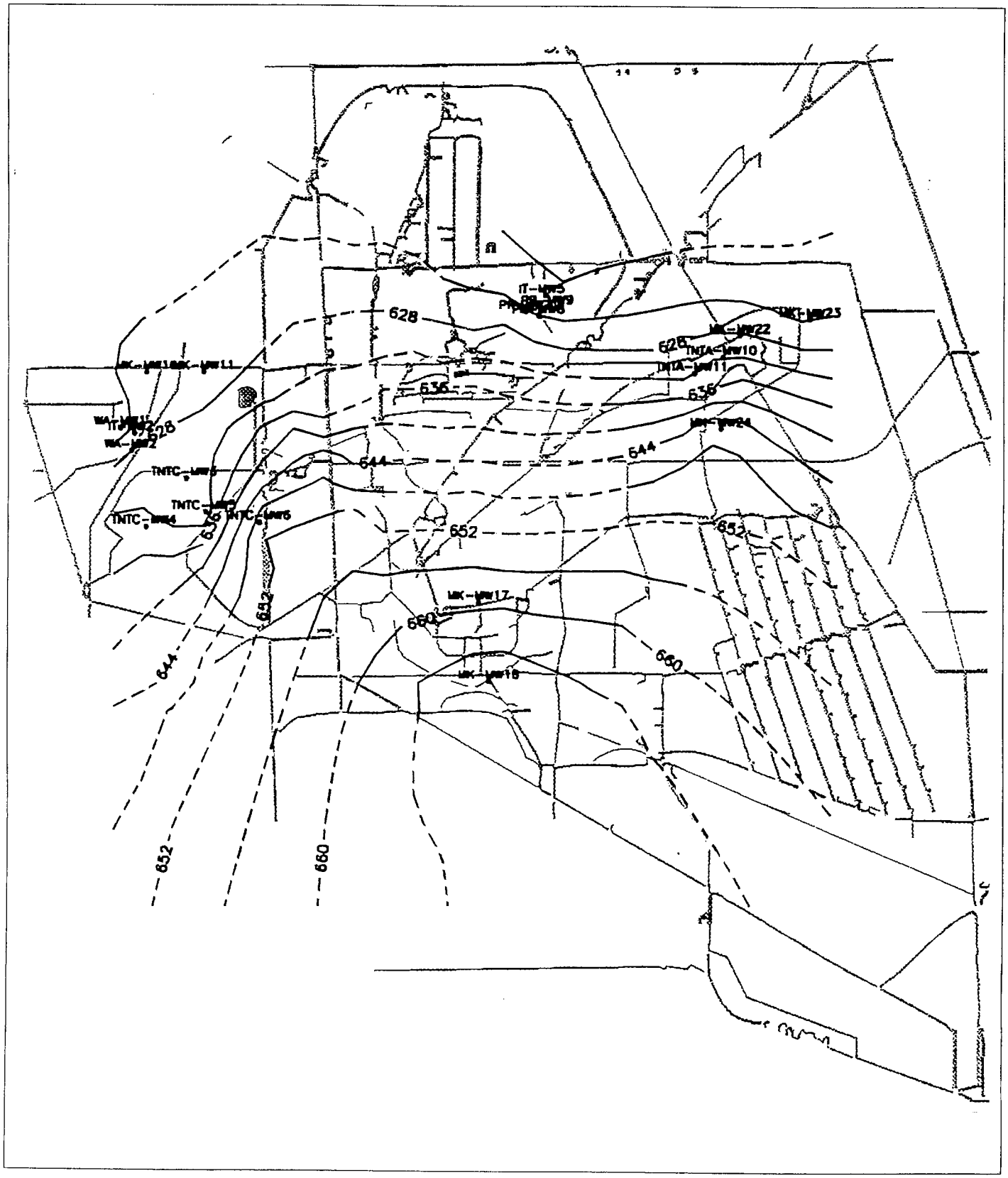
Before interpreting these contour maps, several important points must be noted. First, the data are clustered around the investigation areas, and large portions of the site have no data available. In particular, the entire southern section of the site, south of well MK-MW-16, has no data available. The groundwater contour maps were constructed by kriging using the available data, and represent the best fit kriged surface to the data. Groundwater contours in areas with little or no data available should be considered speculative. Second, the overburden is highly heterogeneous both in thickness and hydraulic conductivity. There may be regions of relatively high hydraulic conductivity, leading to pathways of preferential flow which may not be in a direction perpendicular to groundwater contours depicted on the figures. However, on a regional basis, the contour patterns depict the overall direction of groundwater flow.

Both maps show an overall groundwater gradient from south to north, with an average gradient of approximately 0.0045 ft/ft (25 ft/mile). Through the central and eastern portions of the site, the groundwater elevation contours trend east-west, indicating flow directly northward. On the western side of the site the groundwater contours

TABLE 6-2

SUMMARY OF OVERBURDEN GROUNDWATER WELL INFORMATION

Monitoring Well ID	Top of Casing Elevation (ft)	Ground Surface Elevation (ft)	Well Depth bgs (ft)	Depth to Groundwater Dec. 1994 (ft)	Depth to Groundwater Mar. 1995 (ft)	Groundwater Elevation Dec. 1994 (ft)	Groundwater Elevation Mar. 1995 (ft)	Difference in Water Levels 12/94 - 03/95 (ft)	Easting	Northing
TNT-A Area										
TNTA-MW10	640.18	637.50	11.00	6.47	3.14	633.71	637.04	-3.33	27478.66	32093.12
TNTA-MW11	640.50	637.86	11.40	9.94	7.68	630.56	632.82	-2.26	26832.65	31731.51
MK-MW22	638.05	635.56	9.50	9.20	6.50	628.85	631.55	-2.70	27844.34	32580.36
MK-MW23	636.47	636.95	16.00	15.59	8.35	620.88	628.12	-7.24	29414.52	32934.09
MK-MW24	657.12	654.44	9.50	8.81	6.35	648.31	650.77	-2.46	27420.48	30494.71
TNT-B Area										
MK-MW16	674.32	671.33	8.00	7.18	4.96	667.14	669.36	-2.22	22260.12	24938.51
MK-MW17	664.64	660.97	6.00	5.06	3.54	659.58	661.10	-1.52	22019.82	26670.71
TNT-C Area										
TNTC-MW3	645.41	642.57	14.00	dry	6.21	< 628.57	639.20	> -10.63	15532.75	29408.88
TNTC-MW4	654.43	651.89	18.83	19.56	3.36	634.87	651.07	-16.20	14634.99	28332.11
TNTC-MW5	651.81	649.07	29.70	23.80	4.19	628.01	647.62	-19.61	15972.14	28645.94
TNTC-MW6	659.40	656.82	12.20	7.47	4.20	651.93	655.20	-3.27	17169.56	28413.03
West Area RWP										
WA-MW1	644.43	642.32	22.30	24.58	24.98	619.85	619.45	0.40	14060.58	30549.4
WA-MW2	633.65	631.16	12.00	4.06	1.74	629.59	631.91	-2.32	14301.25	30038.91
IT-MW2	639.63	636.69	15.00	12.31	5.88	627.32	633.75	-6.43	14379.83	30428.08
MK-MW10	640.89	638.06	14.00	14.23	Not Measured	626.66	Not Measured	Not Measured	14646.65	31784.09
MK-MW11	637.69	634.71	13.00	12.47	6.33	625.22	631.36	-6.14	15926.81	31782.65
Pentolite Road RWP										
PR-MW7	633.99	631.50	22.30	7.67	2.34	626.32	631.65	-5.33	23074.69	33122.14
PR-MW8	635.02	632.50	27.50	10.47	5.04	624.55	629.98	-5.43	23364.7	33022.17
PR-MW9	633.70	630.70	19.00	10.78	3.58	622.92	630.12	-7.20	23564.68	33227.19
IT-MW5	634.99	631.91		14.80	5.37	620.19	629.62	-9.43	23518.73	33481.14



3000 1500 0 3000 6000 FEET

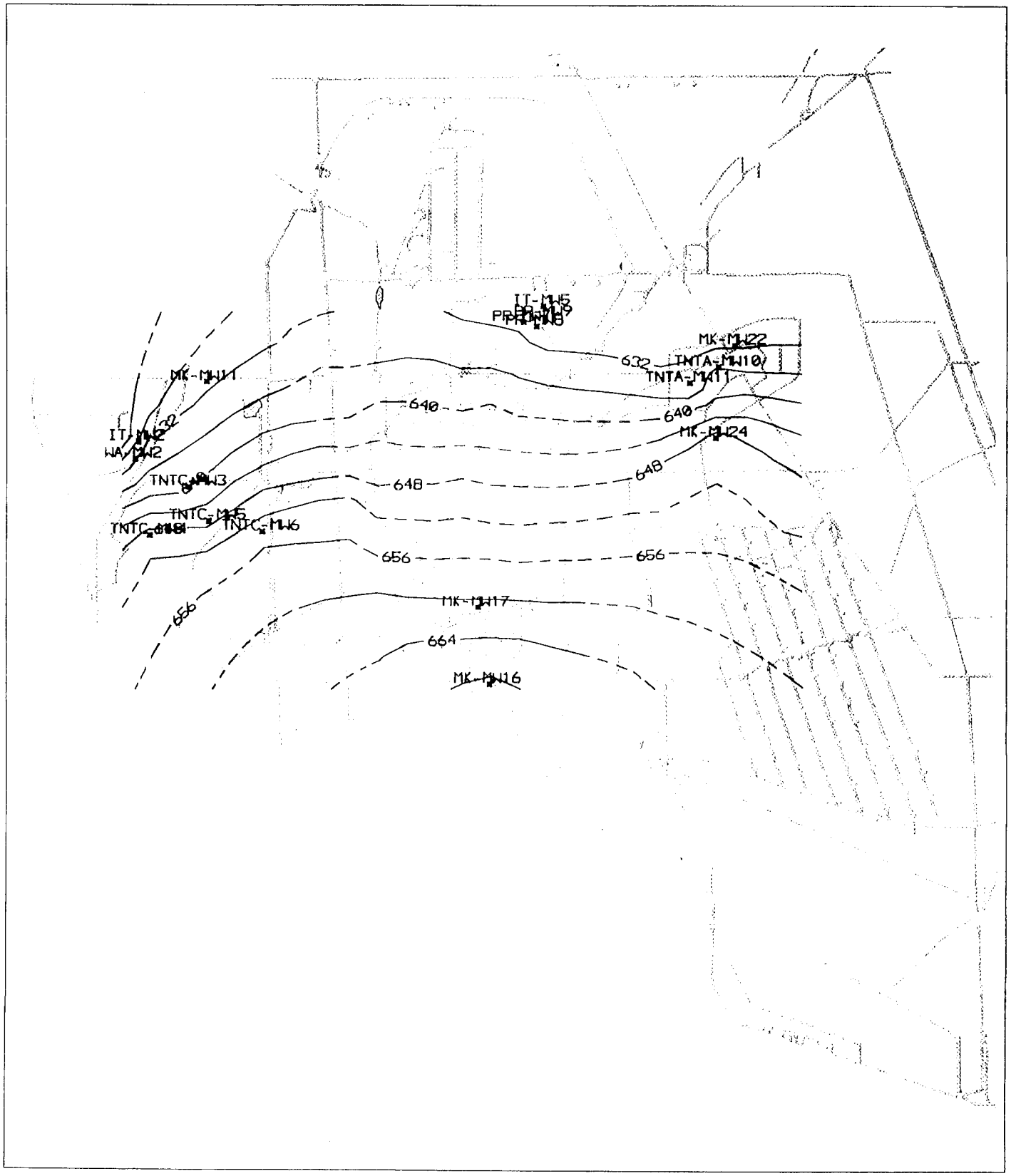
Approximate Scale

N

Figure 6-4

OVERBURDEN WATER TABLE ELEVATION CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-5

OVERBURDEN WATER TABLE ELEVATION CONTOUR MAP

March 1995

Plum Brook Ordnance Works

Sandusky, Ohio

DAMES & MOORE

indicate flow to the northwest. The December 1994 measurements indicate a stronger northwest component to the flow direction on the western side of the site than the March 1995 measurements. It is likely that the change in the direction of groundwater flow on the west side of the site is related to the change in bedrock type which occurs in this area. The contours indicate that the horizontal direction of flow is to the northwest toward the contact between the limestone and shale bedrock units. The contact trends southwest to northeast on the northwest side of the West Area Red Water Ponds Area.

The overburden groundwater elevation contour maps have a close relationship with the surface elevations, especially for the second round of measurements in March 1995. The second round of measurements were made during an unseasonably warm spell in March, after snowmelt occurred. Standing water was observed in the vicinity of 15 of the 19 wells. The groundwater elevations were within 3 feet of the ground surface in 13 of the 19 wells. During the December 1994 measurements, groundwater elevations were within 3 feet of the ground surface elevations in only two of the 19 wells measured.

The groundwater elevations during March 1995 are an average of 4 feet higher than the groundwater elevations during December 1994. In some locations, especially at TNT Area C, groundwater elevations during March 1995 are up to 19 feet higher than during December 1994. The greatest variations in groundwater elevations occur at TNT Area C, and the smallest variations occur at TNT Areas A and B. The West Area Red Water Ponds and the Pentolite Road Red Water Ponds areas had variations in groundwater elevations between 3 and 9 feet.

The pattern of groundwater flow in the overburden aquifer is similar for the December 1994 and March 1995 measurements. The major difference in groundwater flow patterns occurs on the western portion of the site. Based on the December 1994 map, groundwater in the overburden aquifer near TNT Area B moves toward both the north and the northwest, towards TNT Area C. Overburden groundwater in TNT Area C moves northwest towards the West Area Red Water Ponds. Based on the March 1995 map, groundwater in the overburden near TNT Area B no longer moves toward TNT

Area C, but rather moves directly northward. Overburden groundwater at TNT Area C still moves northwest towards the West Area Red Water Ponds.

No apparent relationship exists between the overburden thickness contour map presented on Figure 6-3 and the groundwater elevation contour maps on a sitewide scale. The dramatic thickening of the overburden near well BED-MW-16, north of TNT Area A and on the east side of TNT Area C, has no apparent effect on the groundwater table in these regions. The groundwater gradient does flatten slightly north of TNT Area A, perhaps in response to the thickening of the overburden in that area. However, over most of the site, the groundwater gradient is relatively constant, and is probably more correlated with surface elevations than the thickness of the overburden.

It is difficult to estimate the volume or rate of groundwater flow in the overburden flow regime because very little site specific hydraulic conductivity information is available. Even if it were available, there is probably significant variation in the hydraulic conductivity of the overburden materials, given the nature of the glacial deposits. IT performed a rising head slug test at well IT-MW-2 near the West Area Red Water Ponds which resulted in a hydraulic conductivity value of 0.25 ft/day. Recharge in other wells was too slow to perform hydraulic conductivity testing, indicating significantly lower hydraulic conductivity values.

6.1.1.3 Groundwater Flow in the Bedrock

Two rounds of groundwater level measurements were made in nine bedrock wells at the site, eight bedrock wells installed for this investigation and one PBS Reactor Well. The measurements were made on December 5 to 9, 1994 and March 14, 1995. The results of the groundwater level measurements are summarized in Table 6-3.

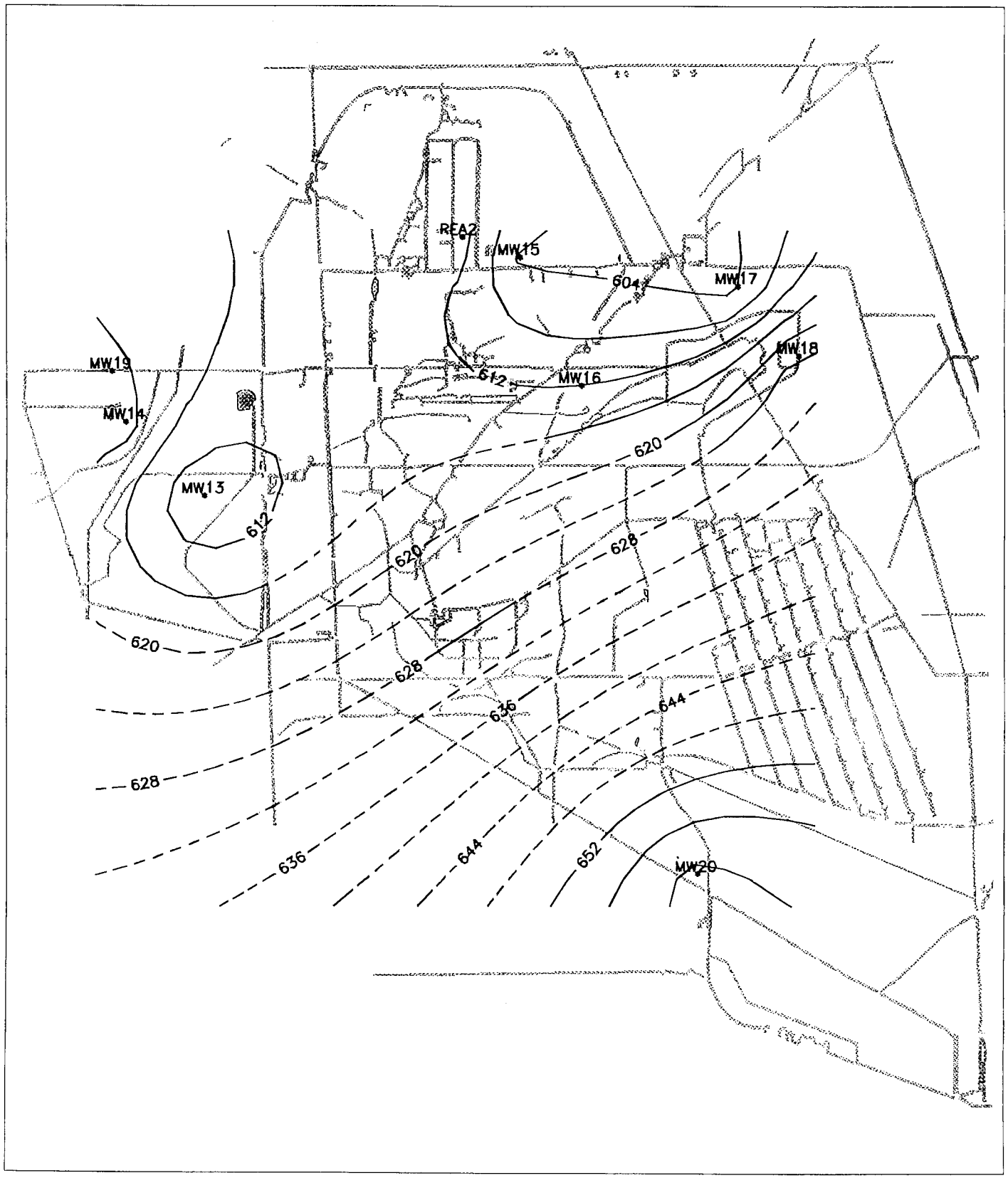
Contour maps of the groundwater elevations in the bedrock hydrostratigraphic unit were constructed for December 1994 and March 1995. Figure 6-6 is a contour map of the groundwater elevations in the bedrock on December 5 to 9, 1994. Figure 6-7 is a contour map of the groundwater elevations in the bedrock on March 14, 1995. These contour maps were constructed using all of the bedrock wells except

TABLE 6-3

SUMMARY OF BEDROCK GROUNDWATER WELL INFORMATION

Monitoring Well ID	Top of Casing Elevation (ft)	Ground Surface Elevation (ft)	Well Depth bgs (ft)	Depth to Groundwater Dec. 1994 (ft)	Depth to Groundwater Mar. 1995 (ft)	Groundwater Elevation Dec. 1994 (ft)	Groundwater Elevation Mar. 1995 (ft)	Difference in Water Levels 12/94 - 03/95 (ft)	Depth to Top of Rock (bgs)	Easting	Northing
BED-MW-13	648.27	645.81	75.5	40.42	28.98	607.85	619.29	-11.44	40.7	16324.84	29004.74
BED-MW-14	646.04	643.05	52.20	24.28	21.65	621.76	624.39	-2.63	24.5	14564.93	30640.67
BED-MW-15	631.64	629.08	74.40	28.10	32.73	603.54	598.91	4.63	24.3	23310.1	34311.28
BED-MW-16	636.02	633.68	74.00	64.64	2.34	571.38	633.68	-62.30	44.2	24688.03	31461.03
BED-MW-17	629.97	627.37	64.40	27.40	27.07	602.57	602.90	-0.33	37.3	28164.75	33667.92
BED-MW-18	651.50	648.83	75.40	26.45	31.11	625.05	620.39	4.66	30.8	29536	32128.05
BED-MW-19	643.07	640.51	49.50	22.00	19.55	621.07	623.52	-2.45	19.1	14256.32	31780.91
BED-MW-20	676.33	673.57	49.50	14.98	15.05	661.35	661.28	0.07	21.5	27305.63	20645.12
REACTOR-2	630.68	630.72		15.97	28.79	614.71	601.89	12.82		22017.22	34762.68

bgs = below ground surface



3000 1500 0 3000 6000 FEET

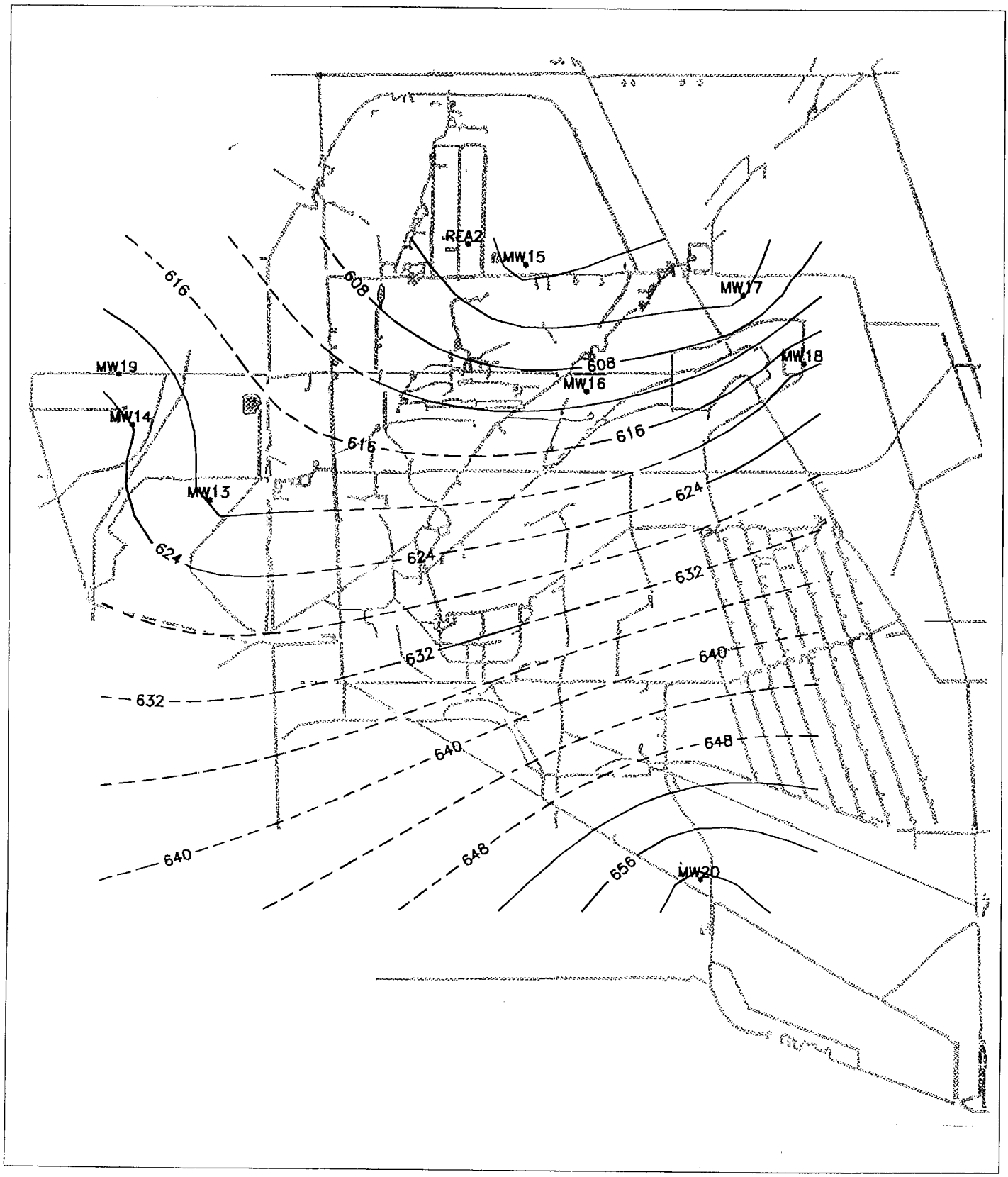
Approximate Scale

N

Figure 6-6

BEDROCK WATER TABLE ELEVATION CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-7

BEDROCK WATER TABLE ELEVATION CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

BED-MW-16, which showed anomalous water levels during both rounds of measurements. During the first round, the measured water level in well BED-MW-16 was below the bottom of the casing, within the open hole interval. All other wells had measured water levels above the bottom of the casing. It is possible that the water level in well BED-MW-16 had not recovered fully for the first sampling event. During the second sampling round, the measured water level in well BED-MW-16 was at the ground surface. No other bedrock wells had measured water levels within 15 feet of the ground surface. Including well BED-MW-16 for contouring water levels in the bedrock aquifer caused severe anomalies for both December 1994 and March 1995, and it was, therefore, not used in the maps presented in this report.

Several other wells showed anomalous results during one or both sets of measurements. Well BED-MW-13 showed evidence in December 1994 of not having recovered fully after development. First, the contour map of the bedrock groundwater levels for the December 1994 (Figure 6-6) indicates a local sink in the area defined by well BED-MW-13. By the March 1995 (Figure 6-7), this sink is no longer present. Second, with the obvious exception of well BED-MW-16, well BED-MW-13 showed the largest increase in measured groundwater level between the two measurement dates, with the water level being nearly 12 feet higher during March 1995.

Reactor Well 2 had a decrease in measured water level of nearly 13 feet between December 1994 and March 1995. Well BED-MW-15, about 200 feet away, had a decrease in measured water level of only about 4 feet. It is not apparent why measured water levels in Reactor Well 2 should decrease so dramatically over a 4-month period.

Care must be taken in interpreting the contour maps of the bedrock flow regime. First, only nine data points are available throughout the site, most of them in the northern portion. Second, the bedrock may contain fractures or fracture zones in which preferential flow occurs. Many of the bedrock wells were situated in locations where fracture zones were suspected to exist. The direction of groundwater flow may not always be perpendicular to the equipotentials (contours of equal groundwater levels). There may be pathways of relatively high hydraulic conductivity, leading to pathways of preferential flow which may not be in a direction perpendicular to groundwater

contours. Given only nine well locations, it is very difficult to delineate any pathways of preferential flow using the groundwater contour maps. As a first approximation, the direction of groundwater flow is assumed to be perpendicular to contours of equal groundwater elevation.

For both measurement events, the general bedrock groundwater flow direction is from south to north, with an average gradient of 0.0042 ft/ft (22 ft/mile). The map of the groundwater levels for December 1994 (Figure 6-6) shows a definite northwest trend to the groundwater flow direction across the central and southern portions of the site. However, the northwest trend may be an artifact of the anomalous reading at well BED-MW-13. In the northwest portion of the site, the groundwater flow direction is toward the east-northeast, from the West Area Red Water Ponds towards the Reactor Area. In the northeast portion of the site, the groundwater flow direction is towards the north-northwest.

The map of groundwater levels from the March 1995 measurements (Figure 6-7) may be more representative of conditions at the site. All wells had time to recover from drilling, development, and sampling activities. In the southern and eastern portions of the site (across TNT Areas A and B), groundwater contours indicate flow towards the north, with a slight northwesterly component. In the western portion of the site (across TNT Area C and West Area Red Water Ponds), groundwater contours indicate flow toward the northeast. Bedrock groundwater flow is indicated from the TNT Area C and the West Area Red Water Ponds toward the Pentolite Road Red Water Pond and Reactor Area.

The direction of groundwater flow in the bedrock may be correlated with the bedrock type. Figure 2-2 shows the location and orientation of the bedrock units underlying the PBS. The Delaware Limestone outcrops in the northwestern portion of the PBS. The assumed contact of the Delaware Limestone with the Plum Brook Shale trends northeast. Southeast of the contact between the Delaware Limestone and the Plum Brook Shale, the direction of groundwater flow in the bedrock is to the north-northwest. Where the Delaware Limestone is present, the direction of groundwater flow is toward the north-northeast. The bending in the groundwater contours

correlates well with the assumed contact between the Delaware Limestone and the Plum Brook Shale.

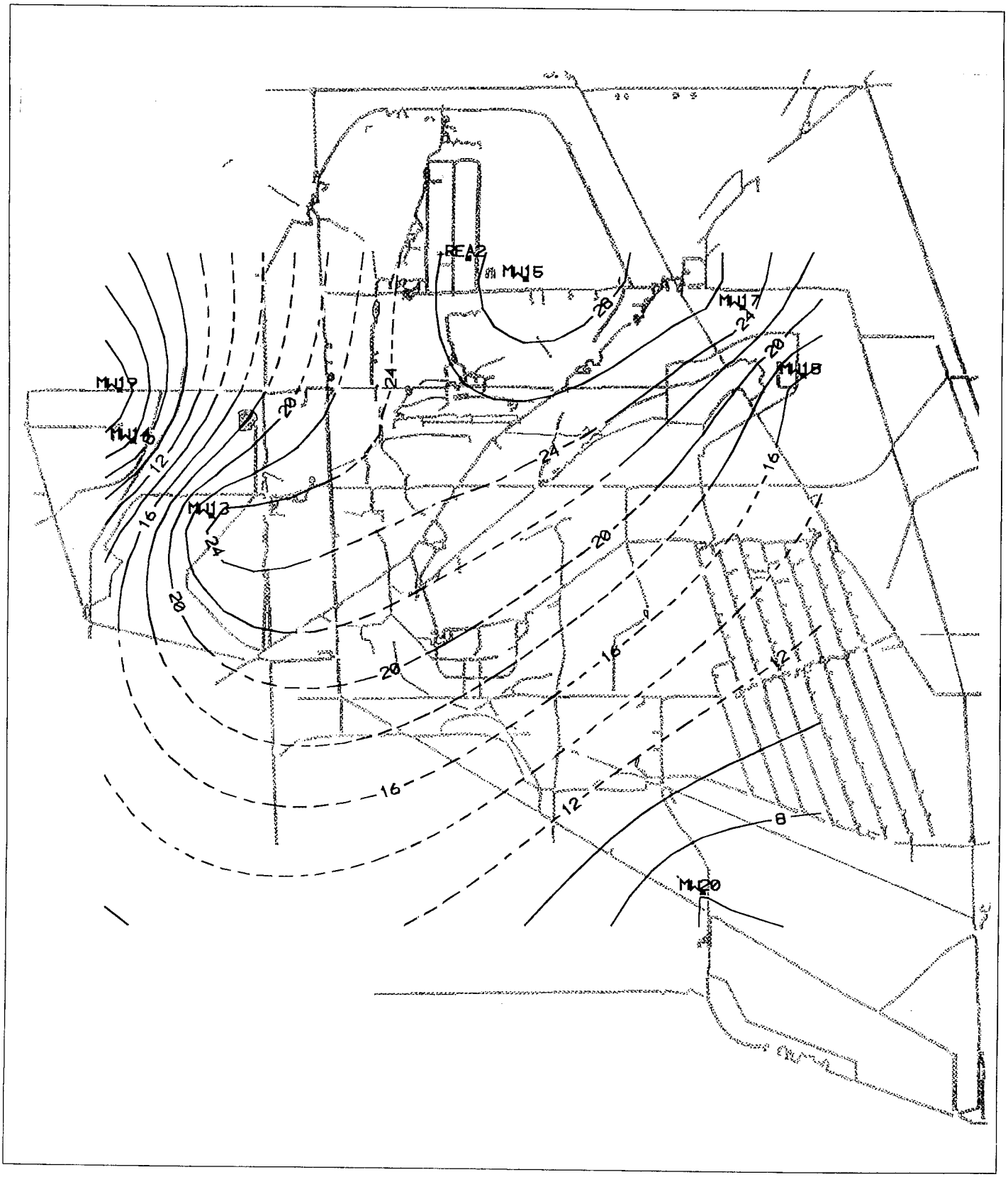
6.1.1.4 Groundwater Flow Between the Overburden and Bedrock Hydrostratigraphic Units

The overburden hydrostratigraphic unit is directly on top of the bedrock in this area. The well boring logs showed no physical evidence of any flow barrier between the overburden and the bedrock. Groundwater flow occurs between the overburden and the bedrock. The rate of groundwater flux between the two units is controlled by the hydraulic gradient and the hydraulic conductivity contrast between the two hydrostratigraphic units.

A cursory examination of the maps of the groundwater levels in both the overburden and the bedrock shows that groundwater levels in the overburden are consistently higher than groundwater levels in the bedrock. These differences in hydraulic heads indicate that downward hydraulic gradients exist throughout the site, and groundwater flows from the overburden to the bedrock.

No well pairs were installed to evaluate the true vertical gradients present at the site. However, the vertical gradient distribution across the site can be approximated. Figure 6-8 is a map showing the approximate difference in hydraulic head between the overburden and bedrock wells in March 1995. This map was constructed by contouring the water levels in the overburden wells, and then noting the difference between the contoured water level and the measured water levels in the bedrock wells. This difference in water levels was then contoured to produce Figure 6-8. The data for March 1995 is presented, because the data for December 1994 appears to be biased due to the anomalous water level at well BED-MW-13. It must be stressed that the head differences indicated by Figure 6-8 are approximate, and only represent one method of estimating the head differences in the absence of paired wells.

Figure 6-8 indicates that the smallest difference in hydraulic heads is in the south at well BED-MW-20. This portion of the map may be inaccurate, because no overburden



3000 1500 0 3000 6000 FEET

Approximate Scale

N

Figure 6-8

OVERBURDEN/BEDROCK HYDRAULIC HEAD DIFFERENCES CONTOUR MAP

March 1995

Plum Brook Ordnance Works

Sandusky, Ohio

DAMES & MOORE

wells are present near this bedrock well. Small differences in hydraulic heads are also present near the West Area Red Water Ponds. The largest differences in hydraulic heads are at the Pentolite Road Red Water Pond, with head differences up to 30 feet. The northern part of TNT Area A area and the TNT Area C area also have significant head differences, up to 25 feet. At the TNT Area B area the head differences are between 15 and 25 feet, though these values are interpolated, since no bedrock wells exist in the area.

To evaluate the approximate vertical hydraulic gradients, the difference in hydraulic heads between the overburden and bedrock wells must be established. Water enters the overburden wells over the length of the screened interval below the water table and enters the bedrock wells over the length of the open hole. The midpoint of the intervals over which water enters the well is assumed to be the measurement point for assessing vertical gradients. The overburden wells are generally screened throughout most of the overburden, with screen lengths between about 5 to 25 feet. The bedrock wells are cased from the surface to at least 5 feet into solid bedrock, and then are open to the bottom of the hole. The open interval ranges from about 15 to 30 feet. As a very rough estimate, the average vertical separation of the midpoint of the measurement interval between the overburden and bedrock wells is approximately 25 feet. If an average vertical separation of 25 feet is assumed between the overburden and bedrock wells throughout the site, the vertical gradients range from a low of 0.08 ft/ft up to 1.0 ft/ft. These vertical gradients are only approximate; however, they indicate the range of vertical gradients present at the site.

The indicated vertical gradients are much greater than the horizontal gradient within either hydrostratigraphic unit. The strong vertical gradients implies that groundwater within the overburden unit will tend to move downward into the bedrock rather than migrate horizontally within the overburden unit.

Given the strong vertical gradients, only a high hydraulic conductivity contrast would prevent downward migration of groundwater from the overburden unit into the bedrock. The high hydraulic conductivity contrast would require that the bedrock be significantly lower in hydraulic conductivity than the overburden. Since the hydraulic

conductivity of neither unit is well known, it is difficult to estimate whether significant downward migration occurs.

6.1.2 Groundwater Flow Characterization in the Overburden in the Red Water Ponds Areas

Groundwater flow patterns are characterized for each of the two red water ponds areas for the overburden hydrostratigraphic unit. These patterns are evaluated from the two rounds of groundwater level measurements. Where bedrock measurements are available near an investigation area, the relationship of groundwater flow between the overburden and the bedrock hydrostratigraphic units is examined.

6.1.2.1 West Area Red Water Ponds

Six overburden and two bedrock wells are located near the West Area Red Water Ponds, including well TNTC-MW3. The water levels of all wells except MK-MW10 were measured in two rounds, and the results are included in Tables 6-2 and 6-3. The depth to bedrock and overburden thickness are derived from the sitewide overburden thickness evaluation included in Section 6.1.1.1 above.

The top of bedrock surface in the vicinity of the West Area Red Water Ponds is very flat. In the center of the area, the elevations of the top of bedrock are all between 618 and 620 feet. To the north, the top of bedrock was not encountered in wells MK-MW11 or MK-MW12, but the bedrock well BED-MW-19 had a top of bedrock elevation of 621 feet. To the south, the elevation of the top of bedrock at well TNTC-MW3 is 628 feet.

The overburden thickness at the West Area Red Water Ponds reaches a maximum of 22 feet on the north side of the ponds, and decreases in thickness to both the north and the south. To the north, the overburden thickness decreases slightly to 19 feet at well BED-MW-19. The overburden thickness on the south side of the pond is only 12 feet at well WA-MW2, but this thickness may be biased due to the location of the

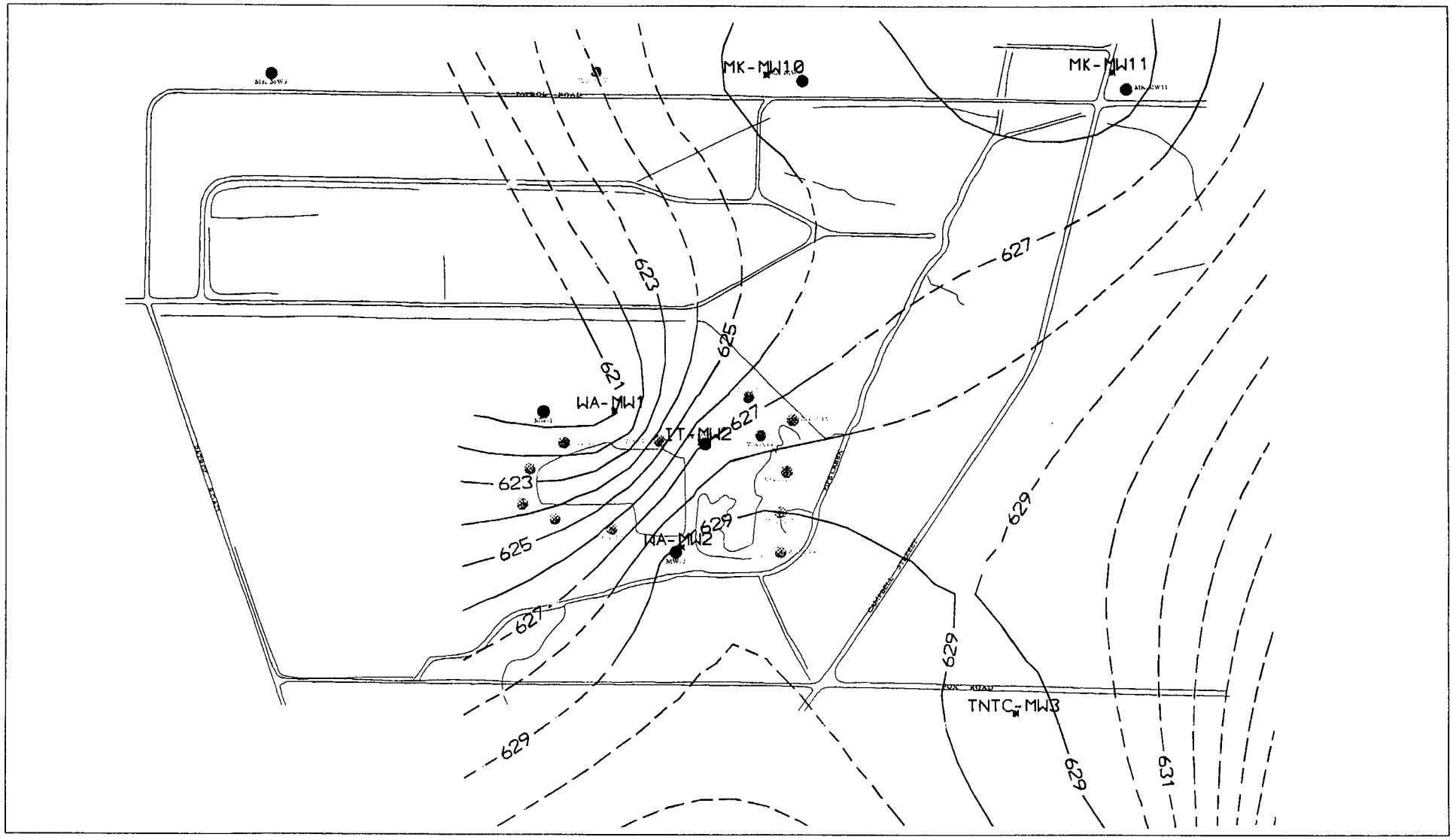
well near the dike between the two ponds and Pipe Creek. Further south, the overburden thickness at well TNTC-MW3 is 14 feet.

Figures 6-9 and 6-10 are contour maps of the groundwater elevations in the overburden for the first and second measurement rounds respectively (December 1994 and March 1995) across the area surrounding the West Area Red Water Ponds. These maps are based primarily on the six overburden groundwater wells in the area, but information from other areas is also used to extrapolate the groundwater contours.

The maps of the groundwater elevations for the two measurement periods show similar directions of groundwater flow, but the groundwater gradients and elevations are somewhat different. In both, the groundwater flow direction across the area is from southeast to northwest, but during December 1994 the gradient is significantly lower. Both show the steepest gradients in the immediate vicinity of the pond, with flatter gradients to both the south and the north.

During December 1994 (Figure 6-9), the groundwater table surface has a steep gradient across the pond, with an elevation drop of approximately 10 feet from well WA-MW2 on the southeast corner of the pond to well WA-MW1 on the northwest corner of the pond. However, east of the pond, the slope in the groundwater table surface is much less steep, with an elevation drop of approximately 3 ft from well TNTC-MW3 south of the area to well MK-MW11 north of the area. During March 1995 (Figure 6-10), the gradient across the pond is significantly steeper, with an elevation drop of over 12 feet from well WA-MW2 to well WA-MW1, and an elevation drop of about 14 feet from well IT-MW2 to well WA-MW1. East of the pond, the slope in the groundwater table surface is less steep than across the pond, but steeper than during the December 1994. The elevation drop between well TNTC-MW3 and well MK-MW11 is approximately 8 feet. Well MK-MW10 was not measured during March 1995, so the contours in that region of the map are interpolated.

Well WA-MW1 had the deepest measured water level below ground surface for any overburden well within the PBS, approximately 25 feet deep for both measurement periods. It was also the only overburden well at the site that showed a decrease in water level from December 1994 to March 1995. All other wells in the area had



650 325 0 650 1300 FEET

Approximate Scale

N

Figure 6-9
WEST AREA
RED WATER PONDS OVERBURDEN
WATER TABLE CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

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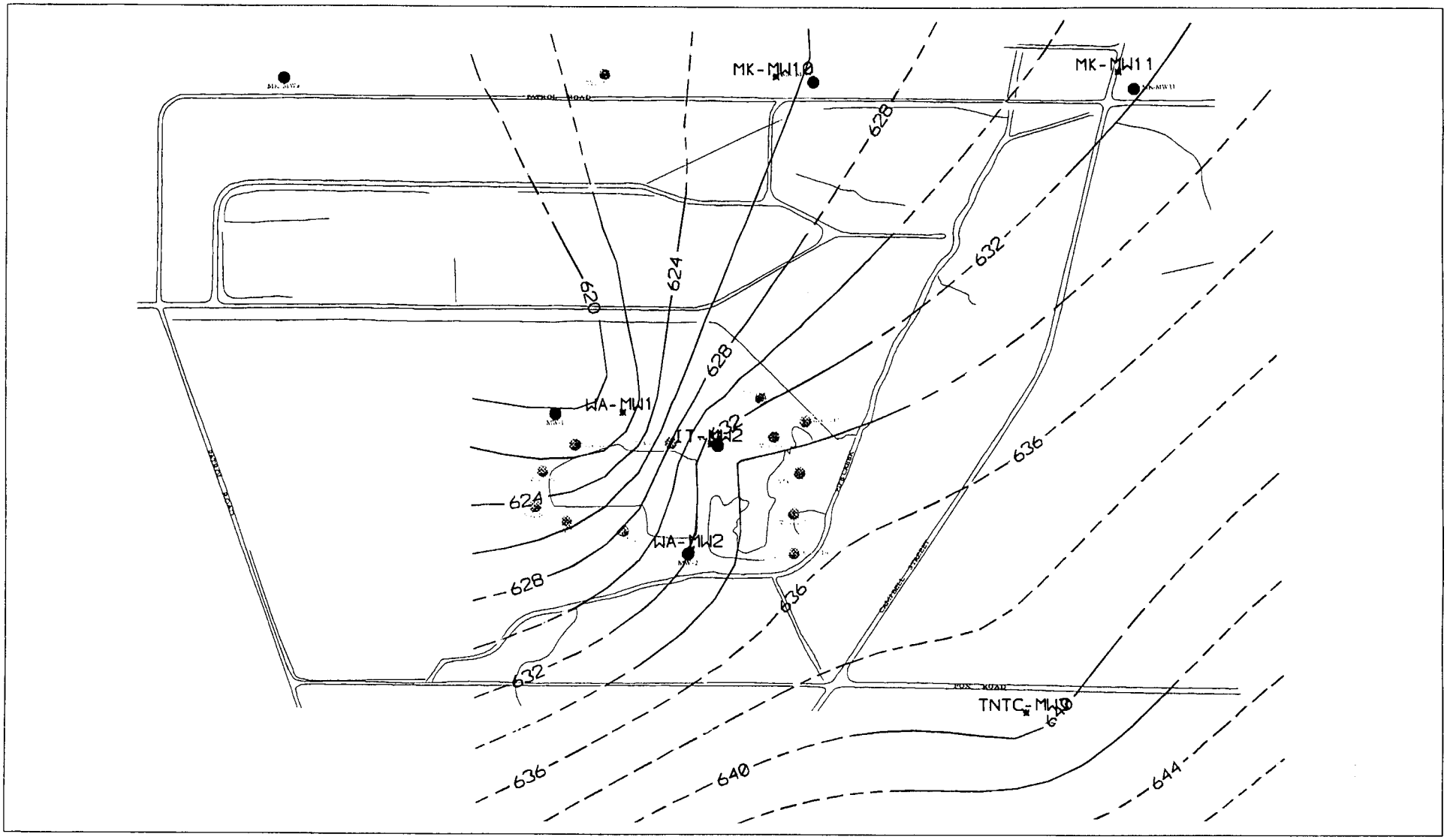

650 325 0 650 1300 FEET

Approximate Scale

N

Figure 6-10
WEST AREA
RED WATER PONDS OVERBURDEN
WATER TABLE CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

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depths to groundwater between 4 to 14 feet during the December sampling period. The increase in groundwater levels between the two measurement dates ranged from 2 to 7 feet.

Based on the steep groundwater gradient across the pond, it appears that the West Area Red Water Pond is poorly connected hydraulically to the overburden aquifer. If a hydraulic connection did exist, the groundwater elevations near the pond would be influenced by the surface water elevation in the pond, and the groundwater gradient would be relatively flat across the pond.

No apparent correlation exists between the thickness of overburden and groundwater levels or pattern of groundwater flow at the West Area Red Water Ponds.

Two bedrock wells are located in the vicinity of West Area Red Water Ponds, well BED-MW-14 near the pond and well BED-MW-19 to the north of the area. The bedrock in this area is mainly limestone to the northwest, and shale to the southeast. The contact between the shale and limestone is located near the southeast corner of the pond.

The groundwater elevation at BED-MW-14 was 621.76 feet in December 1994, and increased to 624.39 feet in March 1995. The groundwater elevation at well BED-MW-19 also increased from 621.07 feet in December 1994 to 623.53 feet in March 1995. The sitewide bedrock groundwater contour maps (Figures 6-6 and 6-7) indicate bedrock groundwater flow toward the northeast across the West Area Red Water Ponds region. As in the other areas of the site, downward gradients exist from the overburden to the bedrock, with approximate groundwater elevation differences of between 2 and 8 feet. These groundwater elevation differences are smaller than in other areas, indicating larger downward gradients. It is possible that the larger downward gradients are due to the presence of more permeable limestone bedrock. The more permeable limestone bedrock may allow a greater degree of hydraulic connection between the overburden and bedrock hydrostratigraphic units. Additional evidence of a greater degree of hydraulic connection is the fact that both bedrock wells experienced an increase in groundwater elevations from December 1994 to March 1995, reflecting the behavior of the overburden wells.

6.1.2.2 Pentolite Road Red Water Ponds

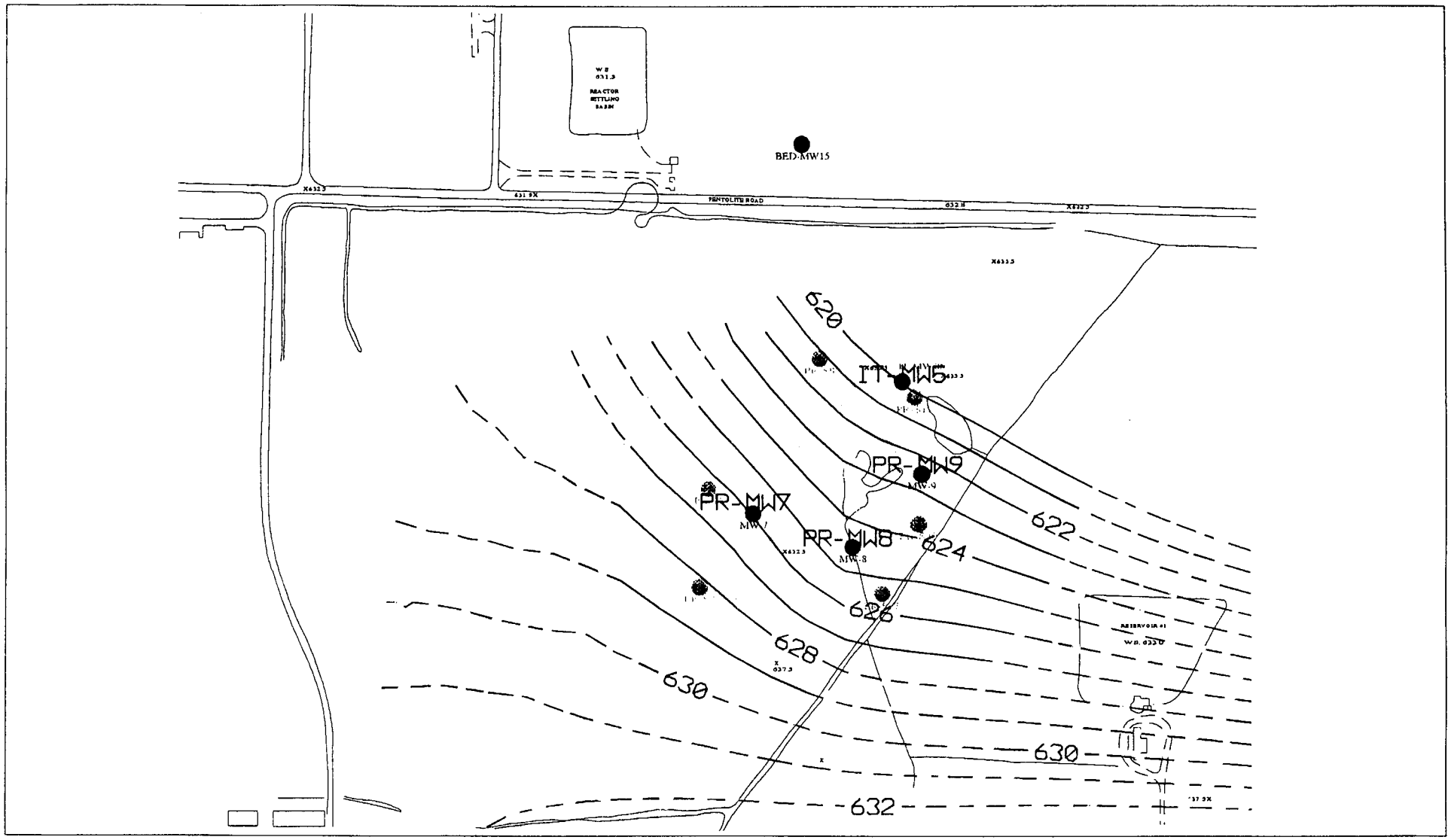
Four overburden and two bedrock wells are located near the Pentolite Road Red Water Ponds, including Reactor Well 2. The water levels of all wells were measured in two rounds, and the results are included in Tables 6-2 and 6-3. The depth to bedrock and overburden thickness are derived from the sitewide overburden thickness evaluation included in Section 6.1.1.1 above.

The top of bedrock surface in the vicinity of the Pentolite Road Red Water Ponds is relatively flat, with top of bedrock elevations between 605 and 611 feet throughout the area. South of the area, the top of bedrock trough is present. North of the area no data is available to evaluate the top of bedrock elevations. The bedrock in this area is shale. The overburden thickness near the Pentolite Road Red Water Ponds is also relatively constant, with a thickness of between 19 and 27 feet. No general pattern is apparent in the distribution of the overburden thickness in the vicinity of the Pentolite Road Red Water Ponds.

Figures 6-11 and 6-12 are contour maps of the groundwater elevations in the overburden for the first and second measurement rounds, respectively (December 1994 and March 1995) across the area surrounding the Pentolite Road Red Water Ponds. These maps are based primarily on the four overburden groundwater wells in the area, but information from other areas is also used to extrapolate the groundwater contours.

The maps of the groundwater elevations for the two measurement dates show similar directions of groundwater flow, but different gradients. The groundwater flow direction across the area is mainly from southwest to northeast, with the March 1995 measurements showing a more pronounced easterly component of groundwater flow. In December 1994, the groundwater levels reflect a significantly steeper groundwater gradient across the area than in March 1995.

During December 1994 (Figure 6-11), the groundwater table surface has a relatively steep gradient in the vicinity of the former ponds, with an elevation drop of



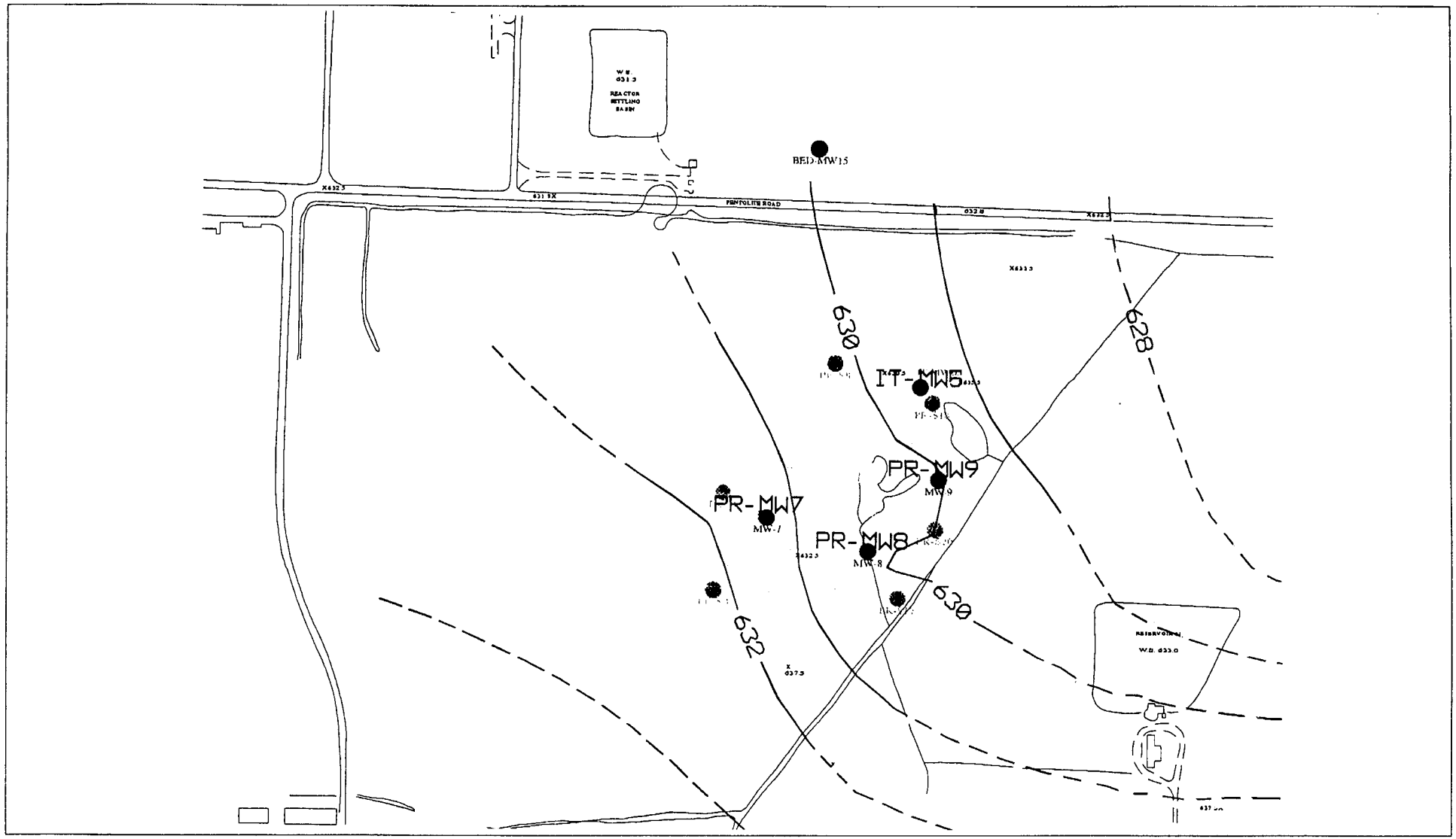
500 250 0 500 1000 FEET

Approximate Scale

N

Figure 6-11
PENTOLITE ROAD
RED WATER PONDS OVERBURDEN
WATER TABLE CONTOUR MAP
December 1994
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



500 250 0 500 1000 FEET

Approximate Scale

N

Figure 6-12
PENTOLITE ROAD
RED WATER PONDS OVERBURDEN
WATER TABLE CONTOUR MAP
March 1995
Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

approximately 6 feet from well PR-MW7 to well IT-MW5. During March 1995 (Figure 6-12), the gradient across the former ponds is less steep, with an elevation drop of only about 2 feet.

The depth to groundwater ranged from 7 to 15 feet for the wells in the area during December 1994, and ranged from 2 to 5 feet during March 1995. All overburden wells showed an increase in water levels in March 1995, with an average increase of nearly 7 feet. No apparent correlation exists between the thickness of overburden and groundwater levels or pattern of groundwater flow at the Pentolite Road Red Water Ponds.

Water levels were measured in two bedrock wells are located in the vicinity of Pentolite Road Red Water Ponds, well BED-MW-15 and the Reactor Well 2. Both wells are located north of the area. The bedrock is shale. Both bedrock wells experienced a decrease in measured groundwater levels between the two measurement dates, with well BED-MW15 decreasing about 5 feet and Reactor Well 2 decreasing nearly 13 feet.

The sitewide bedrock groundwater contour maps (Figures 6-6 and 6-7) indicate bedrock groundwater flow toward the northeast across the Pentolite Road Red Water Ponds region. The groundwater elevation differences between the overburden and the bedrock are the largest on the site, ranging between 28 and 30 feet. It is possible that very little hydraulic connection between the bedrock and overburden exists in this area, based on two lines of evidence. First, the high head differences between the overburden and bedrock show a significant barrier to flow between the two hydrostratigraphic units. Second, the overburden wells increased in hydraulic head by an average of 7 feet during the same period that the bedrock wells both showed decreases in head.

6.1.3 General Conclusions

Both red water ponds areas showed significantly higher groundwater levels in the overburden than the underlying bedrock. The greatest differences occurred at the Pentolite Road Red Water Ponds, and the smallest differences occurred at the West

Area Red Water Ponds. The West Area Red Water Ponds area is the only area located in limestone bedrock, which may account for the close hydraulic connection between the overburden and bedrock in this area.

The vertical flow gradients ranged from 0.1 to 1.0 ft/ft in most areas. The vertical gradients are up to two orders of magnitude higher than the horizontal gradients in all areas.

6.2 GROUNDWATER QUALITY

The results of the chemical analysis of the groundwater samples collected from the seven overburden wells and four bedrock wells installed in the vicinity of the two red water ponds areas are discussed below. Samples from all 11 wells were analyzed for explosives residues, nitrates, and total and dissolved concentrations of 14 metals, the 13 priority pollutant metals plus manganese. Samples from the four bedrock wells were also analyzed for VOCs and SVOCs. The results of the chemical analysis of the samples from the Pentolite Road Red Water Ponds and the West Area Red Water Ponds are discussed in Section 6.2.1 and 6.2.2, respectively. Establishment of a PQL for explosives residues compounds was previously discussed in Section 4.0. Copies of the laboratory reports, which include explosives residues concentrations detected above the MDL but below the PQL, are included in Appendix J.

Measurements of the physical parameters pH, specific conductance, and temperature were gathered during sample collection. These measurements are discussed in Section 6.2.3.

A summary of the groundwater quality for the two red water ponds areas is provided in Section 6.2.4.

6.2.1 Pentolite Road Red Water Ponds

Samples were collected from four overburden wells and two bedrock wells installed in the vicinity of the former Pentolite Road Red Water Ponds.

6.2.1.1 Explosives Residues

Explosives residues were detected at concentrations above the PQL in three of the overburden wells and one of the bedrock wells in the area of the former Pentolite Road Red Water Ponds. Significant levels of nitroaromatics were detected in two overburden wells, DM-MW7 and DM-MW8. Concentrations above the PQL are listed in Table 6-4 and are illustrated on Figure 6-13.

The highest concentrations of explosives residues were detected in the sample collected from well DM-MW7. Relatively low levels of explosives residues were detected throughout the 10 foot length of soil boring PR-S4, the boring which was converted into well DM-MW7. However, red water was noted in the split spoon samples retrieved as the boring was advanced below 10 feet. Of the seven explosives residues detected in well DM-MW7, three were present at significantly high concentrations. 1,3,5-TNB, 1,3-DNB, and 2,4-DNT were reported at concentrations of 5,700 μg/L, 3,000 μg/L, and 980 μg/L, respectively. These three nitroaromatics are among the compounds removed from TNT in the washing process that generates the "red water." 4-Am-2-NT, a product of plant mediated biotransformation of 2,4-DNT was present at a concentration of 66 μg/L. The other three nitroaromatics in the sample, 2,4,6-TNT, 2,6-DNT, and 3,4-DNT, were each present at concentrations of 30 μg/L or less.

Significant levels of nitroaromatics were also detected in well DM-MW8, which was installed in soil boring PR-S14. The purge water that was removed from well DM-MW8 during sampling was red. The highest levels of explosives residues detected in the soils at the Pentolite Road Red Water Ponds were present in the samples from this boring, including high levels of 2,4,6-TNT. As with well DM-MW7, the nitroaromatics reported at the highest levels were 1,3,5-TNB, 1,3-DNB, and 2,4-DNT. The

TABLE 6-4

EXPLOSIVES RESIDUES CONCENTRATIONS
GROUNDWATER MONITORING WELLS

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
West Area Red Water Ponds Overburden Wells	DM-MW2	34	550		320	12		75		5.7					470
	IT-MW2		390		340	24	14		5.1						340
	MK-MW11														
	WA-S16-P		20,000		9,200	850	190	1,500	370	63			110	22	7,200
Pentolite Road Red Water Ponds Overburden Wells	DM-MW7	30	5,700		980	17	66	11							3,000
	DM-MW8	64	1,300		440	33	37	41	10	11					790
	DM-MW9				9.5										49
	IT-MW5														
Bedrock Wells	BED-MW14													11	
	BED-MW15														
	BED-MW19											8.1			
	BED-MW20											53			
	Reactor Well 2							13				23			
QC Samples	DM-MW22	26	570		250	10				5.2					400
	Drill Water		13												

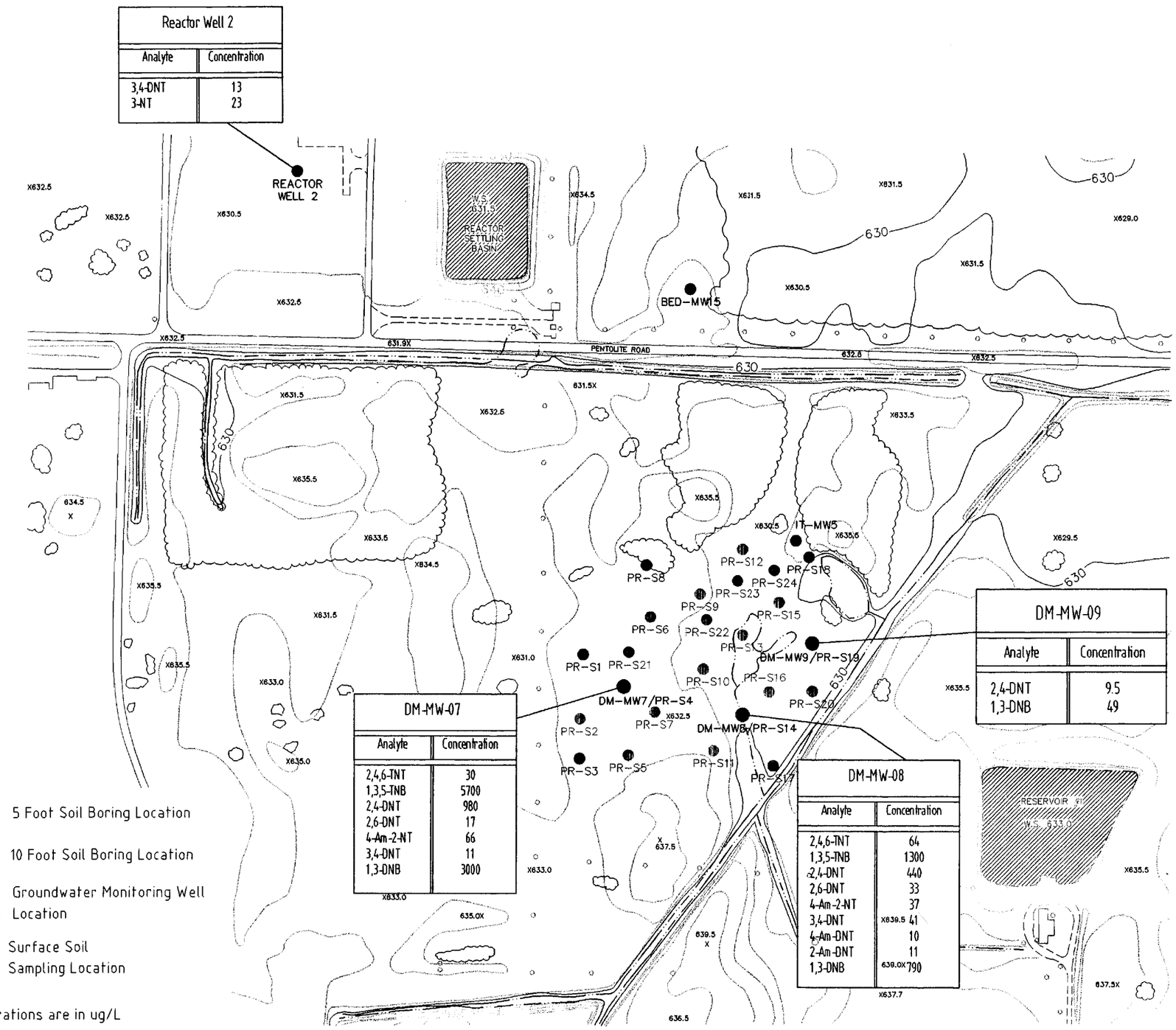
Concentrations are listed in µg/L or ppb.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson, IT = IT Corporation); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the Practical Quantitation Limit (PQL) are listed on the table. Concentrations corresponding to the blank boxes were either below the laboratory detection limit (BDL) or above BDL but less than the PQL.

QC sample DM-MW22 is a duplicate of sample DM-MW2.
Sample WA-S16-P was collected from a test pit excavated on the north bank of the west pond.

G:\WP\C\COE\PLUM-BRO.OK\REDWATER\TAB6-4.WPD



Reactor Well 2	
Analyte	Concentration
3,4-DNT	13
3-NT	23

DM-MW-07	
Analyte	Concentration
2,4,6-TNT	30
1,3,5-TNB	5700
2,4-DNT	980
2,6-DNT	17
4-Am-2-NT	66
3,4-DNT	11
1,3-DNB	3000

DM-MW-08	
Analyte	Concentration
2,4,6-TNT	64
1,3,5-TNB	1300
2,4-DNT	440
2,6-DNT	33
4-Am-2-NT	37
3,4-DNT	41
4-Am-DNT	10
2-Am-DNT	11
1,3-DNB	790

DM-MW-09	
Analyte	Concentration
2,4-DNT	9.5
1,3-DNB	49

PR-S1 — 5 Foot Soil Boring Location

PR-S2 — 10 Foot Soil Boring Location

DM-MW8/PR-S14 — Groundwater Monitoring Well Location

PR-S21 — Surface Soil Sampling Location

Concentrations are in ug/L

Scale: 1" = 500'

FIGURE 6-13
EXPLOSIVES RESIDUES CONCENTRATIONS
IN PENTOLITE ROAD
RED WATER PONDS GROUNDWATER

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

FILENAME: H:\CAD\COE-PLUM\PLOT\GWEXPRPT.DWG

concentrations were 1,300 μg/L, 790 μg/L, and 440 μg/L, respectively. 2,4,6-TNT, which was detected at very high levels in the soil samples collected from 3 to 10 feet in the boring for this well, was detected in the groundwater sample at a concentration of 64 μg/L. Two other likely components of red water from the TNT washing process, 2,6-DNT and 3,4-DNT, were detected at concentrations of 33 μg/L and 41 μg/L, respectively. Also, three biotransformation products were detected. 4-Am-2-NT was detected at a concentration of 37 μg/L. 4-Am-DNT and 2-Am-DNT, microbially mediated biotransformation products of TNT, were also detected.

Only two nitroaromatics were detected in the sample collected from well DM-MW9. 1,3-DNB and 2,4-DNT were detected at concentrations of 49 μg/L and 9.5 μg/L, respectively. This well is located on the eastern boundary of the Pentolite Road Red Water Ponds and, based on a 1956 aerial photograph, is just outside the pond perimeter. However, as stated in Section 5, it is possible that the pond configuration was larger during plant operation and that this location was at one time within the pond area.

No explosives residues were detected in the sample collected from well IT-MW5.

Similarly, no explosives residues were detected in the sample collected from bedrock well BED-MW15 which is located downgradient of the former pond area. However, low levels of two nitroaromatics were detected in Reactor Well 2 which is also located on the north, or downgradient, side of the former pond area. 3-NT and 3,4-DNT were detected at concentrations of 23 μg/L and 13 μg/L, respectively.

6.2.1.2 Nitrates

Significant levels of nitrates were present in each of the three overburden wells in which explosives residues were detected. The nitrate concentrations are listed on Table 6-5. In wells DM-MW7, DM-MW8, and DM-MW9, the nitrate concentrations were 80 milligrams per liter (mg/L), 650 mg/L, and 50 mg/L, respectively. All of these concentrations are significantly above the EPA established Maximum Contaminant Level (MCL) of 10 mg/L for nitrates.

TABLE 6-5

NITRATE CONCENTRATIONS IN GROUNDWATER

	Sample ID	Nitrates (mg/L)
West Area Red Water Ponds	DM-MW2	15
	IT-MW2	12
	MK-MW11	0.2
Pentolite Road Red Water Ponds	DM-MW7	80
	DM-MW8	650
	DM-MW9	50
	IT-MW5	0.1
Bedrock Wells	BED-MW14	3.3
	BED-MW15	0.5
	BED-MW19	0.2
	BED-MW20	0.2
	Reactor Well 2	0.2
QC Samples	DM-MW22	16
	Drill Water	0.3

mg/L = milligrams per liter or ppm.

QC sample DM-MW22 is a duplicate of sample DM-MW2.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson, IT = IT Corporation); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

In the fourth overburden well at the Pentolite Road Red Water Ponds, well IT-MW5, the nitrate concentration was only 0.1 mg/L, well below the MCL. As stated previously, no explosives residues were detected in the sample from this well. This nitrate concentration was comparable to concentrations in the wells in other areas of the site sampled for the TNT Areas Site Investigation and concentrations in all of the bedrock wells.

Nitrate concentrations in both bedrock wells, 0.5 mg/L and 0.2 mg/L, respectively, in well BED-MW15 and Reactor Well 2, were also well below the MCL.

6.2.1.3 VOCs and SVOCs

VOCs and SVOCs were analyzed only for the samples collected from the two bedrock wells. Table 6-6 lists the concentrations detected in each well at the two red water ponds areas. The concentrations are illustrated on Figure 6-14.

Six VOCs, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylenes, were detected in the Pentolite Road Red Water Ponds area bedrock wells. Three of the four hydrocarbon compounds, benzene, ethylbenzene, and xylenes, normally associated with fuels (benzene, toluene, ethylbenzene, xylenes [BTEX]) were detected in both wells. Toluene was detected only in well BED-MW15 which is located north of Pentolite Road. BTEX concentrations were significantly higher in well BED-MW15 than in Reactor Well 2. Generally, the concentrations in BED-MW15 were two orders of magnitude greater than in Reactor Well 2. Releases of hydrocarbon fuels have been investigated by NASA in the past.

Acetone was detected in Well BED-MW15 at a concentration of 660 μg/L. Acetone is a common solvent with a wide variety of common industrial uses. Acetone is also used in the manufacture of pentolite, one of the products of the PBOW. However, acetone is very volatile and it is unlikely that acetone released to the environment during the operation of the PBOW would persist for over 40 years.

TABLE 6-6

VOC AND SVOC CONCENTRATIONS IN BEDROCK WELLS

	VOCs								SVOCs		
	Sample ID	Acetone	Benzene	2-Butanone	Carbon Disulfide	Ethyl-benzene	Toluene	Xylenes	2,4-Dimethyl-phenol	2-Methyl-naphthalene	Naphthalene
Bedrock Wells	BED-MW14					1.6	3	14			
	BED-MW15	660	830		1,500	180	540	1,300		70	60
	BED-MW19	59	5		26	3	5	26			
	BED-MW20		8				4	3			
	Reactor Well 2		1.8			1.2		8			
QC Sample	Drill Water										

VOCs = Volatile organic compounds
SVOCs = semivolatile organic compounds

Concentrations are listed in μg/L or ppb.

All samples listed in the Sample ID column (column 2) were analyzed for all analytes on the VOC and SVOC method analysis lists. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are abbreviated. "BED" indicates a well completed in the bedrock. The well number is designated by MW (e.g., MW13).

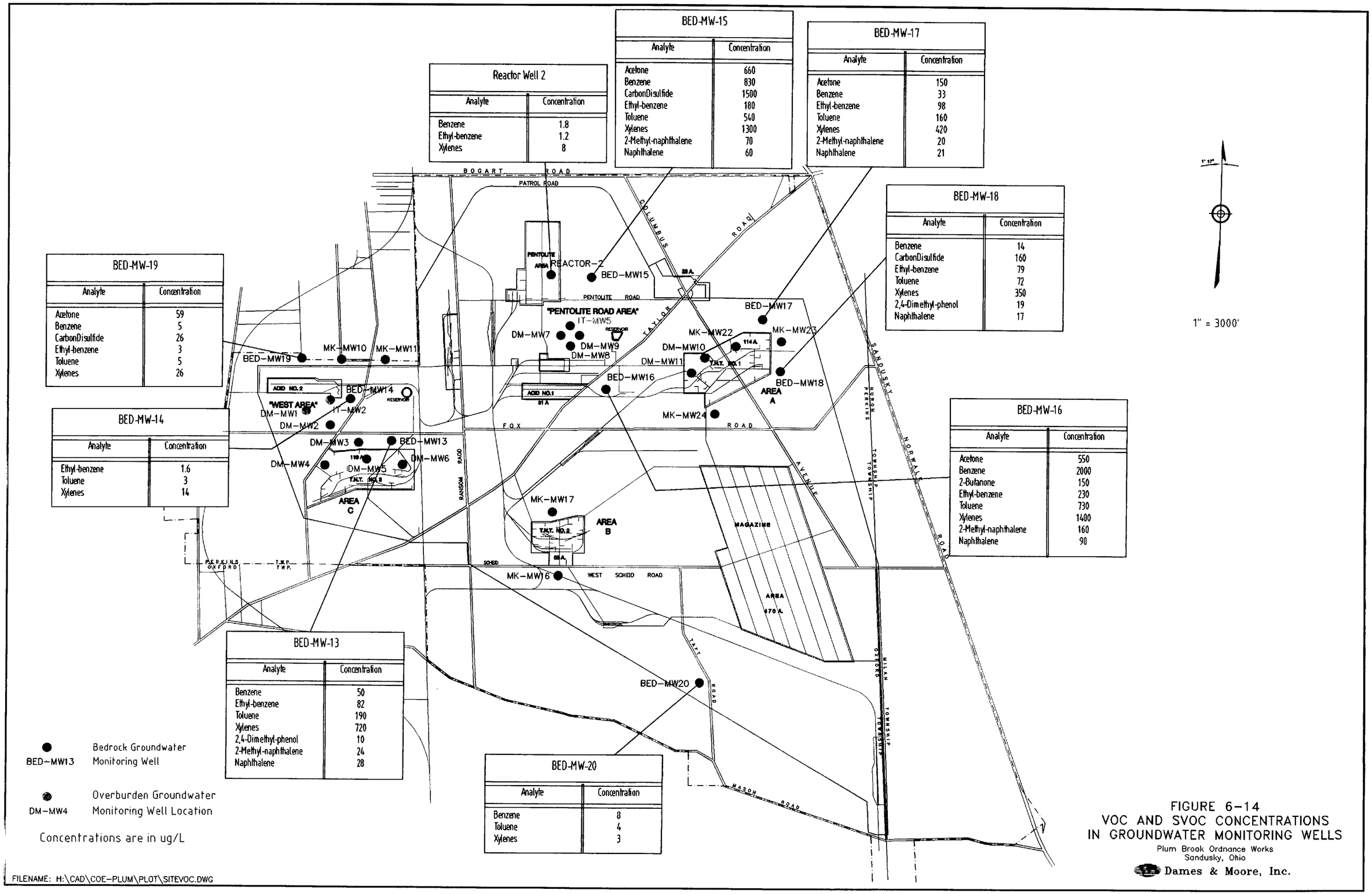


FIGURE 6-14
VOC AND SVOC CONCENTRATIONS
IN GROUNDWATER MONITORING WELLS
Plum Brook Ordnance Works
Sandusky, Ohio
Dames & Moore, Inc.

H:\CAD\COE-PLUM\PLOT\SITEVOC Thu Apr 03 20:44:20 1997 Dames & Moore - Atlanta, GA

Carbon disulfide was also detected in Well BED-MW15 at a concentration of 1,500 μg/L. Carbon disulfide is often found in association with hydrocarbons and associated compounds. Among its many used include the manufacture of dyes, explosives, and rocket fuels.

Two SVOCs were detected in bedrock well BED-MW15. 2-methylnaphthalene and naphthalene were reported at concentrations of 70 μg/L and 60 μg/L, respectively. No SVOCs were detected in Reactor Well 2. Also, no SVOCs were present in the background well sample.

6.2.1.4 Metals

At the Pentolite Road Red Water Ponds, eight metals (antimony, chromium, copper, lead, manganese, nickel, thallium, and zinc) were detected in the groundwater samples. The metals concentrations in both the filtered and unfiltered samples are listed on Table 6-7 and illustrated on Figure 6-15.

Antimony

Antimony was detected in only one well and only in the filtered sample. The concentration in bedrock well BED-MW15 was 18 μg/L which exceeds the MCL of 6 μg/L. As was noted in Section 4, antimony concentrations in filtered groundwater samples are probably related to the sample collection process.

Chromium

Chromium was detected in two overburden wells, DM-MW7 and DM-MW8, at the Pentolite Road Red Water Ponds. Chromium was present in both the unfiltered and the filtered samples in both wells. In both cases, the concentration in the unfiltered sample was about 50 percent higher. Therefore, it is likely that some of the chromium in the unfiltered samples is related to particulate matter, but chromium does appear to

TABLE 6-7

METALS CONCENTRATIONS
GROUNDWATER MONITORING WELLS

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
West Area Red Water Ponds Overburden Wells	DM-MW2-U					14	38	10	1,600		63				88
	DM-MW2-F						20		1,000		60				
	IT-MW2-U						140		2,300		120				34
	IT-MW2-F						130		2,500		130				
	MK-MW11-U								160						30
	MK-MW11-F								180						
Pentolite Road Red Water Ponds Overburden Wells	DM-MW7-U					36	1,400		12,000		2,000			0.9	94
	DM-MW7-F					21	1,100		10,000		1,800			0.7	44
	DM-MW8-U					52	1,600		8,000		2,500				52
	DM-MW8-F					38	1,400		7,000		2,100				50
	DM-MW9-U						770		1,800		1,500				60
	DM-MW9-F						760		1,800		1,600				70
	IT-MW5-U								100						27
	IT-MW5-F								100						

Concentrations are listed in $\mu g/L$ or ppb.

All Samples listed in the Sample ID Column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson, IT = IT Corporation); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

Sample DM-MW2 is a duplicate of QC sample DM-MW22.

TABLE 6-7
(Continued)

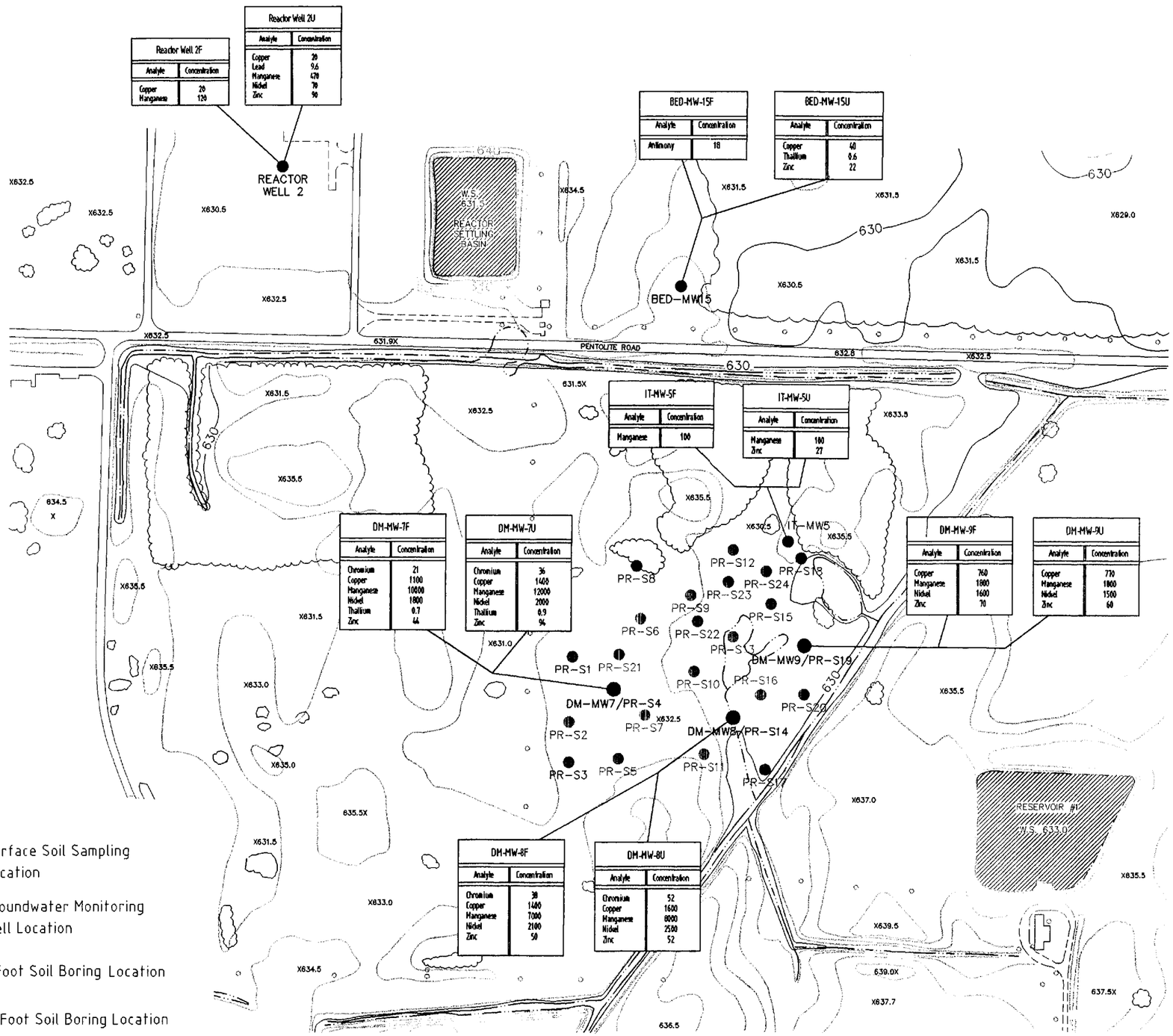
	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Bedrock Wells	BED-MW14-U													0.5	28
	BED-MW14-F														
	BED-MW15-U						40							0.6	22
	BED-MW15-F	18													
	BED-MW19-U						22							0.6	24
	BED-MW19-F	8													
	BED-MW20-U						54		140						24
	BED-MW20-F								140						
	Reactor Well 2-U						20	9.6	470		70				90
	Reactor Well 2-F						20		120						
QC Samples	DM-MW22-U						32	4	1,800		47			0.5	63
	DM-MW22-F						20		970		60				
	Drill Water-U						20	3.1							110
	Drill Water-F	10													240

Concentrations are listed in $\mu g/L$ or ppb.

All Samples listed in the Sample ID Column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson, IT = IT Corporation); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

QC sample DM-MW22 is a duplicate of sample DM-MW2.



Reactor Well 2F	
Analyte	Concentration
Copper	20
Manganese	129

Reactor Well 2U	
Analyte	Concentration
Copper	20
Lead	9.6
Manganese	470
Nickel	70
Zinc	90

BED-MW-15F	
Analyte	Concentration
Antimony	18

BED-MW-15U	
Analyte	Concentration
Copper	40
Thallium	0.6
Zinc	22

IT-MW-5F	
Analyte	Concentration
Manganese	100

IT-MW-5U	
Analyte	Concentration
Manganese	180
Zinc	27

DM-MW-7F	
Analyte	Concentration
Chromium	21
Copper	1100
Manganese	10000
Nickel	1800
Thallium	0.7
Zinc	44

DM-MW-7U	
Analyte	Concentration
Chromium	36
Copper	1400
Manganese	12000
Nickel	2000
Thallium	0.9
Zinc	94

DM-MW-9F	
Analyte	Concentration
Copper	760
Manganese	1800
Nickel	1600
Zinc	70

DM-MW-9U	
Analyte	Concentration
Copper	770
Manganese	1800
Nickel	1500
Zinc	60

DM-MW-8F	
Analyte	Concentration
Chromium	38
Copper	1400
Manganese	7000
Nickel	2100
Zinc	50

DM-MW-8U	
Analyte	Concentration
Chromium	52
Copper	1600
Manganese	8000
Nickel	2500
Zinc	52

Scale: 1" = 500'

PR-S21 Surface Soil Sampling Location

DM-MW8/PR-S14 Groundwater Monitoring Well Location

PR-S3 5 Foot Soil Boring Location

PR-S5 10 Foot Soil Boring Location

Concentrations are in ug/L

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FIGURE 6-15
METALS CONCENTRATIONS
IN PENTOLITE ROAD
RED WATER PONDS GROUNDWATER

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

be present in the dissolved phase in the groundwater in these two areas. All chromium concentrations detected are below the MCL of 100 μg/L.

Copper

Copper was detected in three of the four overburden wells, DM-MW7, DM-MW8, and DM-MW9, and both of the bedrock wells, BED-MW15 and Reactor Well 2. The concentrations in the unfiltered samples were consistently equal to (Reactor Well 2 only) or higher than in the filtered samples. The highest concentrations, 1,400 μg/L and 1,600 μg/L, were detected in wells DM-MW7 and DM-MW8, respectively. As noted above for chromium, these are the two wells in which red water has been observed. Much lower levels of explosives residues from red water were detected in well DM-MW9. The copper levels in the sample from this well, 770 μg/L in the unfiltered sample and 760 μg/L in the filtered sample, were half the levels detected in wells DM-MW7 and DM-MW8. Copper was not detected in overburden well IT-MW5.

Significantly lower levels of copper were detected in the two bedrock wells. In well BED-MW15, copper was detected in the unfiltered sample at a concentration of 40 μg/L. It was not detected in the filtered sample. Copper was detected in both the filtered and unfiltered samples from Reactor Well 2 at concentrations of 20 μg/L.

The concentrations in all samples from overburden wells DM-MW7 and DM-MW8 were above the MCL of 1,300 μg/L. Concentrations in overburden well DM-MW9 and the two bedrock wells were below the MCL and the Secondary Maximum Contaminant Level (SMCL) of 1,000 μg/L.

Lead

Lead was detected in only one groundwater sample from the Pentolite Road Red Water Ponds. The concentration in the unfiltered sample collected from Reactor Well 2 was 9.6 μg/L. No lead was present in the corresponding filtered samples indicating the lead

may be related to particulate matter in the sample. The reported concentration in the unfiltered sample is below the lead Action Level (AL) of 15 μg/L.

Manganese

Manganese was detected at relatively high concentrations in all four of the overburden well samples. The highest concentrations, 12,000 μg/L in the unfiltered sample and 10,000 μg/L in the filtered sample, were reported in well DM-MW7. The manganese levels in well DM-MW8, 8,000 μg/L in the unfiltered sample and 7,000 μg/L in the filtered sample, were not substantially lower. Concentrations in well DM-MW9 were 1,800 μg/L in both the filtered and unfiltered samples. Nitroaromatics were detected in each of these three samples. The manganese concentrations of 100 μg/L in both the unfiltered and filtered samples from well IT-MW5 were an order of magnitude lower than those in well DM-MW9 and two orders of magnitude lower than in well DM-MW7.

Manganese was not detected in bedrock well BED-MW15. It was, however, present in Reactor Well 2 at concentrations of 470 μg/L and 120 μg/L, respectively in the unfiltered and filtered samples.

Manganese values in all samples in which it was detected exceeded the SMCL of 50 μg/L.

Nickel

Nickel was detected in three of the four overburden wells and one of the bedrock wells. Concentrations in overburden wells DM-MW7, DM-MW8, and DM-MW9 ranged from 1,500 μg/L to 2,500 μg/L. All of these values exceed the MCL of 100 μg/L by an order of magnitude. Concentrations in the unfiltered samples from wells DM-MW7 and DM-MW8 slightly exceeded the concentrations in the filtered samples. However, in well DM-MW9, the concentration of 1,600 μg/L in the filtered sample slightly exceeded the concentration of 1,500 μg/L in the unfiltered sample.

Nickel was detected in the unfiltered sample from Reactor Well 2 at a concentration of 70 μg/L. It was not reported in the corresponding filtered sample. The concentration in this bedrock well is below the MCL of 100 μg/L.

Thallium

Thallium was detected at low levels in two wells at the Pentolite Road Red Water Ponds. Concentrations of 0.9 μg/L and 0.7 μg/L were reported in the unfiltered and filtered samples, respectively, from well DM-MW7. Thallium was also reported in well BED-MW15 at a concentration of 0.6 μg/L in the unfiltered sample. No thallium was reported in the filtered sample.

All three thallium concentrations are below the MCL of 2 μg/L.

Zinc

Zinc was detected in all six groundwater samples collected in this area. In each case, zinc was detected in the unfiltered samples. Concentrations in the overburden wells ranged from 27 μg/L to 94 μg/L in the unfiltered samples and from below the detection limit to 70 μg/L in the filtered samples. In one of the overburden wells, DM-MW9, the concentration in the filtered sample (70 μg/L) was slightly higher than in the unfiltered sample (60 μg/L).

In the two bedrock wells, zinc was detected only in the unfiltered samples. The concentrations were 22 μg/L in well BED-MW15 and 90 μg/L in Reactor Well 2. The fact that zinc was only detected in the unfiltered samples from the bedrock wells appears to indicate that it is related to the presence of particulate matter in these samples. However, zinc does appear to be present in the dissolved phase in the overburden groundwater in this area.

Zinc values were all well below the SMCL of 5,000 μg/L.

6.2.2 West Area Red Water Ponds

Three overburden wells and two bedrock wells were sampled at the West Area Red Water Ponds. As stated previously, well DM-MW1, MK-MW9, and MK-MW10 did not contain enough water to obtain samples.

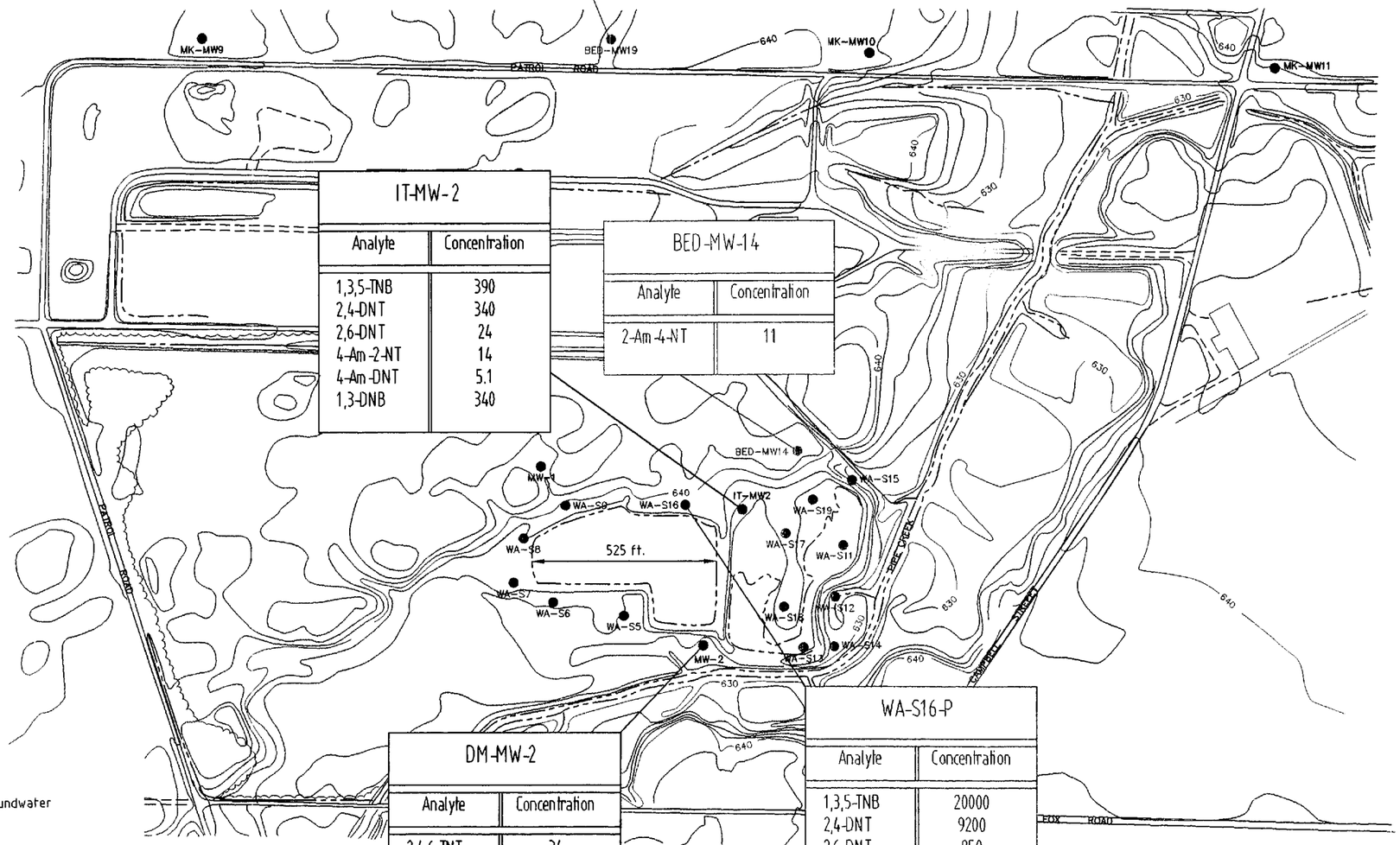
6.2.2.1 Explosives Residues

Explosives residues were detected at concentrations above the PQL in two of the three overburden wells and both of the bedrock wells in the area of the former West Area Red Water Ponds. Concentrations above the PQL are listed in Table 6-4 and are illustrated on Figure 6-16. Nitroaromatics were also detected in a groundwater sample collected from a test pit excavated on the north side of the western pond.

The nitroaromatics concentrations detected in the groundwater in the overburden at the West Area Red Water Ponds were significantly lower than those detected in the samples from wells DM-MW7 and DM-MW8 at the Pentolite Road Red Water Ponds. However, in both areas the highest concentrations were detected for 1,3,5-TNB, 1,3-DNB, and 2,4-DNT. 1,3,5-TNB was detected in wells DM-MW2 and IT-MW2, at concentrations of 560 μg/L (average of two duplicate samples) and 390 μg/L, respectively. 1,3-DNB and 2,4-DNT were detected at slightly lower levels in each well. 2,4,6-TNT was detected only in the sample collected from well DM-MW2 at a concentration of 30 μg/L (average of two duplicate samples). Biotransformation products were present in both wells.

No explosives residues were detected in the sample collected from the third overburden well MK-MW11.

It is noteworthy that the highest concentrations of explosives residues in a groundwater sample from the West Area Red Water Ponds were reported in a sample of water retrieved from the bottom of a test pit excavated on the north side of the west pond. NASA excavated a pit where soil boring WA-S16 had been installed approximately 5 feet from the north bank of the west pond. Total depth of the pit was



BED-MW-19	
Analyte	Concentration
3-NT	8.1

IT-MW-2	
Analyte	Concentration
1,3,5-TNB	390
2,4-DNT	340
2,6-DNT	24
4-Am-2-NT	14
4-Am-DNT	5.1
1,3-DNB	340

BED-MW-14	
Analyte	Concentration
2-Am-4-NT	11

DM-MW-2	
Analyte	Concentration
2,4,6-TNT	34
1,3,5-TNB	550
2,4-DNT	320
2,6-DNT	12
3,4-DNT	75
2-Am-DNT	5.7
1,3-DNB	470

WA-S16-P	
Analyte	Concentration
1,3,5-TNB	20000
2,4-DNT	9200
2,6-DNT	850
4-Am-2-NT	190
3,4-DNT	1500
4-Am-DNT	370
2-Am-DNT	63
4-NT	110
2-Am-4-NT	22
1,3-DNB	7200

Scale: 1" = 350'

MW-1 Overburden Groundwater Monitoring Well

WA-S9 5 Foot Soil Boring

WA-S17 10 Foot Soil Boring

BED-MW14 Bedrock Groundwater Monitoring Well

Concentrations are in ug/L

FIGURE 6-16
EXPLOSIVES RESIDUES CONCENTRATIONS
IN WEST AREA
RED WATER PONDS GROUNDWATER

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

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estimated as approximately 10 feet. Red water collected in the bottom of the pit immediately following excavation. A sample of the water was collected for laboratory analysis. Nine of the 14 explosives residues analytes were detected in this sample, some at significant concentrations noted on Table 6-4. 1,3,5-TNB was present at a concentration of 20,000 μg/L and 1,3-DNB was present at a concentration of 7,200 μg/L. Other components of red water that were also present in this sample were: 2,4-DNT at a concentration of 9,200 μg/L; 2,6-DNT at a concentration of 850 μg/L; 3,4-DNT at a concentration of 1,500 μg/L; and 4-NT at a concentration of 110 μg/L. Four biotransformation products were also present in this sample: 4-Am-2-NT at a concentration of 190 μg/L; 2-Am-4-NT at a concentration of 22 μg/L; 4-Am-DNT at a concentration of 370 μg/L; and 2-Am-DNT at a concentration of 63 μg/L. These nitroaromatics concentrations are significantly higher than the concentration detected in the groundwater monitoring wells at the West Area Red Water Ponds and indicate that nitroaromatics are present in the immediate vicinity of the west pond at concentration comparable to those observed at the Pentolite Road Red Water Ponds.

QC sample DM-MW22 was a duplicate of sample DM-MW2. Six nitroaromatics were detected in each of the duplicate samples at comparable concentrations. 3,4-DNT was detected at a concentration of 75 μg/L in one sample, but was not detected in the other sample.

Low levels of nitroaromatics were detected in each of the bedrock wells at the West Area Red Water Ponds. Only one compound was detected per well. 2-Am-4-NT, a biotransformation product of DNT was detected at a concentration of 11 μg/L in well BED-MW14 which was installed near overburden well IT-MW2. 3-NT was reported at a concentration of 8.1 μg/L in well BED-MW19 which is located along the northern property boundary.

6.2.2.2 Nitrates

Nitrates were present at levels above the MCL in two of the three overburden wells at the West Area Red Water Ponds. The nitrate concentrations are listed on Table 6-5. Concentrations in wells DM-MW2 and IT-MW2 were 15 mg/L and 12 mg/L,

respectively. Elevated levels of nitroaromatics were present in both of these wells. The nitrate concentration in well MK-MW11 was 0.2 mg/L, well below the MCL.

Nitrate levels in the two bedrock wells were also well below the MCL. The concentrations in wells BED-MW14 and BED-MW19 were 3.3 mg/L and 0.2 mg/L, respectively.

6.2.2.3 VOCs and SVOCs

As stated above, VOC and SVOC concentrations for the bedrock wells at the red water ponds areas are provided in Table 6-6 and illustrated on Figure 6-14.

The six VOCs detected at the Pentolite Road Red Water Ponds, acetone, benzene, carbon disulfide, ethylbenzene, toluene, and xylenes, were also detected at the West Area Red Water Ponds. As with the explosives residues, concentrations were significantly lower in the two West Area Red Water Ponds bedrock wells than in bedrock well BED-MW14 at the Pentolite Road Red Water Ponds area. Three of the four BTEX compounds (ethylbenzene, toluene, and xylenes) were detected in both wells. Benzene was detected only in well BED-MW19 which is located along Patrol Road. Overall BTEX concentrations were relatively consistent between the two wells. Releases of hydrocarbon fuels at the site have been investigated by NASA in the past.

Acetone was detected in well BED-MW19 at a concentration of 59 μg/L. Acetone is a common solvent with a wide variety of common industrial uses. Acetone is also used in the manufacture of pentolite, one of the products of the PBOW. However, acetone is very volatile and it is unlikely that acetone released to the environment during the operation of the PBOW would persist for over 40 years.

Carbon disulfide was also detected in Well BED-MW19 at a concentration of 5 μg/L. As stated previously, carbon disulfide is often found in association with petroleum hydrocarbons.

No SVOCs were detected in the bedrock wells at the West Area Red Water Ponds.

6.2.2.4 Metals

At the West Area Red Water Ponds, eight metals (antimony, chromium, copper, lead, manganese, nickel, thallium, and zinc) were detected in the groundwater samples. Metals concentrations are listed on Table 6-7 and are illustrated on Figure 6-17.

Antimony

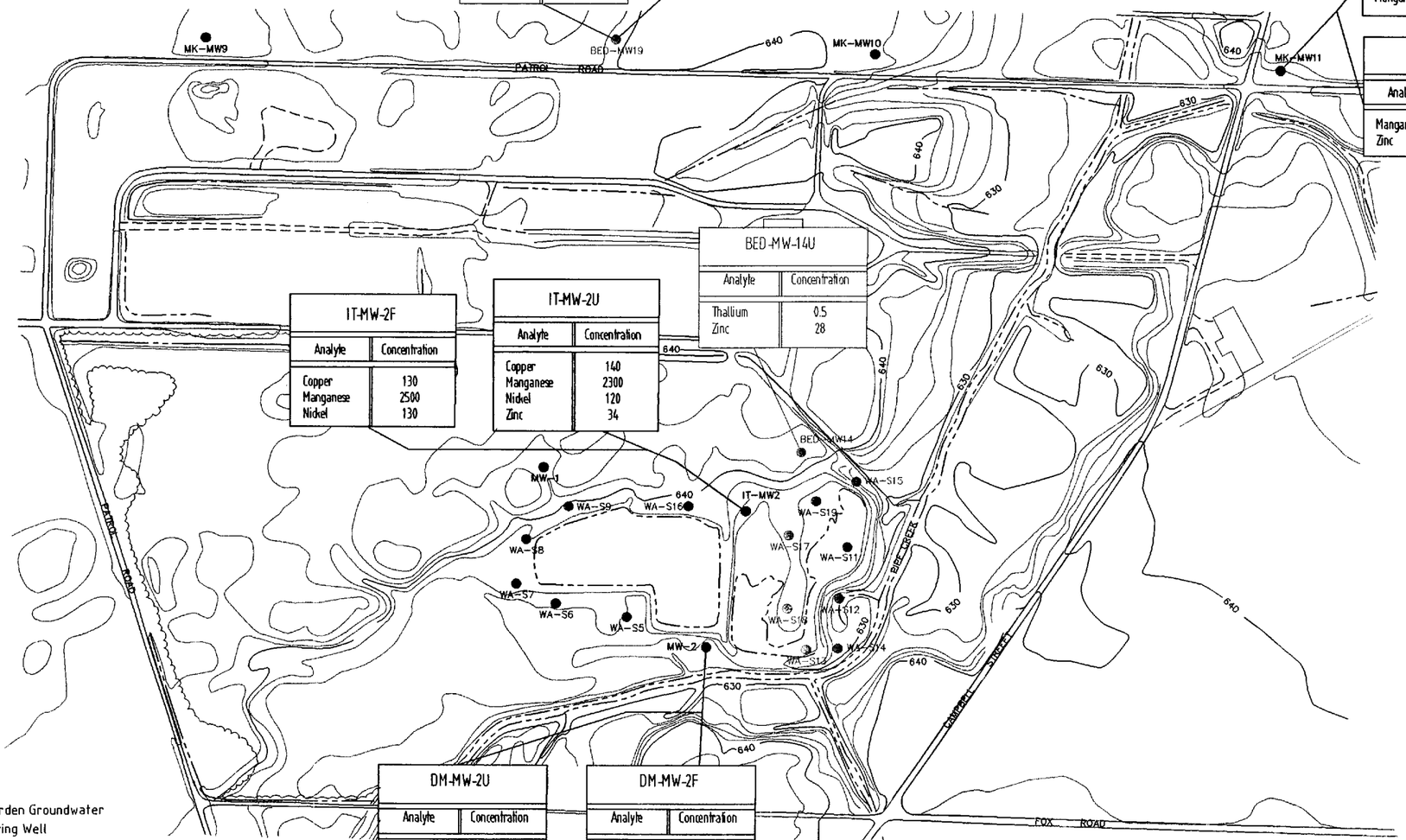
Antimony was detected in only one well and only in the filtered sample. The concentration in bedrock well BED-MW19 was 8 μg/L which exceeds the MCL of 6 μg/L. As was noted in Section 4, antimony concentrations in filtered groundwater samples are probably related to the sample collection process.

Chromium

Chromium was detected in only one overburden well at the West Area Red Water Ponds. A concentration of 14 μg/L was reported in the unfiltered sampled from one of two duplicate samples collected from well DM-MW2. Chromium was not reported in the other duplicate sample. As chromium was reported only in one unfiltered sampled from well DM-MW2, it is likely that it is related to particulate matter suspended in the sample. As no chromium was reported in either of the filtered duplicate samples, it is probably not present in the dissolved phase in the groundwater in this area. In any event, the reported concentration is below the MCL of 100 μg/L.

Copper

Copper was detected in two overburden wells, DM-MW2 and IT-MW2. The concentrations in well IT-MW2 were an order of magnitude higher than in well DM-MW2. In both wells, copper was detected in both the filtered and unfiltered samples. The concentrations in the unfiltered samples were both only slightly higher than in the



BED-MW-19U	
Analyte	Concentration
Copper	22
Thallium	0.6
Zinc	24

BED-MW-19F	
Analyte	Concentration
Antimony	8

MK-MW-11F	
Analyte	Concentration
Manganese	180

MK-MW-11U	
Analyte	Concentration
Manganese	160
Zinc	30

BED-MW-14U	
Analyte	Concentration
Thallium	0.5
Zinc	28

IT-MW-2F	
Analyte	Concentration
Copper	130
Manganese	2500
Nickel	130

IT-MW-2U	
Analyte	Concentration
Copper	140
Manganese	2300
Nickel	120
Zinc	34

DM-MW-2U	
Analyte	Concentration
Chromium	14
Copper	38
Lead	10
Manganese	1600
Nickel	63
Zinc	88

DM-MW-2F	
Analyte	Concentration
Copper	20
Manganese	1000
Nickel	60

Scale: 1" = 350'

MW-1 Overburden Groundwater Monitoring Well

WA-S16 5 Foot Soil Boring

WA-S18 10 Foot Soil Boring

BED-MW14 Bedrock Groundwater Monitoring Well

Concentrations in ug/L

FILENAME: H:\CAD\COE-PLUM\PLOT\GWMETRWS.DWG

FIGURE 6-17
METALS CONCENTRATIONS
IN WEST AREA
RED WATER PONDS GROUNDWATER

Plum Brook Ordnance Works
Sandusky, Ohio

Dames & Moore, Inc.

COE-PLUM\PLOT\GWMETRWS Thu Apr 03 20:40:23 1997 D.. : Moore - Atlanta, GA

filtered samples indicating copper is probably present in both areas in the dissolved phase. The concentrations in all samples from the two overburden wells were well below the MCL of 1,300 μg/L and the SMCL of 1,000 μg/L.

Copper was also detected in bedrock well BED-MW19, the well located along Patrol Road. It was present only in the unfiltered sample at a concentration of 22 μg/L. As copper was not also detected in the corresponding filtered sample, its presence in the unfiltered sample may be related to particulate matter in the sample.

Lead

Lead was detected in only one groundwater sample from the West Area Red Water Ponds. The concentration in the unfiltered sample collected from well DM-MW2 was 7 μg/L (average of two duplicate samples) No lead was present in either of the corresponding duplicate filtered samples indicating the lead may be related to particulate matter in the sample. The reported concentration in the unfiltered sample is below the lead AL of 15 μg/L.

Manganese

Manganese was detected at relatively high concentrations in all three of the overburden well samples, but was not reported in either of the two bedrock well samples. In two of the overburden wells, IT-MW2 and MK-MW11, the manganese concentration in the filtered sample was slightly higher than in the unfiltered sample. Manganese levels were an order of magnitude lower in well MK-MW11, the well located north of the West Area Red Water Ponds along patrol Road. In the two wells in or immediately adjacent to the ponds area, wells DM-MW2 and IT-MW2, the manganese concentrations were all 1,000 μg/L or more. Manganese values in all samples in which it was detected exceeded the SMCL of 50 μg/L.

Nickel

Nickel was detected only in the two overburden wells installed immediately adjacent to the ponds area, wells IT-MW2 and DM-MW2. Concentrations in well IT-MW2 (120 μg/L for the unfiltered sample and 130 μg/L for the filtered sample) were about double concentrations in well DM-MW2 (55 μg/L (average of two duplicate samples) for the unfiltered sample and 60 μg/L for the filtered sample). In both wells, the concentration in the filtered samples was slightly higher than in the unfiltered sample. Therefore, it appears that nickel is present in the groundwater in the overburden in the dissolved phase. The nickel concentrations in well IT-MW2 were above the MCL of 100 μg/L.

Thallium

Thallium was detected at low levels in three wells at the West Area Red Water Ponds. A concentration of 0.5 μg/L was reported in one of two duplicate unfiltered samples collected from well DM-MW2. Thallium was not detected in the other duplicate unfiltered sample, in either of the duplicate filtered samples, or in any of the samples from either of the other overburden wells. However, thallium was detected in the unfiltered samples from both bedrock wells. The concentrations in wells BED-MW14 and BED-MW19 were 0.5 μg/L and 0.6 μg/L, respectively.

As thallium was only detected in unfiltered samples, it is likely that its presence is related to particulate matter in the groundwater samples. Thallium was not reported in any of the soil samples collected in this area; however, the detection limit for thallium in soils was three orders of magnitude higher than the detection limit for groundwater samples. Thallium was detected in soil samples in TNT Area B which was investigated as part of the TNT Areas Site Investigation.

All three thallium concentrations are below the MCL of 2 μg/L.

Zinc

Zinc was detected in all five groundwater samples collected in this area. In each case, zinc was detected only in the unfiltered samples. Concentrations ranged from 30 μg/L to 88 μg/L in the overburden wells and from 24 μg/L to 28 μg/L in the bedrock wells. The fact that zinc was only detected in the unfiltered samples appears to indicate that it is related to the presence of particulate matter in the samples. Zinc values were all well below the SMCL of 5,000 μg/L.

6.2.3 pH and Specific Conductance

pH, specific conductance, and temperature measurements made during the sample collection in December 1994 are listed on Table 6-8.

The normal range of pH in groundwater is 6.0 to 8.5. All of the pH values for the samples collected in the red water ponds areas were within this range. pH values in the overburden wells ranged from 6.0 to 6.82. pH values in the bedrock wells ranged from 6.0 to 7.5.

Specific conductance is a measure of the ability of a fluid like water to conduct an electric current. Values above 1,000 microhoms per centimeter (*u*mhos/cm) are considered elevated. Specific conductance in all of the red water ponds wells except wells IT-MW5 and Reactor Well 2 were elevated. The specific conductance in overburden well IT-MW5 at the Pentolite Road Red Water Ponds was 931 *u*mhos/cm. The specific conductance in bedrock well Reactor Well 2 was 700 *u*mhos/cm. The highest specific conductance values measured at the site were in the three overburden wells completed within the boundaries of the former Pentolite Road Red Water Ponds. Specific conductance values of 18,060 *u*mhos/cm, 26,400 *u*mhos/cm, and 11,520 *u*mhos/cm, respectively, were measured in wells DM-MW7, DM-MW8, and DM-MW9. These are the three wells in which the highest levels of explosives residues and metals were detected.

TABLE 6-8

GROUNDWATER SAMPLING FIELD MEASUREMENTS

	Well Identification	Type of Well	pH	Temperature (°F)	Conductivity (µmhos/cm)	Remarks
West Area Red Water Ponds	DM-MW2	Overburden	6.5	48	>1990	
	IT-MW2	Overburden	6.0	51	>1990	
	MK-MW11	Overburden	6.7	54	1080	
	BED-MW14	Bedrock	6.0	47	1580	
	BED-MW19	Bedrock	7.0	50	>1990	
Pentolite Road Red Water Ponds	DM-MW7	Overburden	6.75	52	18,060	
	DM-MW8	Overburden	6.82	53	26,400	Water is red
	DM-MW9	Overburden	6.82	53	11,520	
	IT-MW5	Overburden	6.61	52	931	
	BED-15	Bedrock	7.5	50	>1990	
	Reactor Well 2	Bedrock	6.5	52	700	
Background	BED-MW20	Bedrock	6.0	51	>1990	

µmhos/cm - microhoms per centimeter

The sample IDs used in this table are abbreviated. For overburden wells, the ID is composed of two parts: the investigation for which the well was installed (e.g., DM = Dames & Moore, MK = MK Ferguson, IT = IT Corporation); and the well number (e.g. MW10). Bedrock wells are designated by "BED" and the well number.

6.2.4 Summary of Groundwater Chemistry

The results of the groundwater quality investigation indicate that significant levels of explosives residues are present in the groundwater in the overburden aquifer in immediate vicinity of both former red water ponds areas. With increasing distance from the ponds, even in the downgradient direction of horizontal flow, levels of explosives residues decrease dramatically in the overburden aquifer.

6.2.4.1 Pentolite Road Red Water Ponds

Explosives residues were detected at concentrations above the PQL in three of the four overburden wells at the Pentolite Road Red Water Ponds, wells DM-MW7, DM-MW8, and DM-MW9. Each of these wells is located within or immediately adjacent to the boundary of (well DM-MW) the former ponds. Nine of the 14 nitroaromatics analytes were detected in these three wells. The highest concentrations were present in well DM-MW7 and DM-MW8 which are definitely located within the perimeter of the former ponds. The most elevated concentrations (in excess of 500 μg/L) were detected for 1,3,5-TNB, 1,3-DNB, and 2,4-DNT.

Explosives residues were not detected in well IT-MW5 which is located a short distance downgradient of the ponds. Thus, the chemical data for this investigation supports the conclusion of the groundwater flow investigation with regard to the predominance of vertical flow in the overburden hydrostratigraphic unit. Even after 50 years, nitroaromatics have not migrated horizontally the short distance to well IT-MW5.

Low levels of explosives residues were detected in one of the two bedrock wells installed downgradient from the Pentolite Road Red Water Ponds. 3,NT and 3,4-DNT were detected at concentrations of 23 μg/L and 13 μg/L, respectively, in Reactor Well 2.

In the three wells in which the high levels of explosives residues were detected, wells DM-MW7, DM-MW8, and DM-MW9, nitrate levels were also elevated. In each well, the nitrate concentration exceeded the MCL of 10 mg/L.

Several VOCs and SVOCs were detected in the two bedrock wells, generally hydrocarbons and associated compounds. Their presence is not apparently related to the former PBOW operations. It is noted that the benzene concentration in bedrock well BED-MW15 was two orders of magnitude above the MCL.

Eight metals (antimony, chromium, copper, lead, manganese, nickel, thallium, and zinc) were detected in the groundwater samples collected at the Pentolite Road Red Water Ponds.

Very elevated levels of copper, manganese, and nickel were detected in each of the three wells in which high explosives residues were detected, wells DM-MW7, DM-MW8, and DM-MW9. One possible explanation for the very elevated metals concentrations may be related to changes in the pH and oxidation/reduction conditions of the water through time. For example, red water is acidic in nature. Many metals, including copper, manganese, and nickel become increasingly soluble as pH is lowered. (This phenomenon is noted, for example, in acid mine drainage which has high dissolved metals concentrations.) When acidic red water was first introduced into the ponds some 50 years ago, the pH may have been low enough that metals in the soil dissolved into the groundwater. Once dissolved, the metals would not be expected to precipitate again unless the pH rose to approximately 8.5 to 9 (depending on the metal). For example, manganese does not precipitate below approximately pH 9. The pH measurements of the overburden groundwater in the Pentolite Road Red Water Ponds overburden wells are well below the 8.5 to 9 range.

Chromium and zinc were also detected in the overburden wells, but at concentrations consistent with those detected in other site wells. Thallium was detected only in well DM-MW7, coincidentally the well with the highest explosives residues concentrations.

The antimony concentration in the filtered sample from bedrock well BED-MW15 is suspect and was the only antimony concentration detected at the Pentolite Road Red

Water Ponds. Lead was detected in the Reactor Well 2 sample at a concentration below the AL. Copper, manganese, nickel, thallium, and zinc were also detected in the bedrock aquifer in this area.

Copper concentrations were above the MCL in two of the three overburden wells, and above the SMCL in all three of the overburden wells in which it was detected. Manganese concentrations were above the SMCL, sometimes by several order of magnitude, in all of the wells in which it was detected. Nickel values exceeded the MCL in all three overburden wells in which it was detected.

6.2.4.2 West Area Red Water Ponds

Explosives residues were also detected in two of the overburden wells at the West Area Red Water Ponds. The explosives residues concentrations in the two overburden wells at the West Area Red Water Ponds were considerably lower than the concentrations detected in the overburden wells installed within the pond perimeter at the Pentolite Road Red Water Ponds. However, the concentrations of explosives residues detected in the sample of reddish-tinted groundwater from the pit excavated on the north bank of the west pond were significantly higher than any concentrations detected at the Pentolite Road Red Water Ponds. Again, the presence of red water and high explosives residues concentrations near the current pond boundary and probably within the boundary of the pond during operation of the PBOW, supports the conclusion of the groundwater flow assessment that the dominant direction of groundwater flow in the overburden is apparently vertically downward, not horizontal.

Low levels of nitroaromatics were also detected in both of the bedrock wells at the West Area Red Water Ponds.

Nitrates were detected at concentrations above the MCL in both of the overburden wells in which explosives residues were also detected. However, concentrations were not as elevated as those at the Pentolite Road Red Water Ponds.

VOCs and SVOCs were detected in both bedrock wells at the West Area Red Water Ponds. The compounds detected, generally hydrocarbons and associated compounds, are not thought to be related to the former PBOW operations. The benzene concentration in well BED-MW19 was 5 μg/L, equal to the MCL.

Eight metals (antimony, chromium, copper, lead, manganese, nickel, thallium, and zinc) were detected in the groundwater samples collected from the West Area Red Water Ponds.

Copper, manganese, and nickel were detected at relatively high concentrations in the two wells in which explosives residues were also detected. Again, the concentrations were significantly lower than those detected in the Pentolite Road Red Water Ponds samples, but higher than metals concentrations detected in other site wells. The high concentrations may be related to the acidic nature of the red water placed in the ponds during operation of the PBOW, as discussed above.

Chromium, lead, and zinc were also detected in unfiltered samples collected from the West Area Red Water Ponds overburden wells. Low levels of thallium and zinc were detected in the unfiltered sample from bedrock well BED-MW14 and low levels of copper, thallium, and zinc were detected in bedrock well BED-MW19, also only in the unfiltered sample.

The antimony concentration in the filtered sample from bedrock well BED-MW19 is suspect and was the only antimony concentration detected in the West Area Red Water Ponds.

Nickel concentrations in overburden well IT-MW2 exceeded the MCL. Manganese concentrations in all samples in which it was detected exceeded the SMCL.

7.0 WEST AREA RED WATER PONDS SURFACE WATER AND SEDIMENT INVESTIGATION

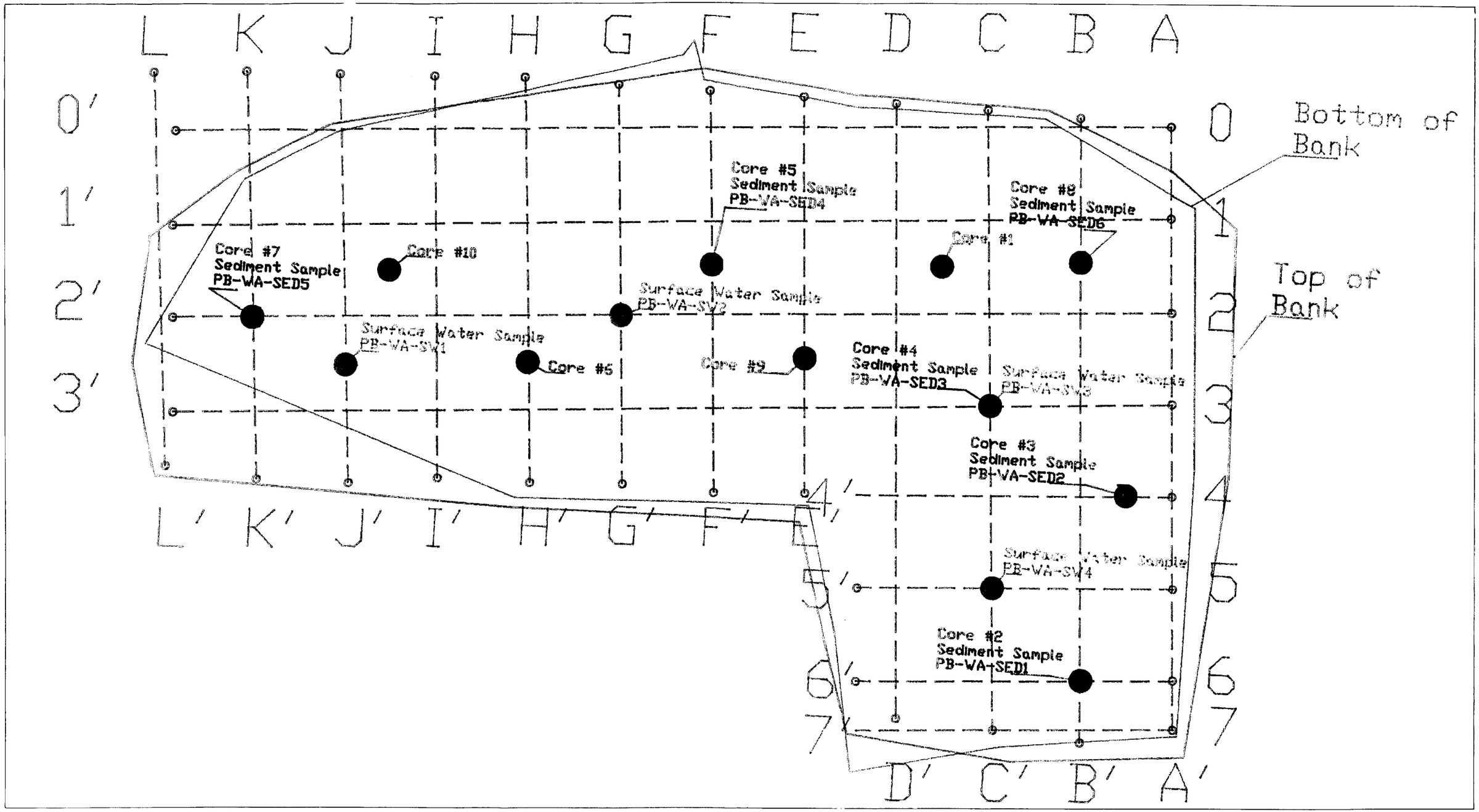
The surface water and sediment investigation at the West Area Red Water Ponds included measurement of water depths, the performance of penetrometer testing, collection of sediment and natural soil cores, and collection of water and sediment samples for laboratory testing.

An approximately 50 foot by 50 foot grid was established over the pond. The grid included 12 control points (A through L) spaced 50 feet apart (center to center) in an approximately east-west trending direction along the northern shore of the pond. Eight control points (0 through 7) spaced 50 feet apart (center to center) were also established in a generally north-south trending direction along the eastern shore of the pond. The grid system and sampling locations are illustrated on Figure 7-1.

7.1 WATER DEPTH AND SEDIMENT THICKNESS MEASUREMENTS

The results of the water depth and sediment thickness measurements at the time of this investigation are presented in Table 7-1. Based on the results of the water depth measurements and penetrometer testing, contour maps illustrating the sediment thickness and height of the water column above the sediment were developed and are presented on Figures 7-2 and 7-3, respectively.

Review of Figure 7-2 indicates that the sediment thickness is generally greater in the eastern portions of the pond (east of Grid Line D). In this area, the greatest sediment thickness was observed adjacent to the shore in the southeast corner (30 inches) and adjacent to the eastern shore between grid lines 3 and 4 (18 to 19 inches). The increased sediment thickness adjacent to the eastern shore between grid lines 3 and 4 is located in the area where water was piped into the western pond (from the eastern pond) during PBOW operation.



50 25 0 50 100 FEET

LEGEND:

Core Samples

Surface Water Samples

N

Figure 7-1

CORE SEDIMENT AND NATURAL SOIL AND SURFACE WATER SAMPLING LOCATIONS

Plum Brook Ordnance Works

Sandusky, Ohio

DAMES & MOORE

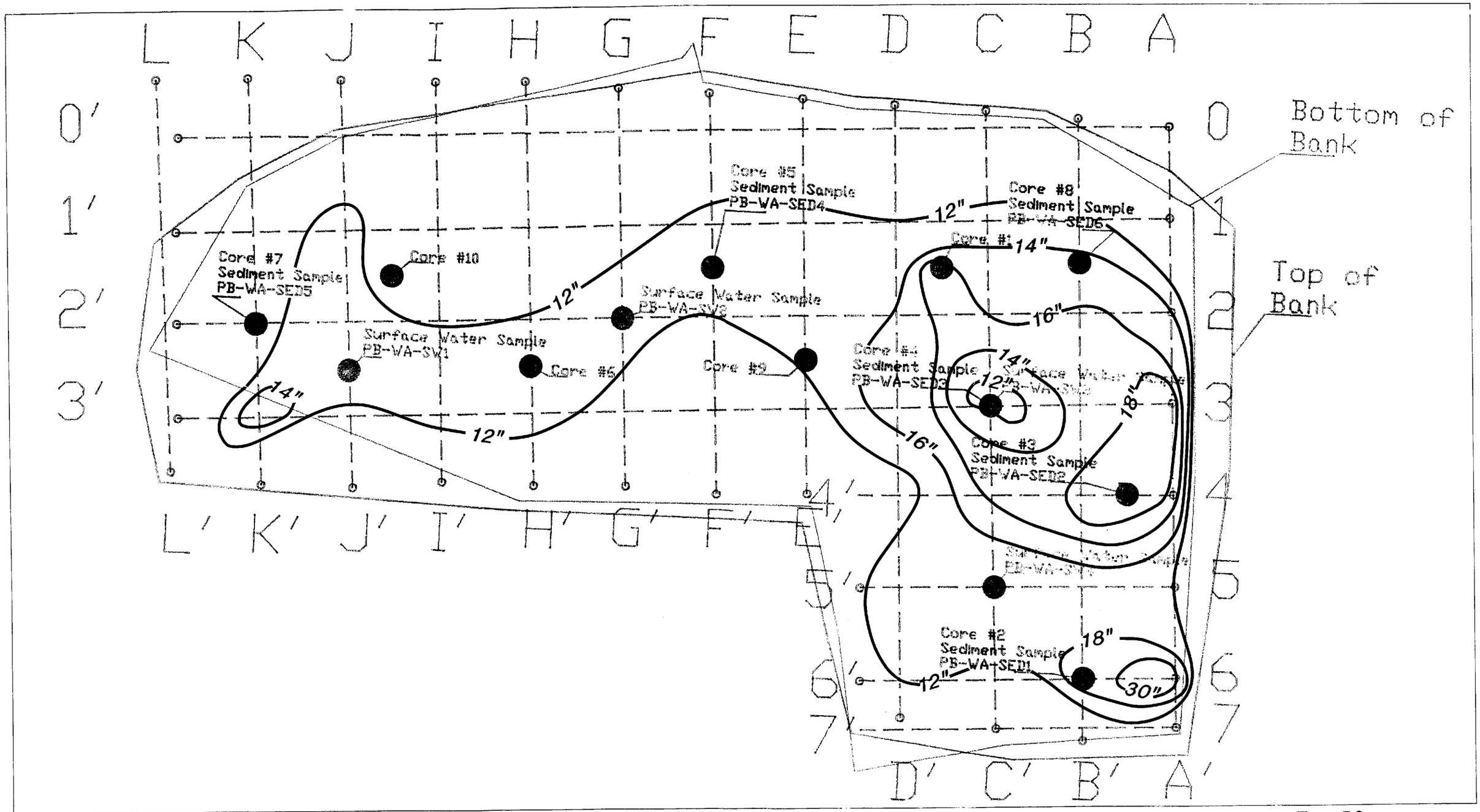
TABLE 7-1

WESTERN POND PENETROMETER TESTING AND WATER DEPTH MEASUREMENT RESULTS

Grid Location	Water Depth (Inches)	Sediment Thickness (Inches)
A-2	6	14
A-3	7	19
A-4	6	18
A-5	4	12
A-6	6	33
C-1	12	13
C-2	16	16
C-3	12	14
C-4	18	16
C-5	15	12
C-6	11	9
D-1	11	12
D-2	14	14
D-3	12	15
D-4	12	10
D-5	14	14
D-6	11	12
F-1	16	13
F-2	16	12
F-3	12	8
H-1	9	7
H-2	16	12
H-3	11	13
J-1	6	13
J-2	19	7
J-3	21	11

TABLE 7-1
(Continued)

Grid Location	Water Depth (Inches)	Sediment Thickness (Inches)
K-1	2	8
K-2	15	10
K-3	29	14



50 25 0 50 100 FEET

N

LEGEND:

Core Samples

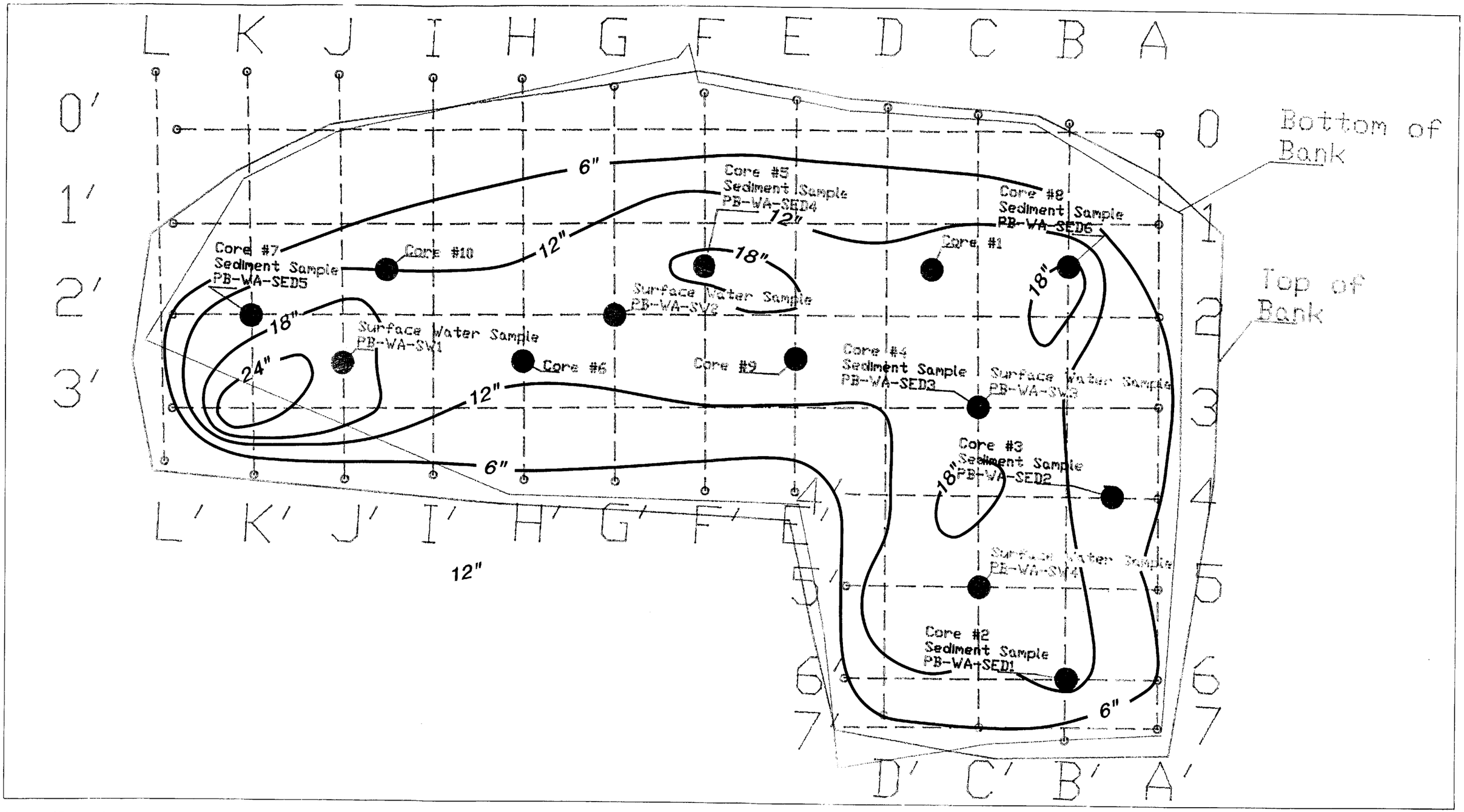
Surface Water Samples

Figure 7-2

SEDIMENT THICKNESS CONTOUR MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE



50 25 0 50 100 FEET

LEGEND:

- Core Samples
- Surface Water Samples

N

Figure 7-3

WATER DEPTH CONTOUR MAP

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE

Based on the results of the penetrometer testing, the quantity of sediments within the western pond is estimated to be approximately 132,000 cubic feet. This equates to an average sediment thickness throughout the pond of approximately 1 foot.

Review of Figure 7-3 indicates that the depth of water generally gradually increases with increasing distance from the shore, with the average water depth being between 12 and 18 inches in the interior portions of the pond. In the southwestern corner of the pond, the water depth was to approximately 29 inches.

Based on the results of the water depth measurements, the volume of water within the pond at the time of this investigation was estimated to be approximately 114,000 cubic feet (850,500 gallons). This equates to an average water depth of approximately 0.8 foot. The water surface at the time of the investigation for at elevation 634.90 feet above mean sea level.

The water in the pond appears to be perched and not connected directly to the underlying groundwater. The water in the trench excavated on the north side of the pond stabilized at elevation 631.2 feet msl, well below the pond level.

7.2 SEDIMENT/NATURAL-SOIL CORE CHARACTERISTICS

Evaluation of the western pond sediment samples indicates that the sediments generally consist of a dark gray to black organic silty clay with decayed organic material (roots, leaves, etc.) and fine to medium sand. Sediments of this type are consistent with typical pond and lake sediments. Although differentiation between old sediments and recent sediments could not be made, visual evidence of the presence of contamination was not observed in any of the sediment and natural-soil cores.

The consistency of the sediments ranged from very soft, slurry-like material to soft. The transition from the ponded water to sediments was therefore difficult to establish. The sediment thickness varied from approximately 0.4 feet in Core #6 (Grid Location: H, 2 + 25 feet) to 1.5 feet in Core #1 (Grid Location: C + 25 feet, 1 + 25 feet) and Core #2 (Grid Location: B, 6).

Below the sediments, the cores encountered natural-soils consisting of gray to brown silty clays with varying amounts of fine sand and organic material. In general, the differentiation between the sediments and the underlying natural soils was made based on the apparent color change and the presence of mottling within the natural soils.

Detailed description of the sediments and natural-soils encountered are presented on the boring logs of the cores in Appendix I.

7.3 SEDIMENT CHEMICAL ANALYSIS

Twelve sediment samples, two from each of six cores were submitted for laboratory analysis. One sample (the top sample) was from the sediments assumed to have accumulated in the pond during and since operation of the PBOW when the pond was created. The second sample (the bottom sample) was from the original soil material. The differentiation between the two was made in the field at the time of sample collection.

7.3.1 Explosives Residues

Five of the fourteen explosives residues analytes were detected at low concentrations in six samples from four of the six cores collected from the western pond. Explosives residues concentrations are listed on Table 7-2. The four cores in which nitroaromatics were detected are located in the northern section of the pond. No explosives residues were detected in the four samples from cores WA-SED1 and WA-SED2. These two cores were collected from the southern leg of the pond along the berm. The pond sediment depth is deepest in this part of the pond, achieving a maximum depth of 30 inches in the extreme southeastern corner of the pond. The sampling depths in cores WA-SED1 and WA-SED2 were 2.5 and 2 feet, respectively, indicating the entire sediment depth was sampled.

2,4-DNT was the most commonly detected nitroaromatic. It was present in all six samples in which nitroaromatics were detected, WA-SED3 (both samples), WA-SED4

TABLE 7-2

EXPLOSIVE RESIDUES CONCENTRATIONS
WEST POND SEDIMENT SAMPLES
WEST AREA RED WATER PONDS

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Pond Sediment West Pond	WA-SED1-0.2/1.7														
	WA-SED1-1.7/2.5														
	WA-SED2-0.2/1														
	WA-SED2-1/2														
	WA-SED3-0.2/1.0														
	WA-SED3-1.0/2.0		0.6		0.5										0.7
	WA-SED4-0.2/0.5				0.3										
	WA-SED4-0.5/1.5		0.8		0.4										0.3
	WA-SED5-0.2/0.5														
	WA-SED5-0.5/1.5		0.6		0.7										0.7
	WA-SED6-0.2/1.3				0.4	0.4									
	WA-SED6-1.3/1.7				0.7					0.3					0.7
QC Sample	WA-SED7-0.2/1														

QC sample WA-SED7-0.2/1 is a split of sample WA-SED2-0.2/1.

Concentrations are listed in mg/Kg or ppm.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are composed of three parts. The investigation area, WA, for the West Area Red Water Ponds; the sediment sample number (e.g., SED1 = Sediment Sample 1); and the depth interval over which the sample was collected (e.g., 0.2/1.7 = sediments from 0.2 to 1.7 feet were composited). The PB designation at the beginning of all sample IDs on the laboratory reports was not used in this table.

(top sample only), WA-SED5 (bottom sample only), and WA-SED6 (both samples). The concentrations were very similar in all six samples in which 2,4-DNT was detected and ranged from 0.3 mg/Kg in sample WA-SED4-0.2/0.5 to 0.7 mg/Kg in both samples WA-SED5-0.5/1.5 and WA-SED6-1.3/1.7.

Four of the samples that contained 2,4-DNT also contained 1,3-DNB. Concentrations ranged from 0.3 mg/Kg in sample WA-SED4-0.5/1.5 to 0.7 in the other three samples in which it was detected.

Three of the four samples that contained both 2,4-DNT and 1,3-DNB also contained 1,3,5-TNB. Concentrations ranged from 0.6 mg/Kg in two samples to 0.8 mg/Kg in the third sample.

2,6-DNT was reported in only one sample. A concentration of 0.4 mg/Kg was detected in sample WA-SED6-0.2/1.3. 2,4-DNT was also detected in this sample at the same concentration.

2-Am-DNT was detected at a concentration of 0.3 mg/Kg in sample WA-SED6-1.3/1.7. Two other nitroaromatics, 2,4-DNT and 1,3-DNB were also detected in this sample, each at concentrations of 0.7 mg/Kg.

The presence of nitroaromatics in the bottom samples from four of the cores indicates very low levels of explosives residues are probably present in the original natural soils underlying the west pond.

7.3.2 Metals

Seven of the 14 metal analytes were detected in the sediment samples. Metals concentrations in the sediment samples are listed on Table 7-3. Five of these, chromium, lead, manganese, nickel, and zinc, were present in every sediment sample.

Arsenic was detected in five of the 12 sediment samples. The concentrations ranged from 4.0 mg/Kg in sample WA-SED4-0.5/1.5 to 11.3 mg/Kg in sample WA-SED2-1/2.

TABLE 7-3

METALS CONCENTRATIONS
WEST POND SEDIMENT SAMPLES
WEST AREA RED WATER PONDS

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Pond Sediment West Pond	WA-SED1-0.2/1.7					11		19	180		12				46
	WA-SED1-1.7/2.5					17		15	220		23				74
	WA-SED2-0.2/1					22		17	190		19				94
	WA-SED2-1/2		11.3			17	3.2	12	159		20				70
	WA-SED3-0.2/1.0					16		16	180		16				57
	WA-SED3-1.0/2.0		5.2			22		12	220		23				73
	WA-SED4-0.2/0.5					9.9	3.9	19	149		8.8				36
	WA-SED4-0.5/1.5		4.0			13	3.9	10.7	262		18				50
	WA-SED5-0.2/0.5		4.2			11.5		21	169		10.7				44
	WA-SED5-0.5/1.5		7.2			17		13	329		20				62
	WA-SED6-0.2/1.3					14		16	164		14				59
	WA-SED6-1.3/1.7					19		13	250		21				73
QC Sample	WA-SED7-0.2/1					10		16	160		13				63

QC sample WA-SED7-0.2/1 is a split of sample WA-SED2-0.2/1.

Concentrations are listed in mg/Kg or ppm.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are composed of three parts. The investigation area, WA, for the West Area Red Water Ponds; the sediment sample number (e.g., SED1 = Sediment Sample 1); and the depth interval over which the sample was collected (e.g., 0.2/1.7 = sediments from 0.2 to 1.7 feet were composited). The PB designation at the beginning of the sample IDs on the laboratory reports was not used in this table.

G:\WP\C\COE\PLUM-BRO.OK\REDWATER\TAB7-3.WPD

These arsenic concentrations are consistent with the concentrations observed in the background soils.

Chromium was detected in all 12 sediment samples. Concentrations ranged from 11 mg/Kg in sample WA-SED1-0.2/1.7 to 22 mg/Kg in sample WA-SED3-1.0/2.0. The average chromium concentration for the 12 sediment samples is 15.3 mg/Kg which is also the average chromium concentration for the soils in the three TNT areas. This average concentration is only slightly higher than the average background soil chromium concentration of 13.5 mg/Kg and is consistent with the average chromium concentration of 15.1 mg/Kg for the soils in the red water ponds areas. Thus, the chromium concentrations in the sediment samples in the west pond appear to be representative of site soil conditions. Chromium concentrations were higher in the deeper of the two samples collected per core in all six sediment cores from the west pond. Chromium was present in every soil sample collected for the PBOW investigations and its presence in all of the sediment samples is consistent with the site soil conditions.

Copper was detected in three of the sediment samples at concentrations ranging from 3.2 mg/Kg in sample WA-SED2-1/2 to 3.9 mg/Kg in both samples from core WA-SED4. The copper concentrations in these three samples were consistent with but somewhat lower than the average copper concentration in the background soils of 12.3 mg/Kg.

Lead was also detected in all 12 sediment samples. Concentrations ranged from 10.7 mg/Kg in sample WA-SED4-0.5/1.5 to 21 mg/Kg in sample WA-SED5-0.2/0.5. The average lead concentration for the 12 sediment samples is 15.3 mg/Kg which is consistent with the average lead concentration for the background soils. Unlike chromium, lead concentration were higher in all six cores in the more shallow of the two samples collected from each core. As with chromium, lead was present in every soil sample collected for the PBOW investigations. Its presence in all of the sediment samples is consistent with the site soil conditions.

Manganese also was present in all 12 sediment samples at concentrations ranging from 149 mg/Kg in sample WA-SED4-0.2/0.5 to 329 mg/Kg in sample WA-SED5-

0.5/1.5. The average manganese concentration in the sediment samples, 205 mg/Kg, is consistent with the average manganese concentration in the background soil samples of 228 mg/Kg. Similar to chromium, the manganese concentrations were higher in the deeper of the two samples collected in five of the six sediment cores. Only in WA-SED2 was the manganese concentration higher in the shallower sample. As with chromium and lead, manganese was detected in every soil sample collected for the PBOW investigation. Its presence in the 12 sediment samples is consistent with site conditions.

All 12 sediment samples also contained nickel. The average nickel concentration in the sediment samples was 16.9 mg/Kg and compared well with the average nickel concentration in the background soils of 19.4 mg/Kg. Concentrations ranged from 8.8 mg/Kg in samples WA-SED4-0.2/0.5 to 23 mg/Kg in samples WA-SED1-1.7/2.5 and WA-SED3-1.0/2.0. Nickel concentrations were all higher in the deeper of the two samples collected from each core. Nickel also was detected in all of the PBOW soil samples and its presence in the west pond sediment is consistent with site conditions.

Zinc was detected in all 12 sediment samples at concentration ranging from 36 mg/Kg in sample WA-SED4-0.2/0/5 to 78.5 mg/Kg (average of two split samples) in sample WA-SED2-0.2/1. The average zinc concentration for the 12 sediment samples is 60.21 mg/Kg which is consistent with the average zinc concentration of 53 mg/Kg for the background soils. In five of the six cores, the zinc concentration was higher in the deeper of the two samples collected. Only in core WA-SED2 was the zinc concentration higher in the shallower sample. As with chromium, lead, manganese, and nickel, zinc was detected in all soil samples collected for the PBOW investigation. Its presence in the west pond sediments is representative of site conditions.

7.3.3 Biological Activity Analysis

Two sediment samples, WA-SED5-0.2/0.5 and WA-SED5-0.5/1.5, were submitted for analysis of biological activity. The results of the analysis are presented in Appendix K.

As the laboratory results indicate, TNT microbial degrader populations are virtually nonexistent in the sediments in the west pond at the West Area Red Water Ponds. However, nutrient conditions are generally favorable for biodegradation. Phosphate augmentation would probably be required, but abundant nitrogen is available and soil pH conditions are favorable.

At the time the analysis was requested, the nature of nitroaromatics present in the soils in the Red Water Pond Areas was not known. TNT was used as the sole carbon source for enumerating biological "degrader" populations in the analysis performed for this investigation. The results of the Focused Remedial Investigation indicate that no 2,4,6-TNT is present in the sediments at the west pond. However, as mentioned above, one biodegradation product, 2-Am-DNT was detected at a very low concentration in one of the sediment samples.

7.4 SURFACE WATER CHEMICAL ANALYSIS

Five surface water samples, four from the west pond and one from an areas of ponded water in the former east pond, were collected for laboratory analysis.

7.4.1 Explosives Residues

Only one surface water sample contained explosives residues above the PQL. As shown on Table 7-4, 3-NT was detected at a concentration of 54 μg/L in sample WA-SW5-U, the sample collected from an area of ponded water with a reddish tint in the east pond. The western pond sample analysis indicated no elevated levels of explosives residues.

TABLE 7-4

EXPLOSIVES RESIDUES CONCENTRATIONS
SURFACE WATER SAMPLES
WEST AREA RED WATER PONDS

	Sample ID	2,4,6-TNT	1,3,5-TNB	NB	2,4-DNT	2,6-DNT	4-Am-2-NT	3,4-DNT	4-Am-DNT	2-Am-DNT	2-NT	3-NT	4-NT	2-Am-4-NT	1,3-DNB
Surface Water Samples	WA-SW1-U														
	WA-SW2-U														
	WA-SW3-U														
	WA-SW4-U														
	WA-SW5-U											54			
QC Sample	WA-SW7-U														

QC sample WA-SW7-U is a duplicate of sample WA-SW3-U.

Concentrations are listed in $\mu g/L$ or ppb.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 nitroaromatic compounds listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are composed of three parts. The investigation area, WA, for the West Area Red Water Ponds; the surface water sample number (e.g., SW1 = surface water Sample 1); and U or F designation, respectively, for unfiltered sample or filtered sample.

7.4.2 Metals

Five of the 14 metals were detected in the surface water samples collected at the West Area Red Water Ponds. The metals concentrations detected in each sample are listed on Table 7-5.

Three metals, chromium, lead, and nickel, were each detected in only one unfiltered sample. It is likely that these concentrations are related to particulate matter suspended in the samples and that chromium, lead, and nickel are not present in the pond water in the dissolved phase. The lead concentration of 65.5 μg/L (average of two duplicate samples) in sample WA-SW3 was above the MCL of 15 μg/L. The chromium and nickel concentrations of 10 μg/L and 20 μg/L, respectively, in sample WA-SW5 from the east pond were below their MCLs.

Manganese was detected in each of the filtered and unfiltered samples for all five surface water samples. Concentrations in the unfiltered samples were consistently, but not significantly, higher. In the unfiltered samples, manganese levels ranged from 190 μg/L in sample WA-SW1 to 1,600 μg/L in sample WA-SW5. In the filtered samples, concentrations ranged from 150 μg/L in sample WA-SW1 to 1,300 μg/L in sample WA-SW5. The highest manganese samples were present in sample WA-SW5 which was collected from an area of ponded water with a reddish tint in the east pond. As noted previously in connection with the soil and groundwater analyses, manganese levels in the former red water ponds areas are significantly elevated. All surface water manganese samples are above the SMCL of 50 μg/L.

Zinc was reported in four of the five surface water samples. In three of the four samples, it was detected only in the unfiltered samples. However, in sample WA-SW2, the zinc concentration in the filtered sample, 23 μg/L, was slightly higher than the concentration in the unfiltered sample, 20 μg/L. Zinc concentrations in the other three unfiltered samples ranged from 34.5 μg/L (average of two duplicate samples) in WA-SW3 to 70 μg/L in WA-SW5. All of these zinc concentrations are considerably below the SMCL of 5,000 μg/L. It is likely that zinc is not present in the pond water in the dissolved phase. In four or five samples, it was detected only in the unfiltered

TABLE 7-5

METALS CONCENTRATIONS
SURFACE WATER SAMPLES
WEST AREA RED WATER PONDS

	Sample ID	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
Surface Water Samples	WA-SW1-U								190						
	WA-SW1-F								150						
	WA-SW2-U								260						20
	WA-SW2-F								210						23
	WA-SW3-U							77	230						43
	WA-SW3-F								210						
	WA-SW4-U								260						46
	WA-SW4-F								200						
	WA-SW5-U					10			1,600		20				70
	WA-SW5-F								1,300						
QC Samples	WA-SW7-U							54	240						26
	WA-SW7-F								230						

QC samples WA-SW7-U and SW7-F are duplicates of samples WA-SW3-U and SW3-F.

Concentrations are listed in µg/L or ppb.

All samples listed in the Sample ID column (column 2) were analyzed for all 14 metals listed across the top row of the table. Only concentrations above the detection limit are listed on the table. Concentrations corresponding to the blank boxes were below the laboratory detection limit.

The sample IDs used in this table are composed of three parts. The investigation area, WA, for the West Area Red Water Ponds; the surface water sample number (e.g., SW1 = surface water sample 1); and a U or F designation, respectively, for unfiltered sample or filtered sample.

sample. Zinc was detected in the equipment blank and its presence in the filtered sample for WA-SW2 may be related to the sampling procedure.

7.4.3 Biological Activity Analysis

One surface water sample, WA-SW2, was submitted for analysis of biological activity. The results of the analysis are presented in Appendix K.

As the laboratory results indicate, TNT microbial degrader populations are virtually nonexistent in this surface water sample. However, as no nitroaromatics were detected in the west pond surface water samples, remediation of the pond water does not appear to be needed.

8.0 CONCLUSIONS

The results of the Focused Remedial Investigation indicate that explosives residues are present in soils in both former red water ponds areas at the PBOW. Additionally, significant levels of explosives residues, metals, and nitrates are present in the groundwater in the overburden in both areas. Low levels of explosives residues may be present in the bedrock hydrostratigraphic unit.

8.1 SOILS INVESTIGATION

The Focused Remedial Investigation included collection of 103 soil samples from the two former Red Water Ponds areas, the Pentolite Road Red Water Ponds and the West Area Red Water Ponds. All soil samples were analyzed for explosives residues and metals.

1,3,5-TNB and 2,4-DNT were the most commonly detected explosives residues. 1,3,5-TNB was present in 43 of the 103 samples and 2,4-DNT was present in 40 samples.

Nitroaromatics were much more prevalent and were detected at much higher concentrations in the samples collected from the Pentolite Road Red Water Ponds than from the West Area Red Water Ponds.

A statistical analysis comparing metals concentrations in background soil samples to concentrations in samples collected from the two former red water ponds areas indicated that manganese levels in these areas are above background.

8.1.1 Pentolite Road Red Water Ponds

The sampling scheme utilized at the Pentolite Road Red Water Ponds appears to have been successful in confirming the approximate perimeter of the former ponds. Nitroaromatics were detected at relatively low levels outside the apparent footprint of

the pond in only two areas. In general, the horizontal extent of contamination can be considered satisfactorily delineated.

The highest concentrations of explosives residues at the Pentolite Road Red Water Ponds were detected in the sample from the boring installed near the inlet to the ponds. 2,4,6-TNT concentrations in samples from the 3 to 5 foot interval and the 5 to 10 foot interval in this boring exceeded the risk-based industrial scenario screening level.

1,3,5-TNB was present at levels exceeding the residential scenario risk-based screening level in several locations at the Pentolite Road Red Water Ponds.

Contamination was detected in all of the samples collected inside the pond perimeter from the 5 to 10 foot interval indicating that the vertical extent of contamination has not been delineated. Since samples were composited over the entire interval from 5 to 10 feet, it is not known whether contamination extends to and beyond 10 feet or is limited to a depth between 5 and 10 feet. However, further delineation of the vertical extent of contamination is probably not warranted. The water table at the site rises seasonally to a depth of 3 to 5 feet below the ground surface. Since delineation of the vertical extent of soil contamination is usually limited to the unsaturated zone, further delineation of the extent of contamination within the 5 to 10 foot interval and below 10 feet is probably unnecessary.

Antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc were present in soil samples collected at the West Area Red Water Ponds. Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Manganese concentrations were clearly above background levels.

8.1.2 West Area Red Water Ponds

The results of the West Area Red Water Ponds soils investigation indicate that low levels of nitroaromatics are present in shallow soils on the south and southeast sides of the perimeter of the ponds. Most of the borings around the ponds in which

nitroaromatics were detected ar located in a narrow corridor of land between the ponds and Pipe Creek. Concentrations greater than 5 mg/Kg were detected only in one sample which was collected at a depth of 3 to 5 feet in boring WA-S10 on the south side of the west pond. In general, the horizontal extent of contamination can be considered to be satisfactorily delineated.

Two compounds, 1,3,5-TNB and 2,4-DNT, were present at concentrations slightly above 5 mg/Kg. 1,3,5-TNB concentrations were above the Region III residential risk screening criteria of 3.9 mg/Kg in samples WA-S6-2.0/5.0 and WA-S10-3.0/5.0.

Since explosives residues were detected in the deeper samples collected at borings both inside and outside the ponds, the vertical extent of contamination apparently has not been delineated. Very low levels of nitroaromatics were detected in the samples collected in the 5 to 10 foot interval in each of the three borings inside the east pond. All concentrations were below 5 mg/Kg. Low levels of nitroaromatics were also detected in samples collected from 2 to 5 feet in borings installed around the pond perimeter. However, similar to the Pentolite Road Red Water Ponds, because of the high seasonal water table in the area, further delineation of the vertical extent of contamination at the West Area Red Water Ponds is probably not warranted.

The 1,3,5-TNB concentration in sample WA-S17-5.0/10.0 exceeded the residential risk screening criteria.

Antimony, arsenic, cadmium, chromium, copper, lead, manganese, nickel, and zinc were present in soil samples collected at the West Area Red Water Ponds. Cadmium and antimony were each detected in only one sample. Chromium, lead, manganese, nickel, and zinc were present in every soil sample. Manganese concentrations were clearly above background levels.

8.1.3 Background Soils Investigation

No explosives residues were detected in any of the 14 background soil samples. However, four VOCs and one SVOC were detected. VOCs and SVOCs were detected in soils from many areas of the site during previous investigations.

Eight metals, antimony, arsenic, chromium, copper, lead, manganese, nickel, and zinc were detected in the background soils. Chromium, lead, manganese, nickel, and zinc were present in every soil sample.

8.2 GROUNDWATER INVESTIGATION

The results of the groundwater investigation indicate that generally groundwater flow in both the overburden and the bedrock is to the north, eventually toward Lake Erie, as would be expected for this site. However, it is likely that with the shallow bedrock and thin veneer of overburden materials overlying the bedrock, vertical flow of groundwater downward from the overburden into the bedrock predominates over horizontal flow in the overburden. This flow pattern, if accurate, would facilitate migration of contaminants in the overburden soils and groundwater into the bedrock aquifer.

The presence of groundwater in the overburden hydrostratigraphic unit at the site is apparently very seasonal. During the early winter when groundwater samples were collected for this investigation, two of the overburden monitoring wells were dry. In early spring after abundant winter precipitation, groundwater was present in all of the previously dry wells.

Several VOCs and SVOCs were detected in the bedrock aquifer in both former red water ponds areas. Generally, these were hydrocarbons and associated compounds.

Groundwater at the site is not used for potable water. However, copper, manganese, and nickel were present in the Pentolite Road Red Water Ponds at concentrations above their regulatory action levels. Nickel and manganese was present at

concentrations above their regulatory actions levels at the West Area Red Water Ponds.

8.2.1 Pentolite Road Red Water Ponds

Explosives residues were detected at concentrations above the PQL in three of the four overburden wells at the Pentolite Road Red Water Ponds. Each of these wells is located within or immediately adjacent to the boundary of the former ponds. The most elevated concentrations were detected for 1,3,5-TNB, 1,3-DNB, and 2,4-DNT.

Explosives residues were not detected in downgradient overburden well. The analysis of groundwater flow indicates that flow in the overburden is probably predominantly vertical which is supported by the groundwater quality assessment.

Low levels of explosives residues were detected in one of the two bedrock wells installed downgradient from the Pentolite Road Red Water Ponds. However, these downgradient bedrock wells are located some distance from the former ponds. A bedrock well is not located in the immediate vicinity of the ponds, near the area where high explosives residues concentrations were detected in the overburden. It is possible that explosives residues have migrated vertically into the bedrock in the immediate vicinity of the ponds and were not detected in this investigation.

Nitrate levels in were also elevated in the three wells where elevated explosives residues concentrations were detected. In each well, the nitrate concentration exceeded the MCL of 10 mg/L.

Eight metals (antimony, chromium, copper, lead, manganese, nickel, thallium, and zinc) were detected in the groundwater samples collected at the Pentolite Road Red Water Ponds. Very elevated levels of copper, manganese, and nickel were detected in each of the three wells in which high explosives residues were detected. The presence of these metals at such elevated concentrations may be the result of introduction of acidic red water into this area during operation of the PBOW.

Copper concentrations were above the MCL in two of the three overburden wells, and above the SMCL in all three of the overburden wells in which it was detected. Manganese concentrations were above the SMCL, sometimes by several orders of magnitude, in all of the wells in which it was detected. Nickel values exceeded the MCL in all three overburden wells in which it was detected.

8.2.2 West Area Red Water Ponds

Explosives residues were also detected in two of the overburden wells at the West Area Red Water Ponds. The explosives residues concentrations in the two overburden wells at the West Area Red Water Ponds were considerably lower than the concentrations detected in the overburden wells installed within the pond perimeter at the Pentolite Road Red Water Ponds. However, the concentrations of explosives residues detected in the sample of reddish-tinted groundwater from the pit excavated on the north bank of the west pond were significantly higher than any concentrations detected at the Pentolite Road Red Water Ponds. Again, the presence of red water and high explosives residues concentrations near the current pond boundary and probably within the boundary of the pond during operation of the PBOW, supports the conclusion of the groundwater flow assessment. The dominant direction of groundwater flow in the overburden is apparently vertically downward.

Low levels of nitroaromatics were also detected in both of the bedrock wells at the West Area Red Water Ponds.

Nitrates were detected at concentrations above the MCL in both of the overburden wells in which explosives residues were also detected. However, concentrations were not as elevated as those at the Pentolite Road Red Water Ponds.

Eight metals (antimony, chromium, copper, lead, manganese, nickel, thallium, and zinc) were detected in the groundwater samples collected from the West Area Red Water Ponds. Copper, manganese, and nickel were detected at relatively high concentrations in the two wells in which explosives residues were also detected. Again, the

concentrations were significantly lower than those detected in the Pentolite Road Red Water Ponds samples.

Nickel concentrations in overburden well IT-MW2 exceeded the MCL. Manganese concentrations in all samples in which it was detected exceeded the SMCL.

8.3 WEST POND SURFACE WATER AND SEDIMENT INVESTIGATION

The west pond contained water with an average depth of 14 inches at the time of this investigation. The water surface was at elevation 634.90 feet and the volume of water contained at that time is estimated at 850,000 gallons.

The water did not contain elevated levels of explosives residues and thus would not require treatment provided most of the water can be removed without disturbing the underlying sediments. However, this is likely to be difficult to accomplish and would require special care and testing.

The sediment thickness averaged approximately 1 foot at the time of this investigation. This equates to an approximate volume of 132,000 cubic feet. As would be expected the separation between the water and sediments is difficult to establish as there is a gradual transition from liquid to solids through a slurry-like material.

The sediments contain explosives residues at low concentrations at the areas investigated. All levels were below the Region III residential risk screening criteria.

The sediments contain a number of metals at low concentrations and five metals were present in every sediment sample. All metals concentrations were consistent with background concentrations.

The sediment samples analyzed for biological activity indicated that conditions are generally not favorable for TNT biodegradation. Phosphate augmentation would probably be required.

8.4 LIMITATIONS

The observations, findings, and conclusions included in this PBOW Red Water Ponds Focused Remedial Investigation Report are professional opinions based upon performance of a Site Investigation for the former PBOW in Sandusky, Ohio. They are intended exclusively for the use of the Nashville and Huntington Districts of the USACE for the purposes outlined herein. Any use or reuse of this document or the comments, findings, and conclusions represented herein is at the sole risk of said user.

The observations and conclusions presented herein apply only to the investigation performed at the two former red water ponds areas at the former PBOW; the site conditions existing at the time of the investigation; and the review of historical information that could reasonably and accurately be obtained during the course of the investigation and as specified in the Scope of Work for the Site Investigation. They cannot apply to subsequent changes in site conditions of which Dames & Moore is not aware and to conditions which were inaccurately portrayed to Dames & Moore by other parties.

-oOo-

Charles T. Allen, P.E.
Principal

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APPENDIX A

NASA DIGGING AND EXCAVATION PERMIT

DIGGING AND EXCAVATING PERMIT

NASA PLUM BROOK STATION
SANDUSKY, OHIO

CONTRACT NO.: N/A CONTRACTOR: Dames & Moore, Inc.

INSPECTOR: N/A WORK ORDER NO.: N/A

INITIATOR: Deborah L. Raede DATE: Sept. 13, 1994

SITE LOCATION: TNT Areas, Red Water Pond Areas, and Various Background Locations

REFERENCE DRAWINGS: Figures 3-1 through 3-22 of Dames & Moore's Sampling and Analysis Plan Dated September 1994

REMARKS:

CLEARANCES:

PLUM BROOK MANAGEMENT OFFICE AND SERVICE CONTRACTOR:

Mechanical: _____ Date: _____

Electrical: _____ Date: _____

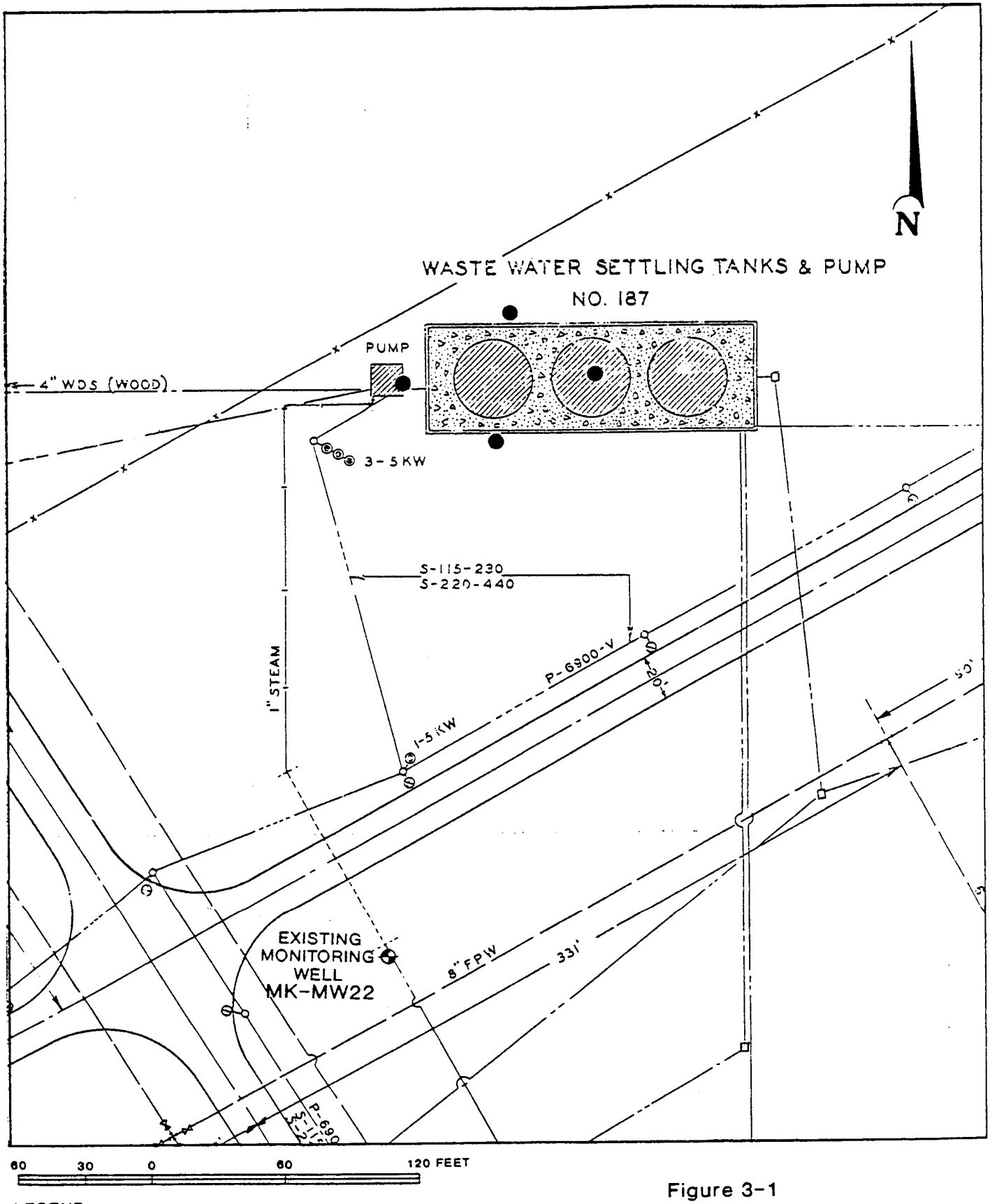
Safety: _____ Date: _____

CLEARANCE (AS APPLICABLE):

NASA PLUM BROOK REACTOR MANAGER:

_____ Date: _____

NASA P-5014 (REV. 12-12-90)



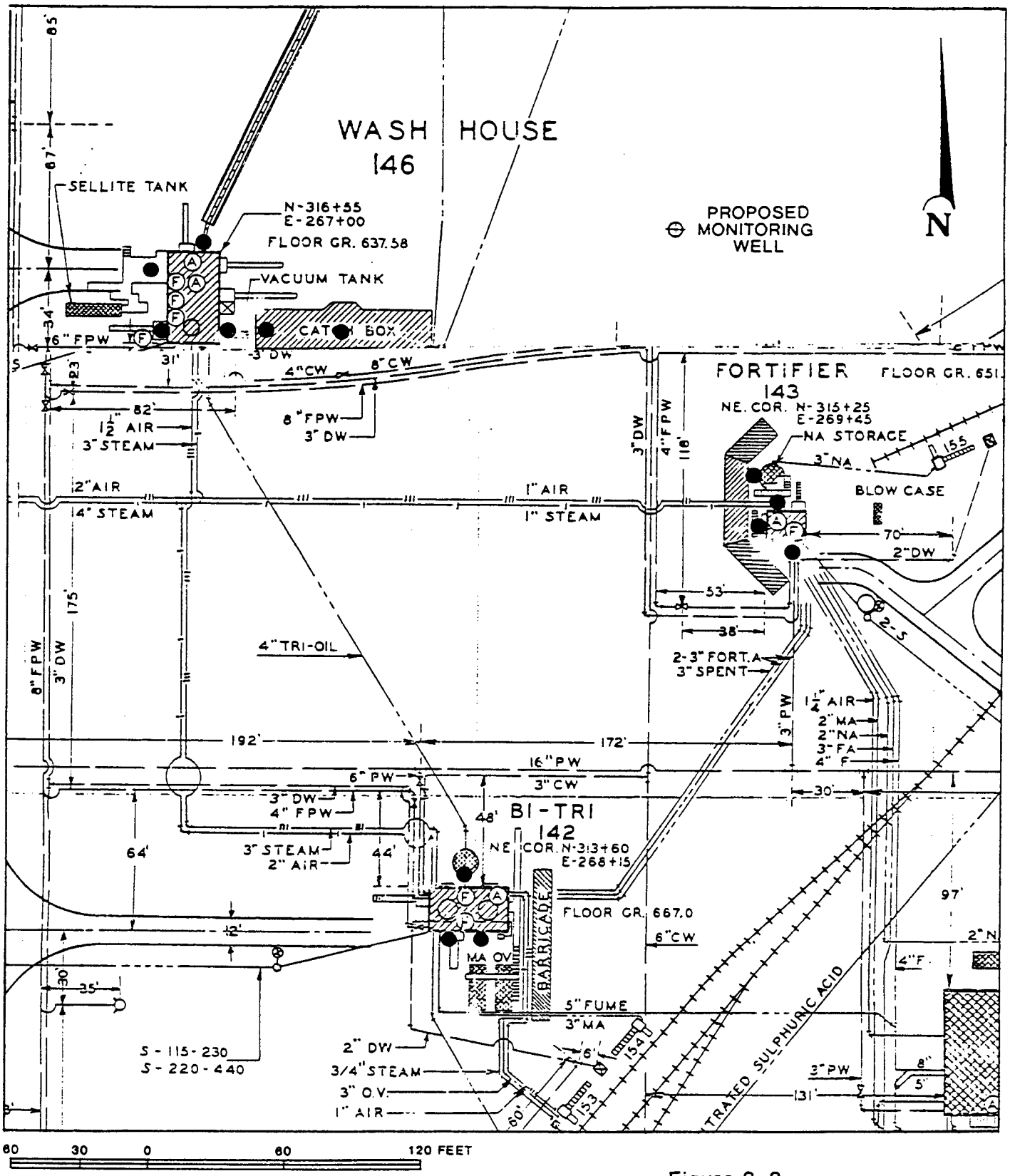
LEGEND:

- ● Proposed Soil Sampling Location
- ⊕ Existing Monitoring Well Location

Figure 3-1

PROPOSED SOIL SAMPLING LOCATIONS AT WASTE WATER DISPOSAL SETTLING TANKS AND PUMP HOUSE AND EXISTING MONITORING WELL
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



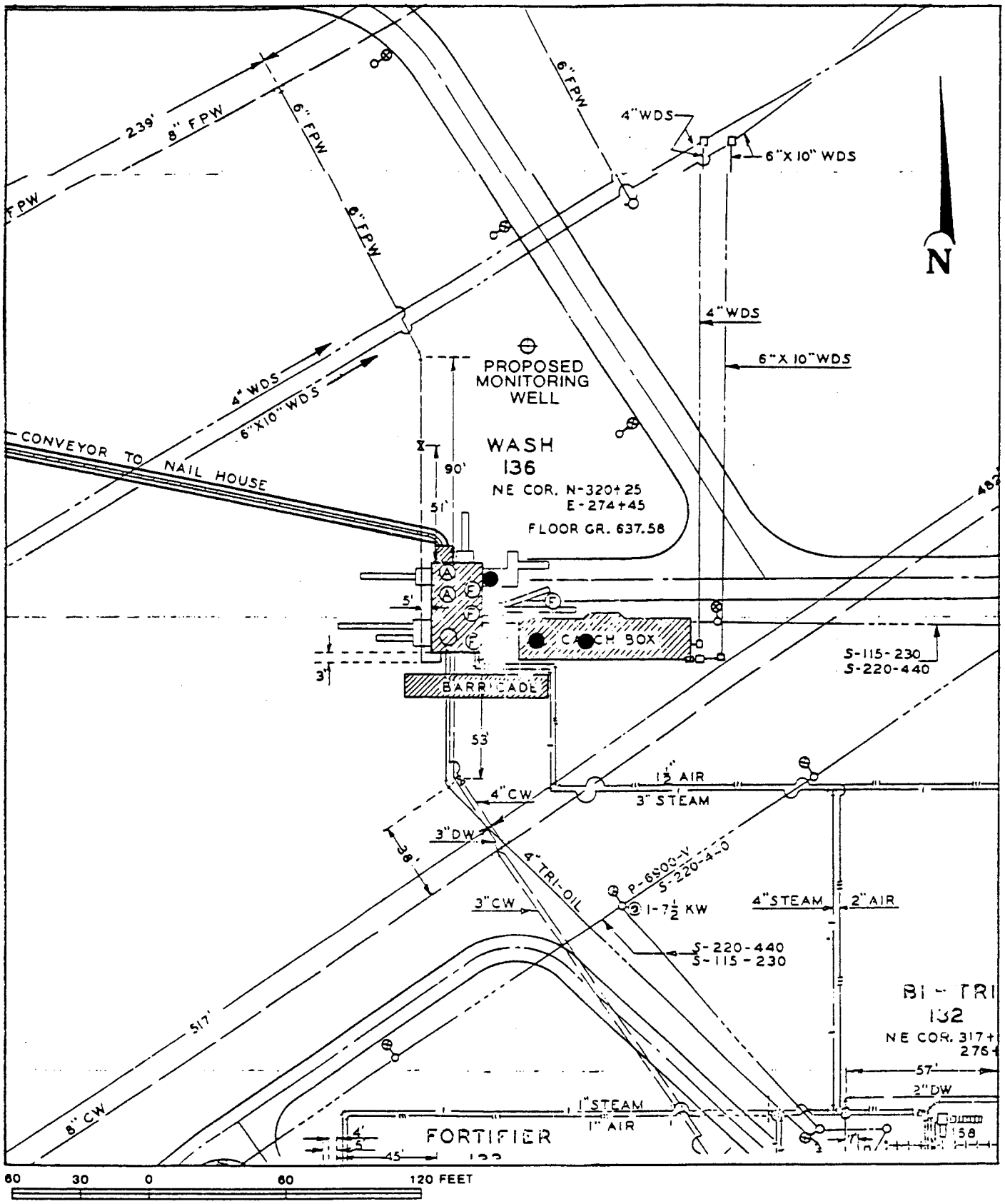
LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

Figure 3-2

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 4, BI-TRI HOUSE AND FORTIFIER HOUSE AND PROPOSED MONITORING WELL
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



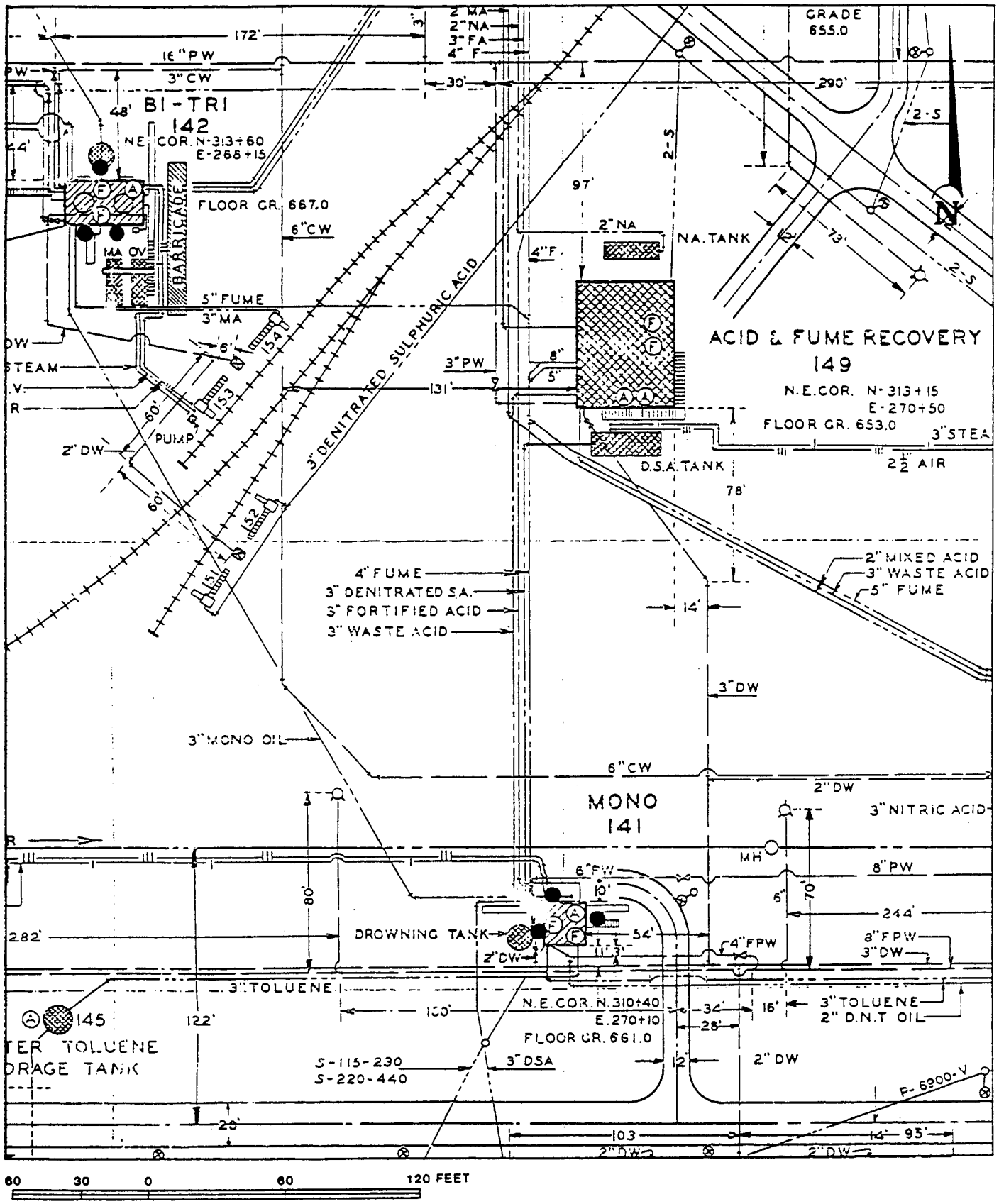
LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

Figure 3-3

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 3 AND PROPOSED MONITORING WELL
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

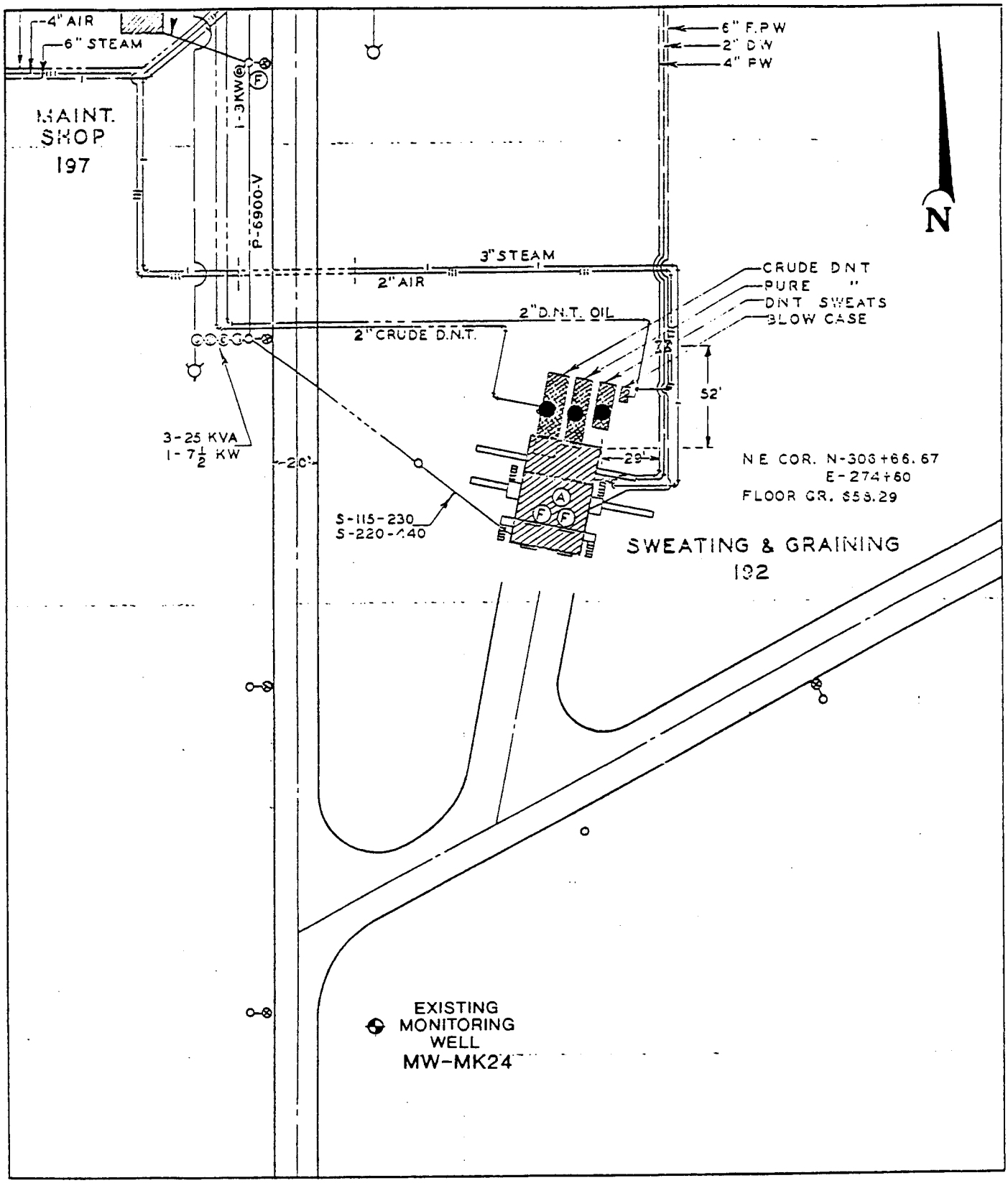
Figure 3-4

PROPOSED SOIL SAMPLING LOCATIONS AT MONO HOUSE

TNT Area A

Plum Brook Ordnance Works

DAMES & MOORE



60 30 0 60 120 FEET

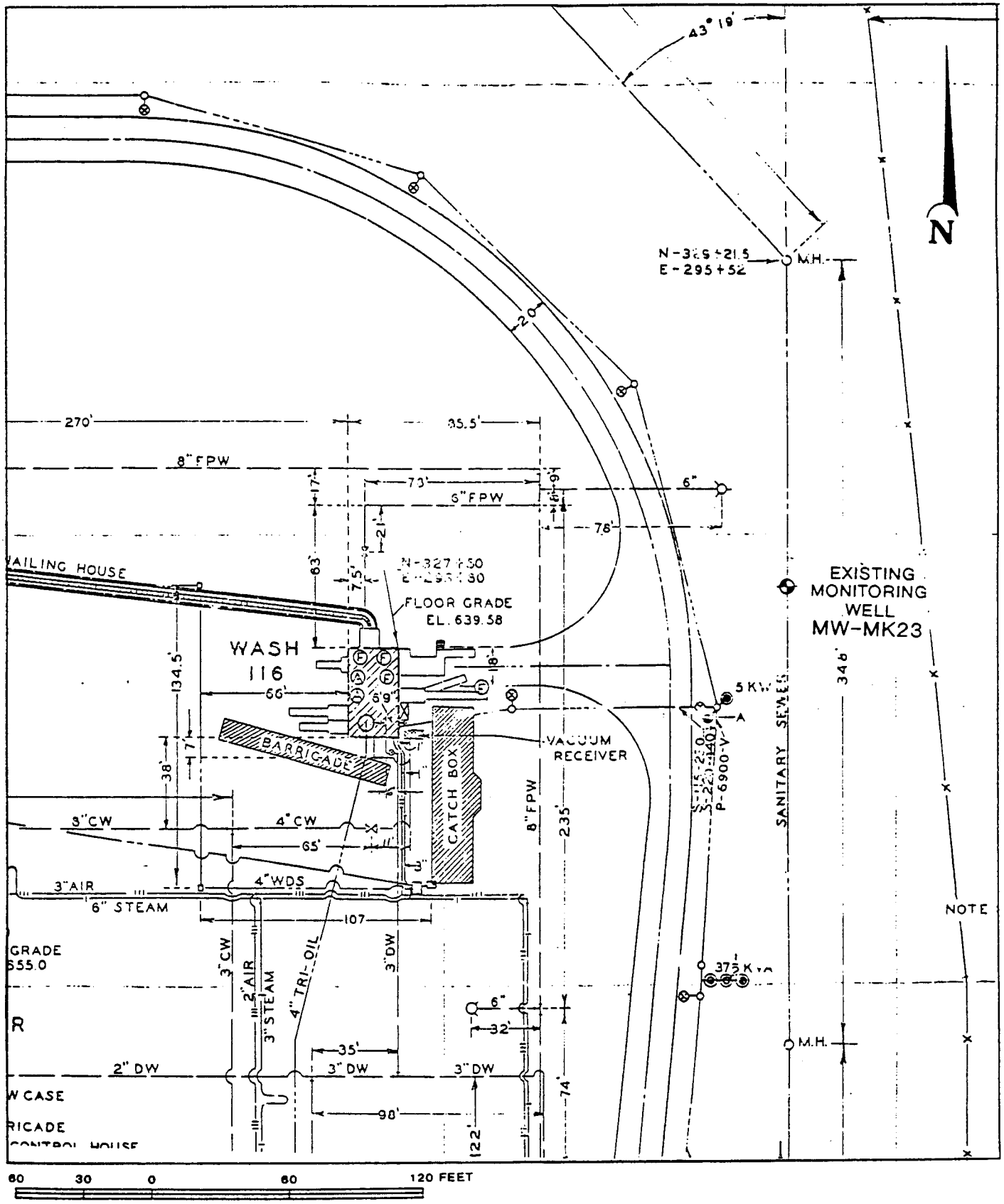
LEGEND:

- ● Proposed Soil Sampling Location
- ⊕ Existing Monitoring Well Location

Figure 3-5

PROPOSED SOIL SAMPLING LOCATIONS AT DNT SWEATING AND GRAINING HOUSE AND EXISTING MONITORING WELL LOCATION
TNT Area A
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

⊕ Existing Monitoring Well Location

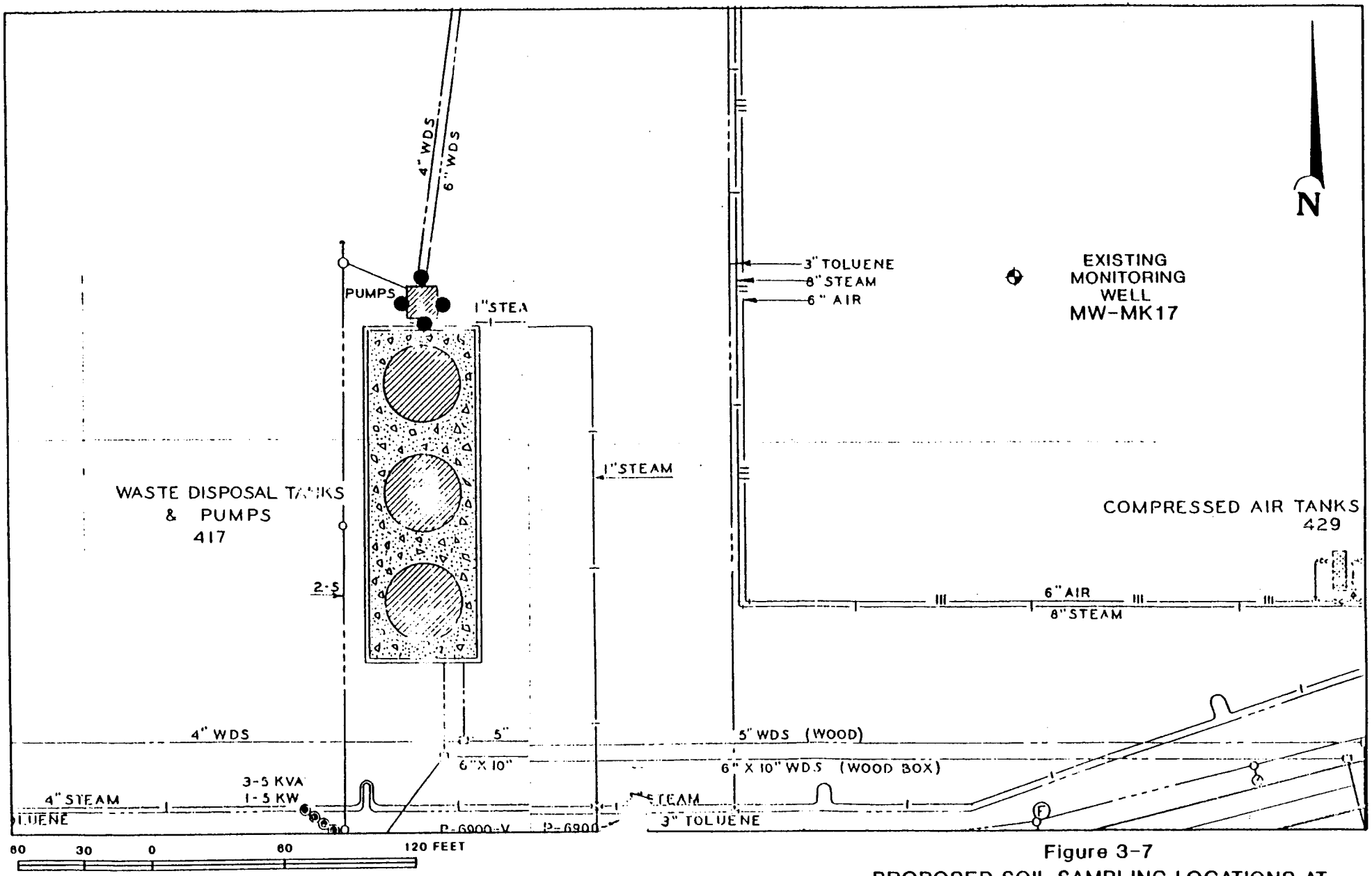
Figure 3-6

EXISTING MONITORING WELL LOCATION

TNT Area A

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

- ● Proposed Soil Sampling Location
- ⊕ Existing Monitoring Well Location

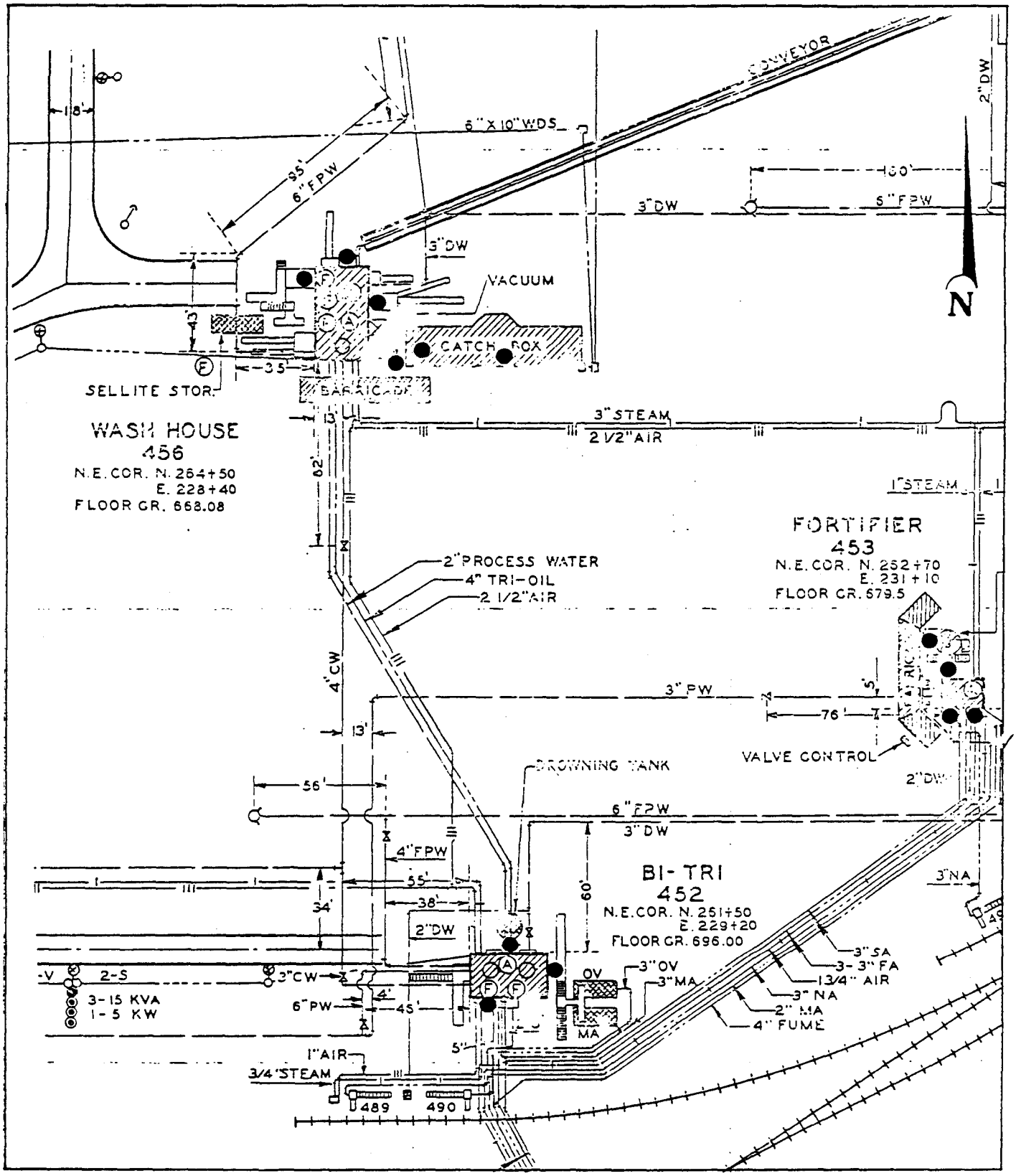
Figure 3-7

PROPOSED SOIL SAMPLING LOCATIONS AT WASTE WATER DISPOSAL SETTLING TANK AND EXISTING MONITORING WELL LOCATION

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

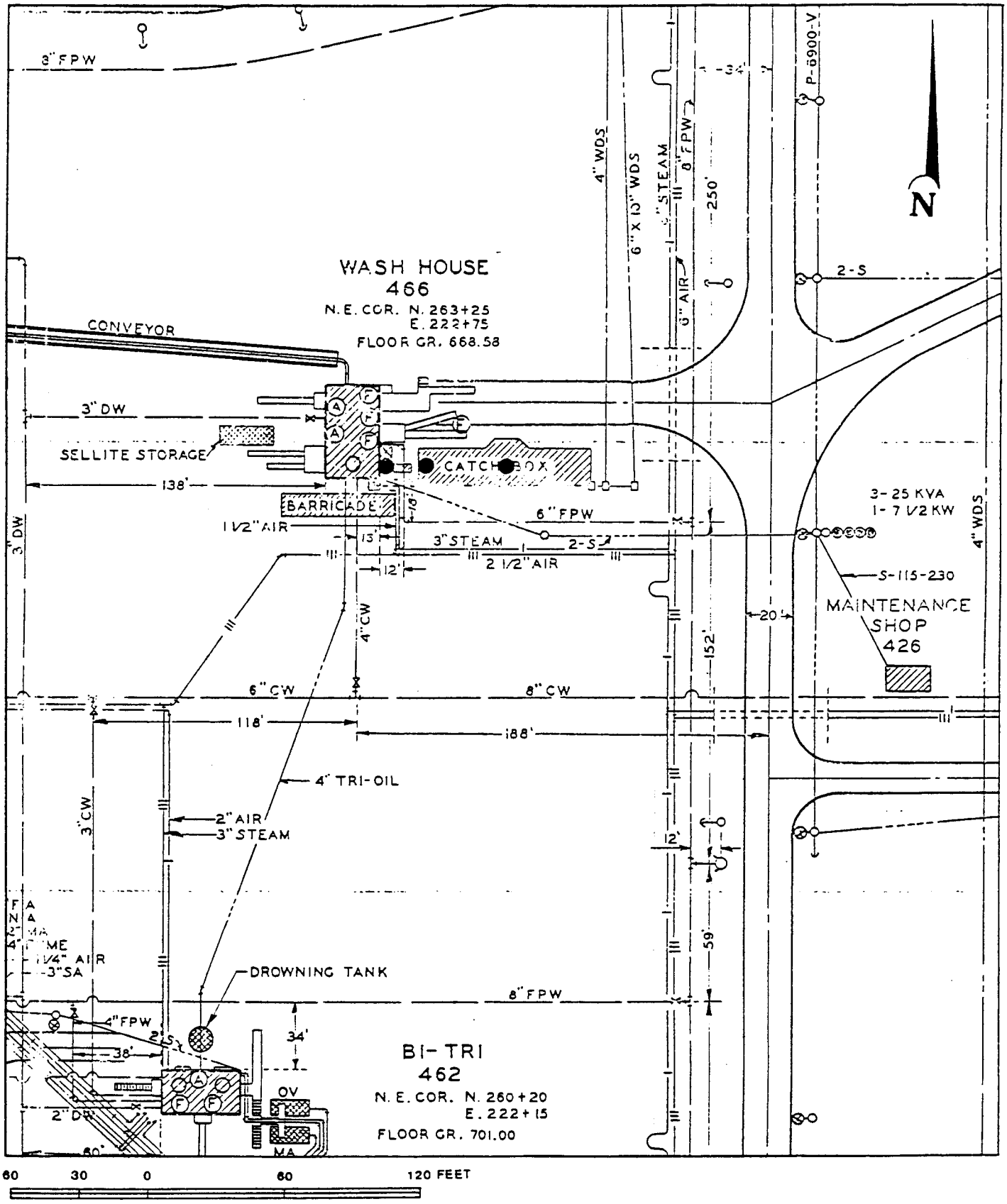
Figure 3-8

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 5 AND BI-TRI HOUSE

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

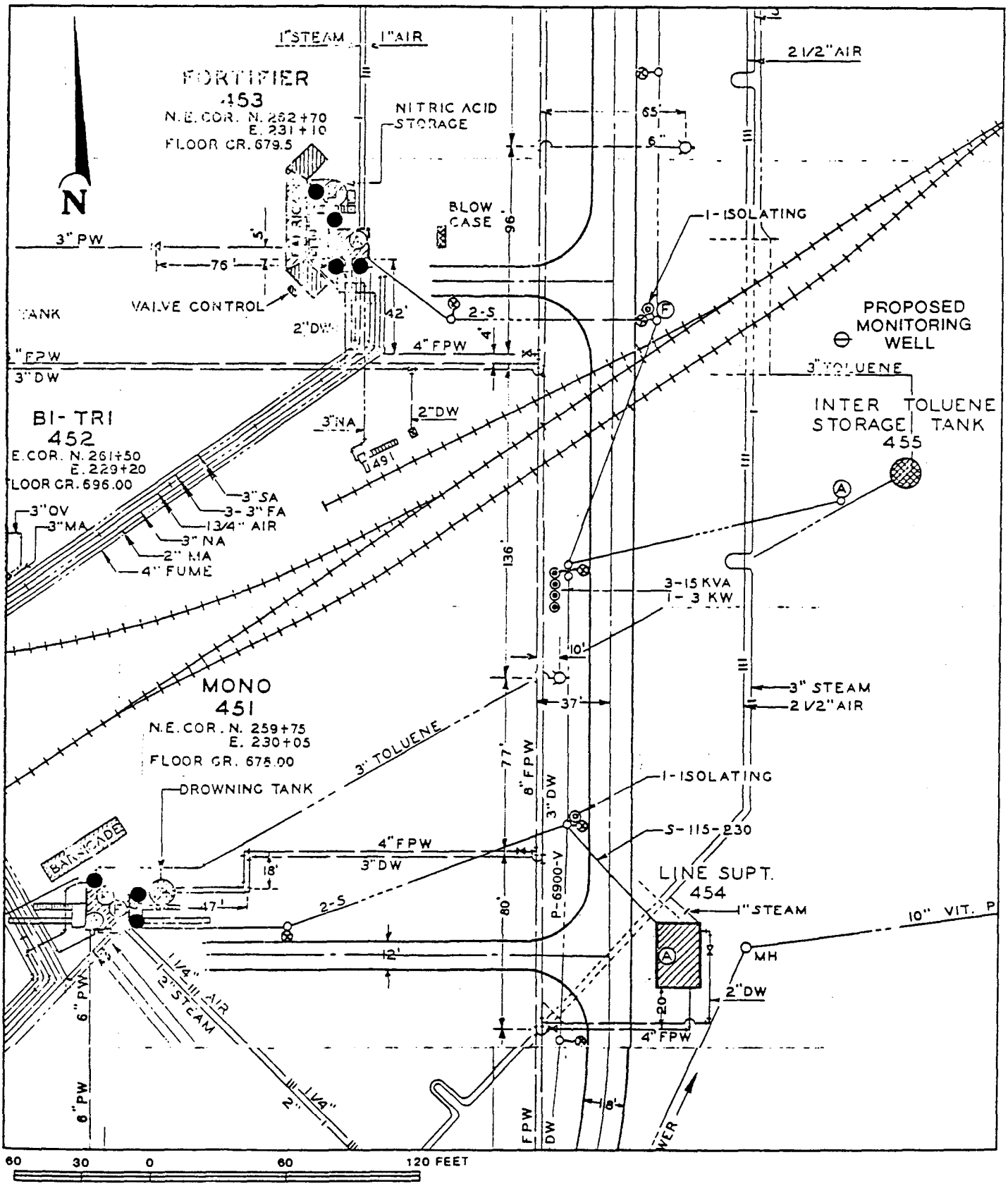
Figure 3-9

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 6

TNT Area B

Plum Brook Ordnance Works

DAMES & MOORE



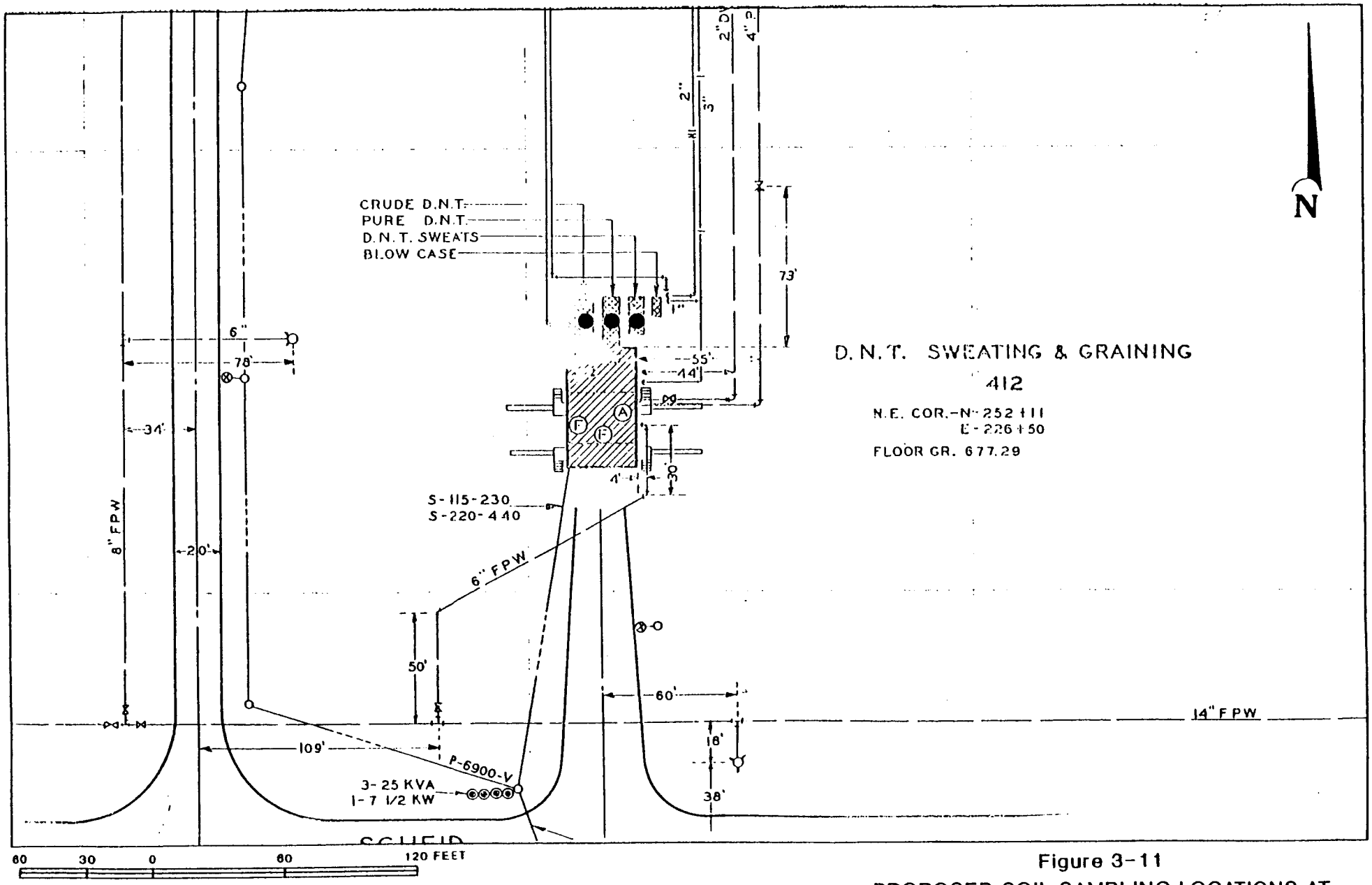
LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

Figure 3-10

PROPOSED SOIL SAMPLING LOCATIONS AT BI-TRI HOUSE, FORTIFIER HOUSE AND MONO HOUSE AND PROPOSED MONITORING WELL
TNT Area B
Plum Brook Ordnance Works

DAMES & MOORE

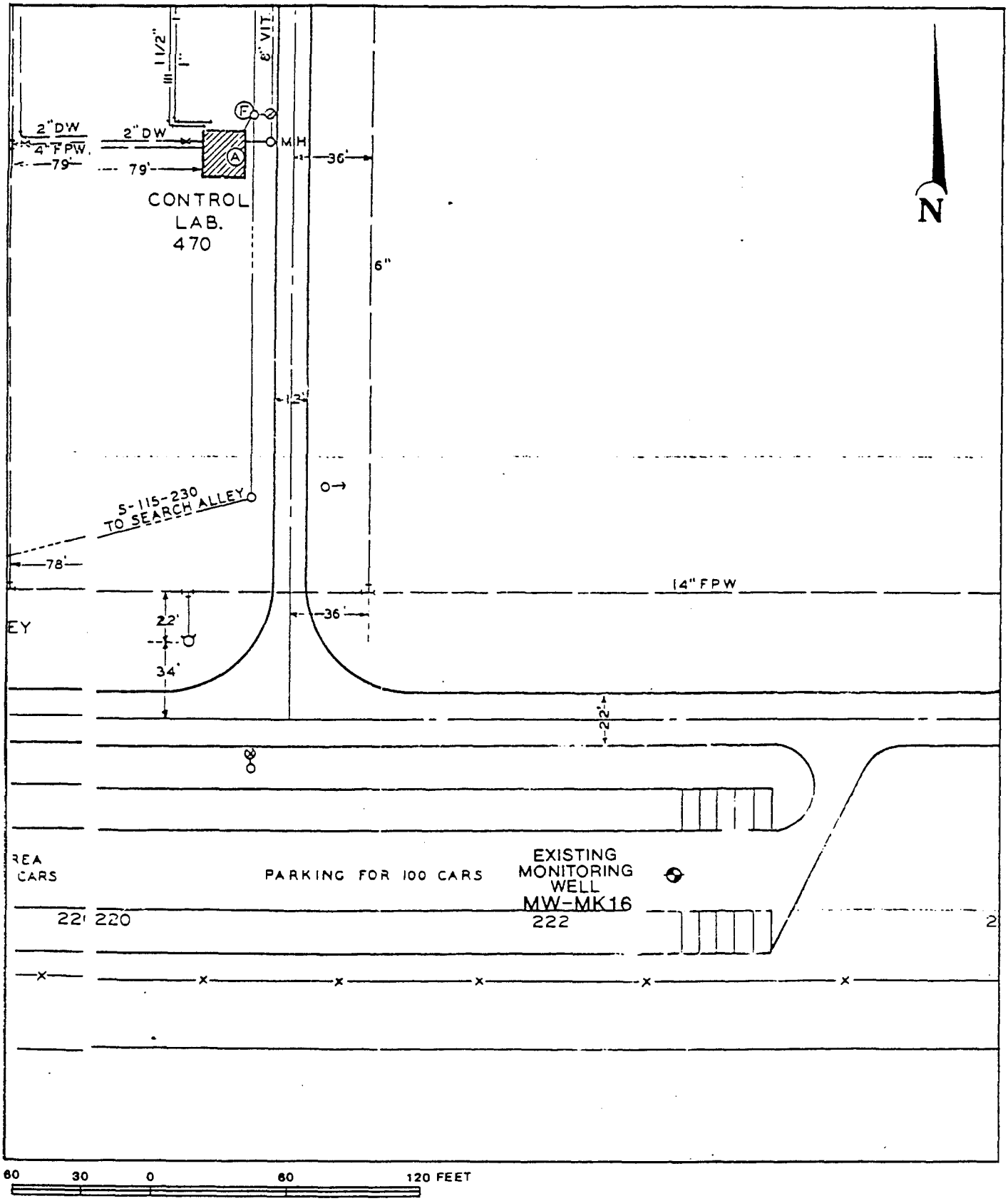


LEGEND:

● Proposed Soil Sampling Location

Figure 3-11
PROPOSED SOIL SAMPLING LOCATIONS AT
DNT SWEATING AND GRAINING HOUSE
TNT Area B
Plum Brook Ordnance Works

DAMES & MOORE



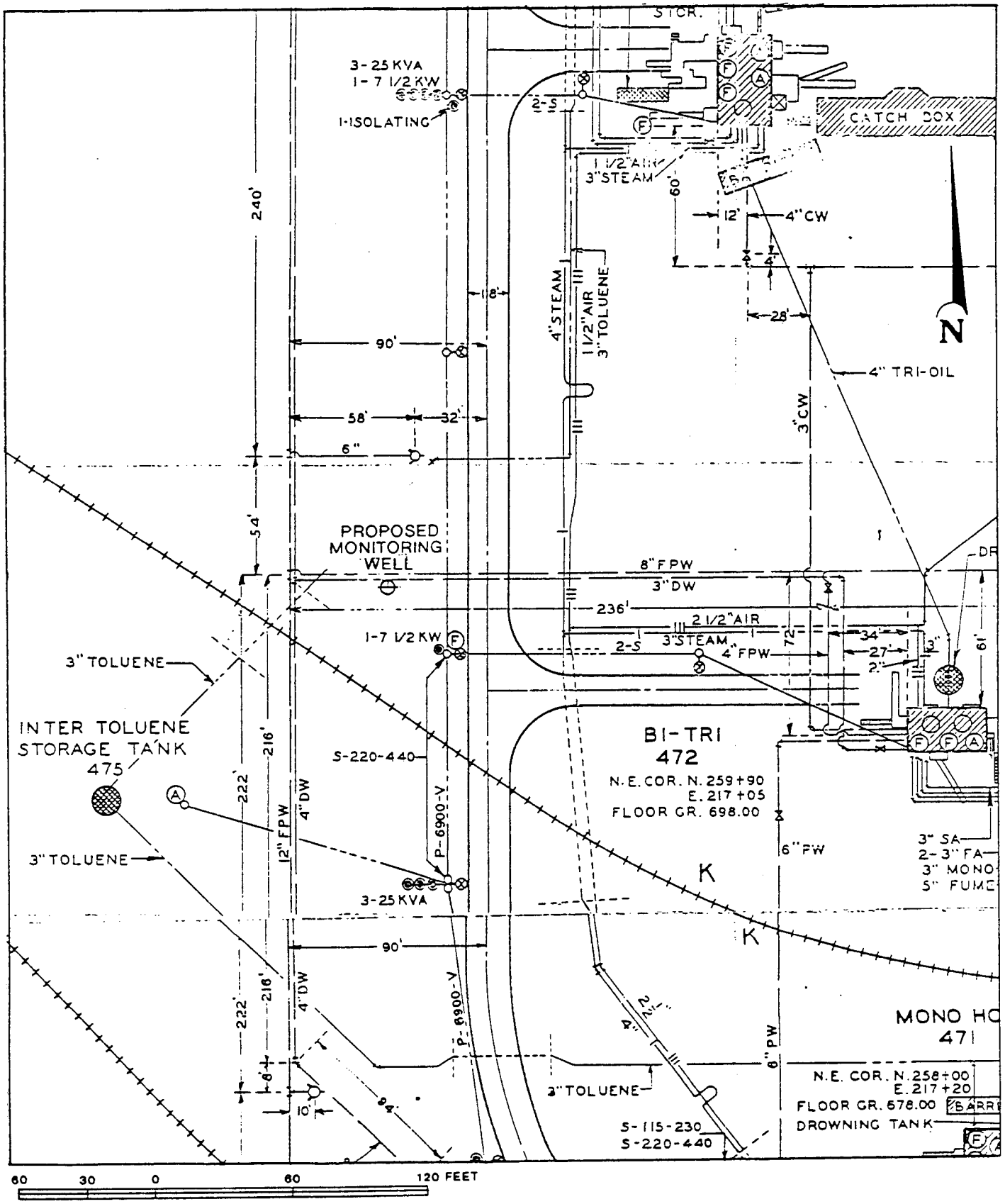
LEGEND:

Existing Monitoring Well Location

Figure 3-12

EXISTING MONITORING WELL LOCATION
TNT Area B
Plum Brook Ordnance Works

DAMES & MOORE



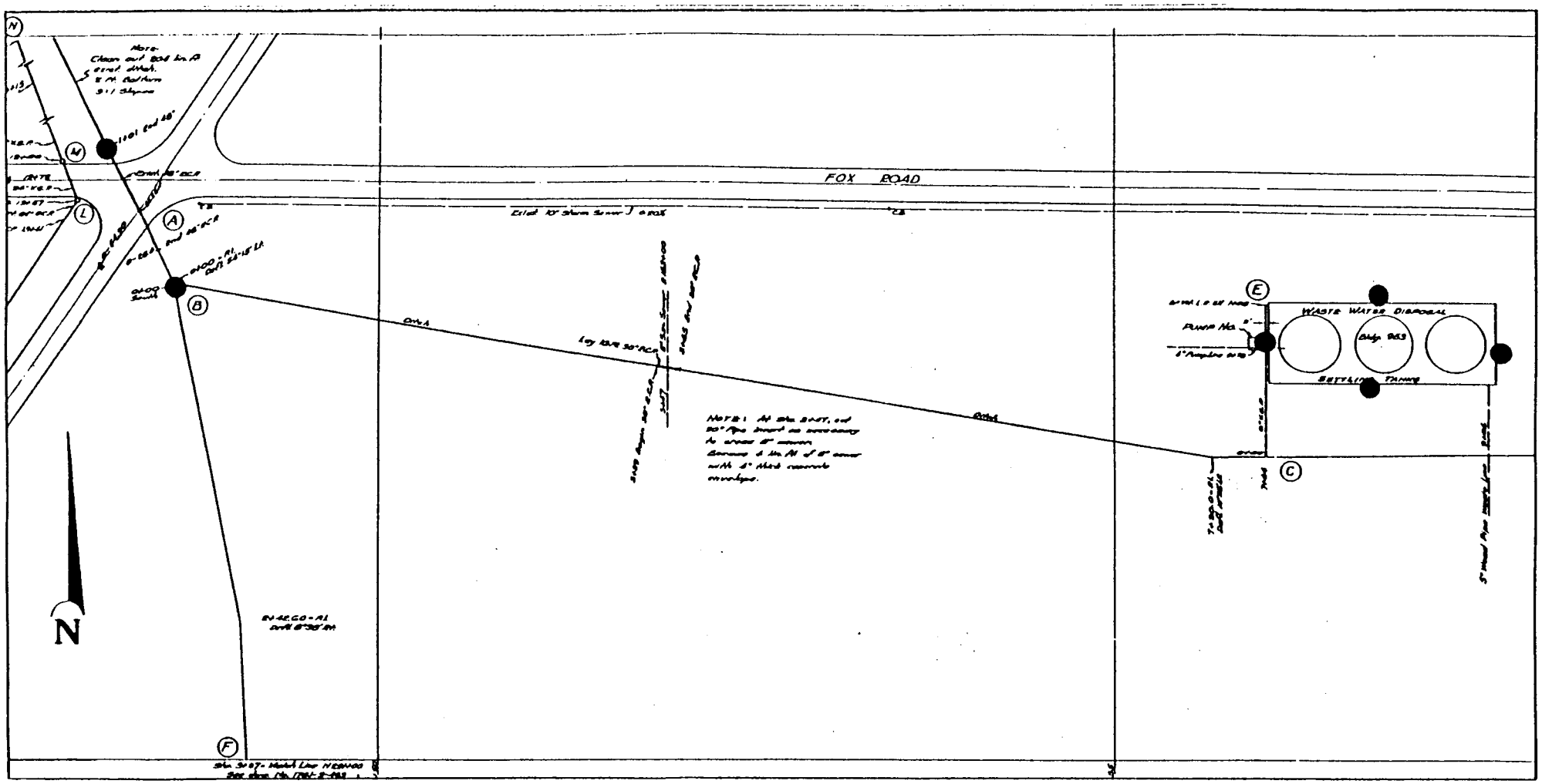
LEGEND:

⊖ Proposed Monitoring Well Location

Figure 3-13

PROPOSED MONITORING WELL LOCATION
TNT Area B
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

100 50 0 100 200 FEET

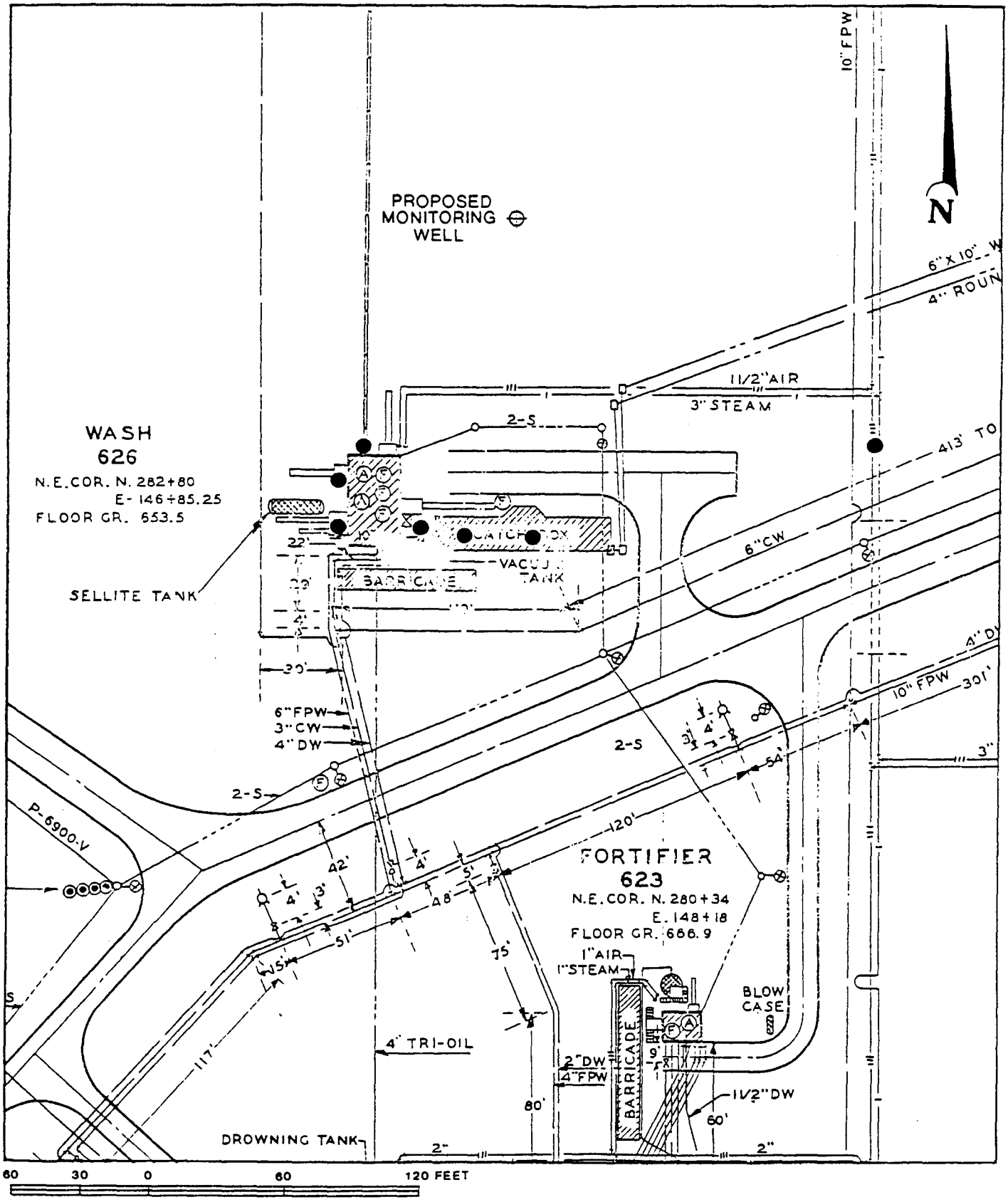
Figure 3-14

PROPOSED SOIL SAMPLING LOCATIONS AT WASTE WATER DISPOSAL SETTLING TANK AND ASSOCIATED DITCHES

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

- ● Proposed Soil Sampling Location
- ⊖ Proposed Monitoring Well Location

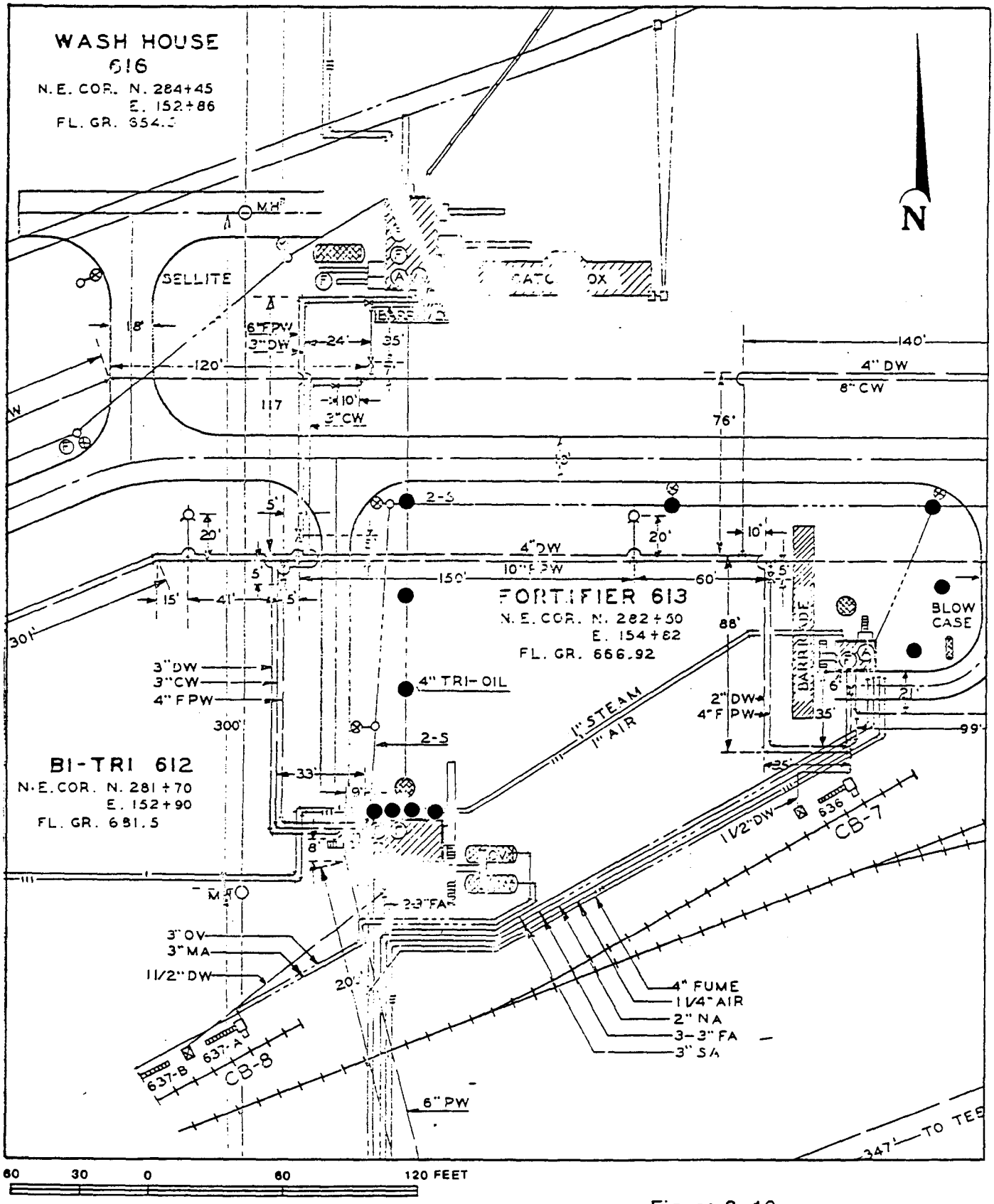
Figure 3-15

PROPOSED SOIL SAMPLING LOCATIONS AT WASH HOUSE - LINE 12 AND ASSOCIATED DITCH AND PROPOSED MONITORING WELL

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



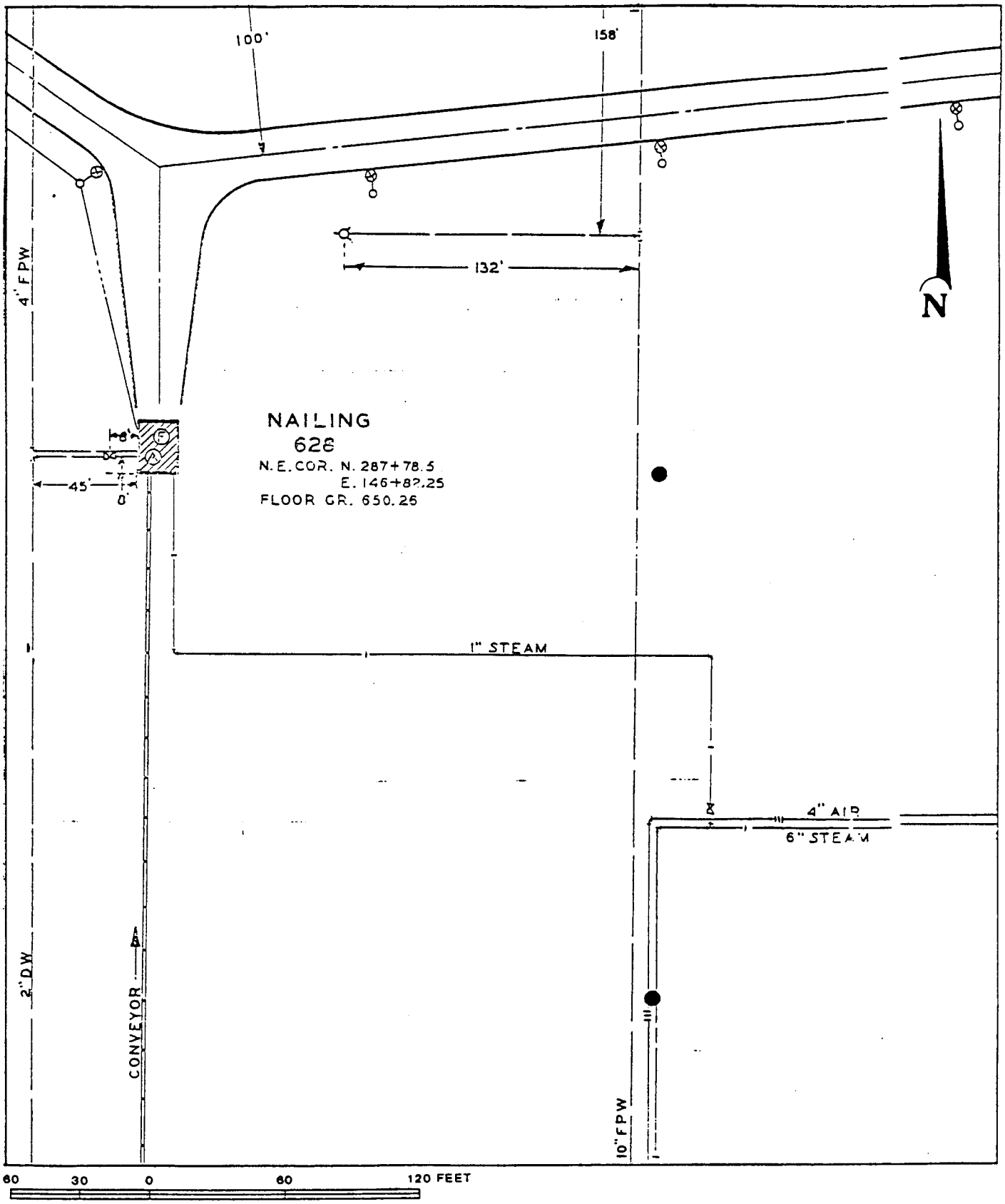
LEGEND:

● Proposed Soil Sampling Location

Figure 3-16

PROPOSED SOIL SAMPLING LOCATIONS AT BI-TRI HOUSE, FORTIFIER HOUSE AND ASSOCIATED DITCHES
TNT Area C
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

● Proposed Soil Sampling Location

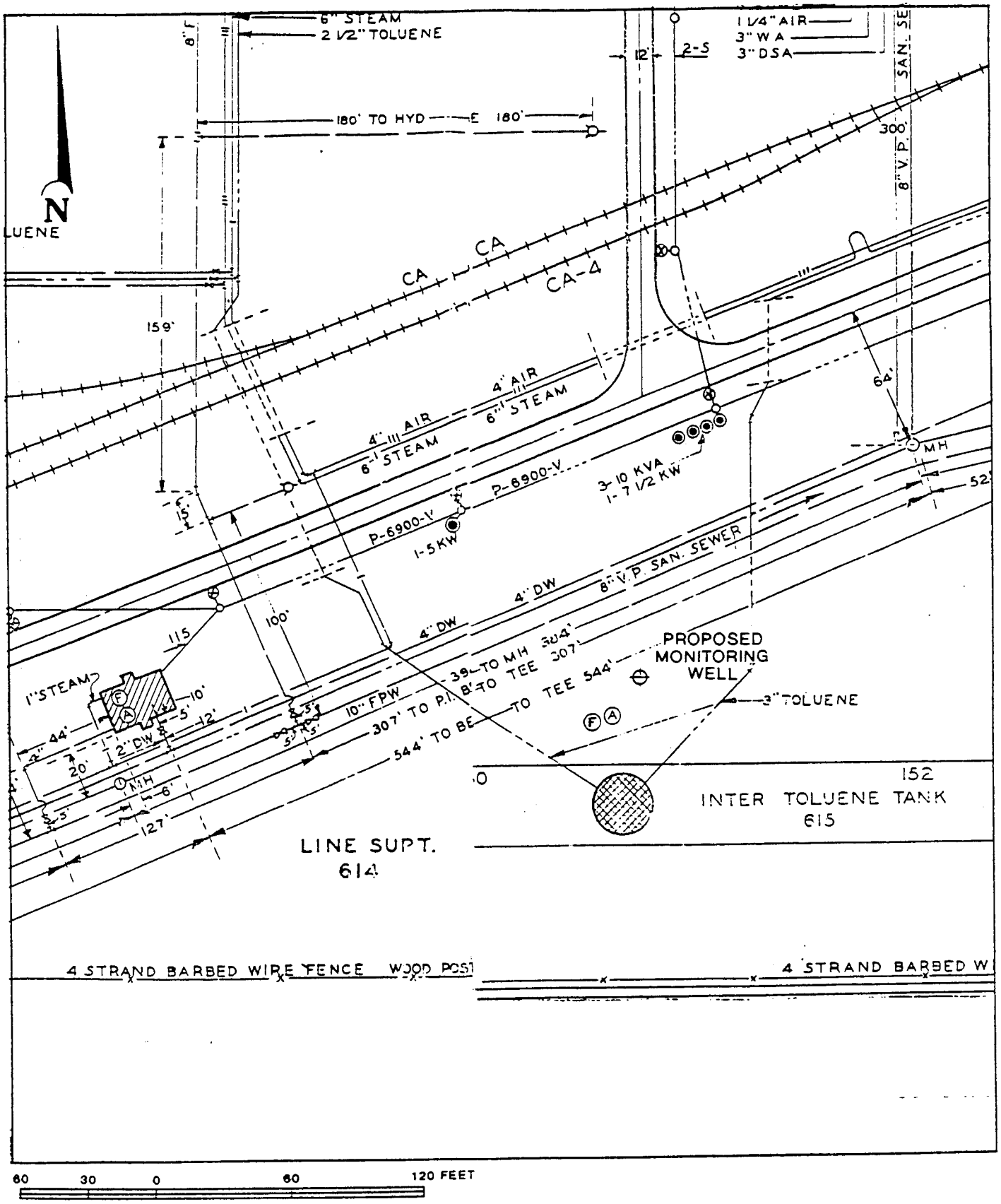
Figure 3-17

PROPOSED SOIL SAMPLING LOCATIONS AT ASSOCIATED DITCH

TNT Area C

Plum Brook Ordnance Works

DAMES & MOORE



60 30 0 60 120 FEET

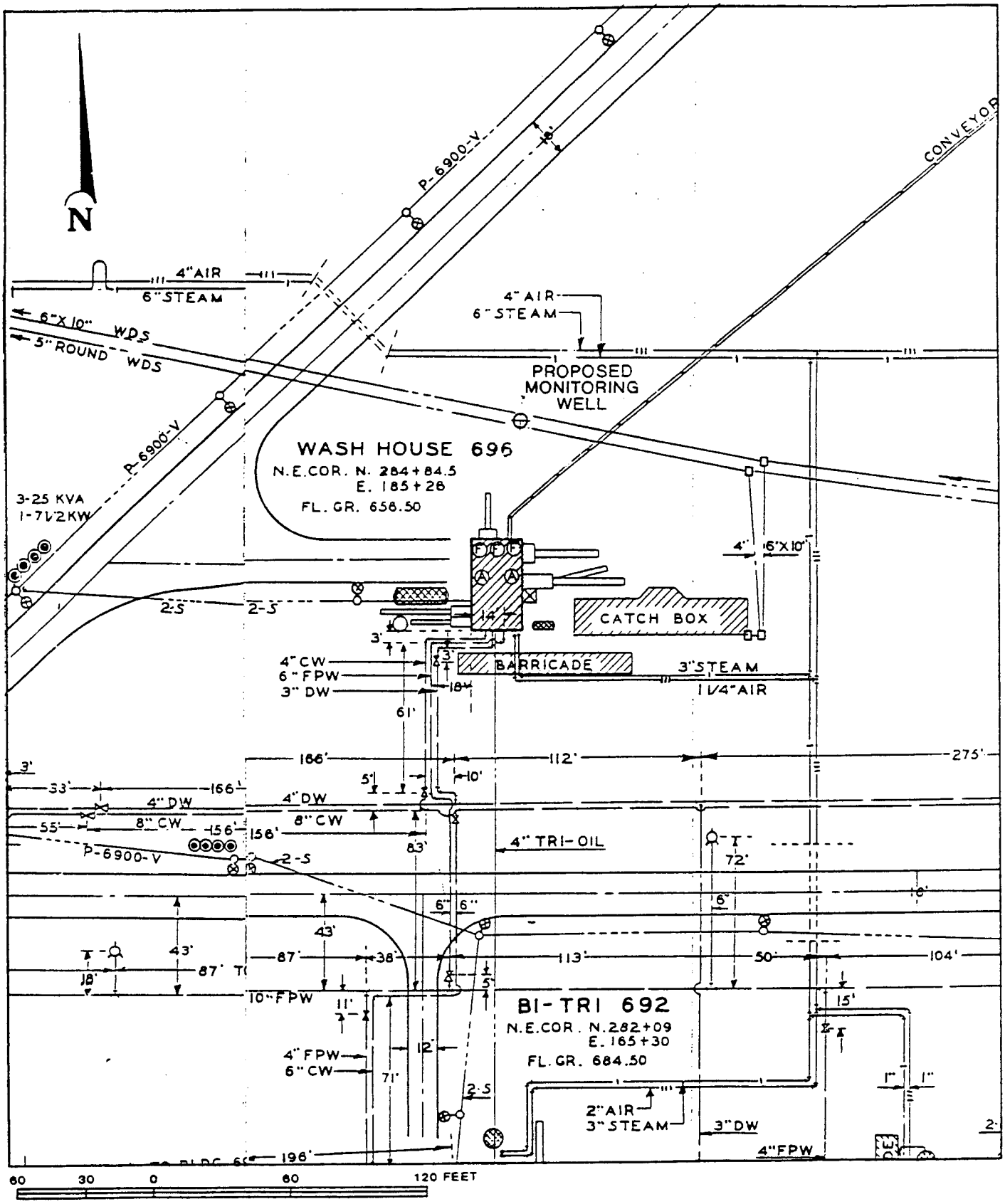
LEGEND:

⊖ Proposed Monitoring Well Location

Figure 3-18

PROPOSED MONITORING WELL LOCATION
TNT Area C
Plum Brook Ordnance Works

DAMES & MOORE



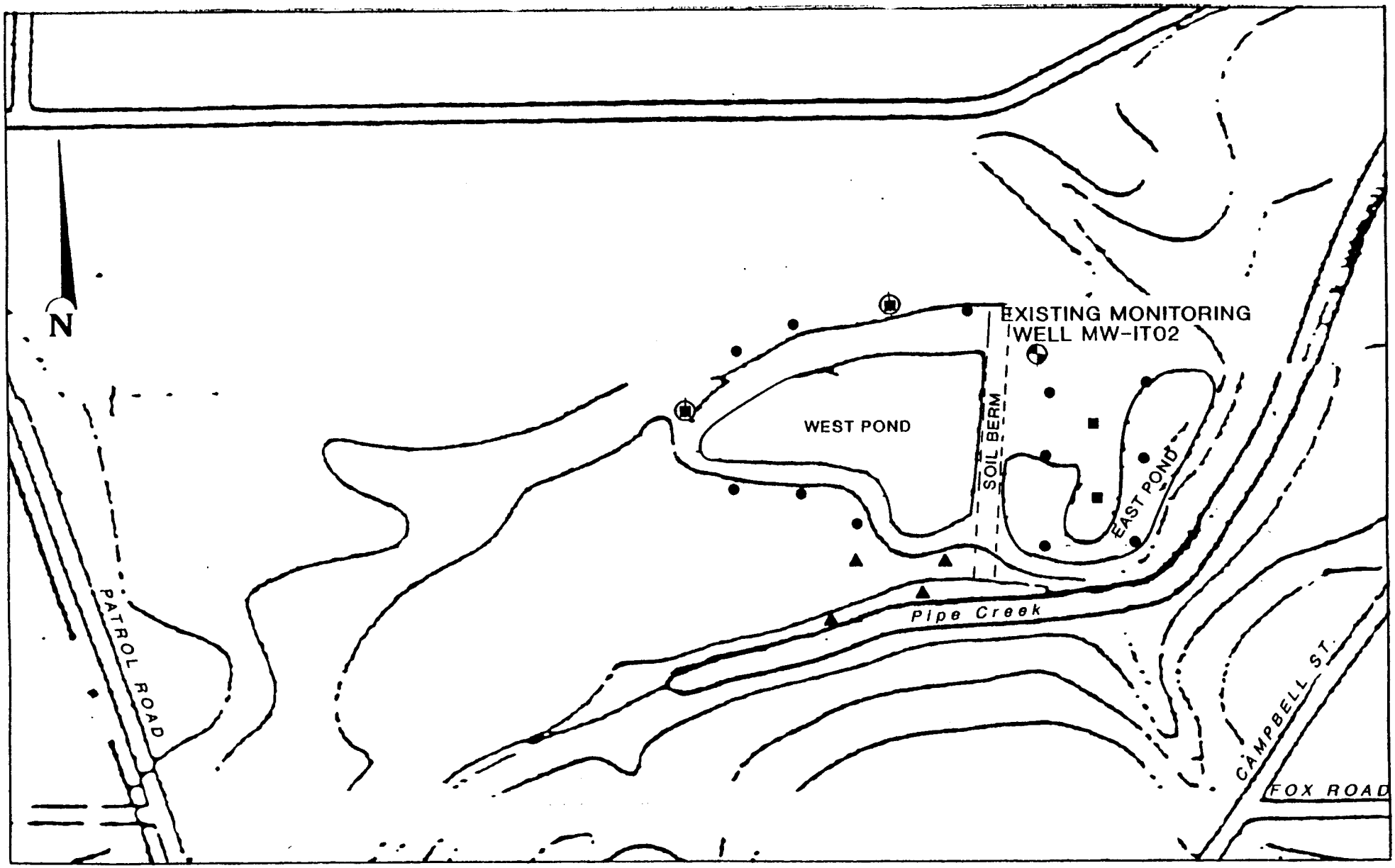
LEGEND:

⊖ Proposed Monitoring Well Location

Figure 3-19

PROPOSED MONITORING WELL LOCATION
TNT Area C
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

- ● 5-Foot Soil Boring
- ■ 10-Foot Soil Boring
- Existing Monitoring Well
- Proposed Monitoring Well
- ▲ Surface Soil Sample

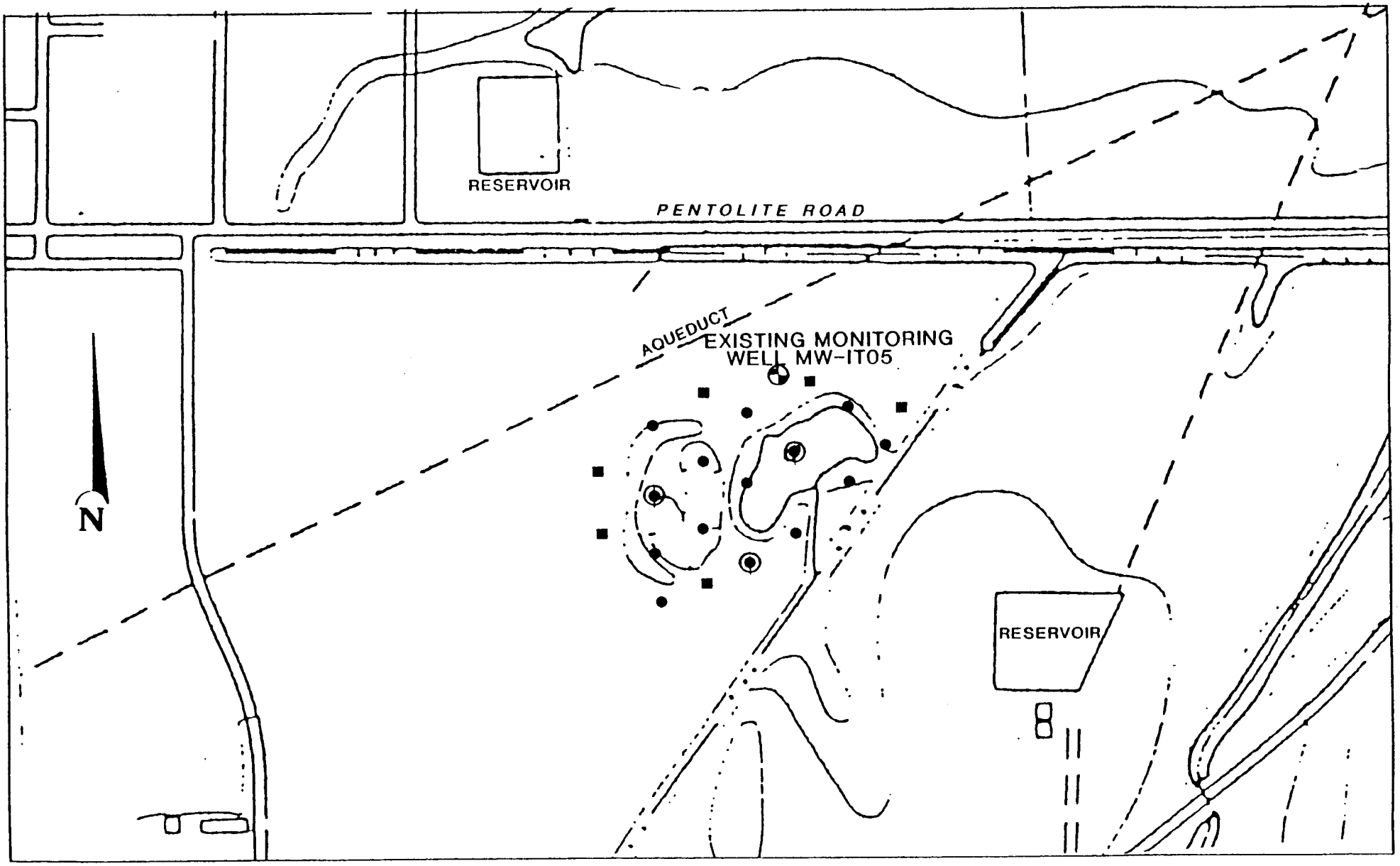
SOURCE: Base map was enlarged from a portion of the U.S.G.S. 1:24,000 scale topographic map titled: "Sandusky, Ohio", 1969

Figure 3-20

PROPOSED SOIL SAMPLING LOCATIONS AND PROPOSED AND EXISTING MONITORING WELL LOCATIONS

West Area Red Water Ponds
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

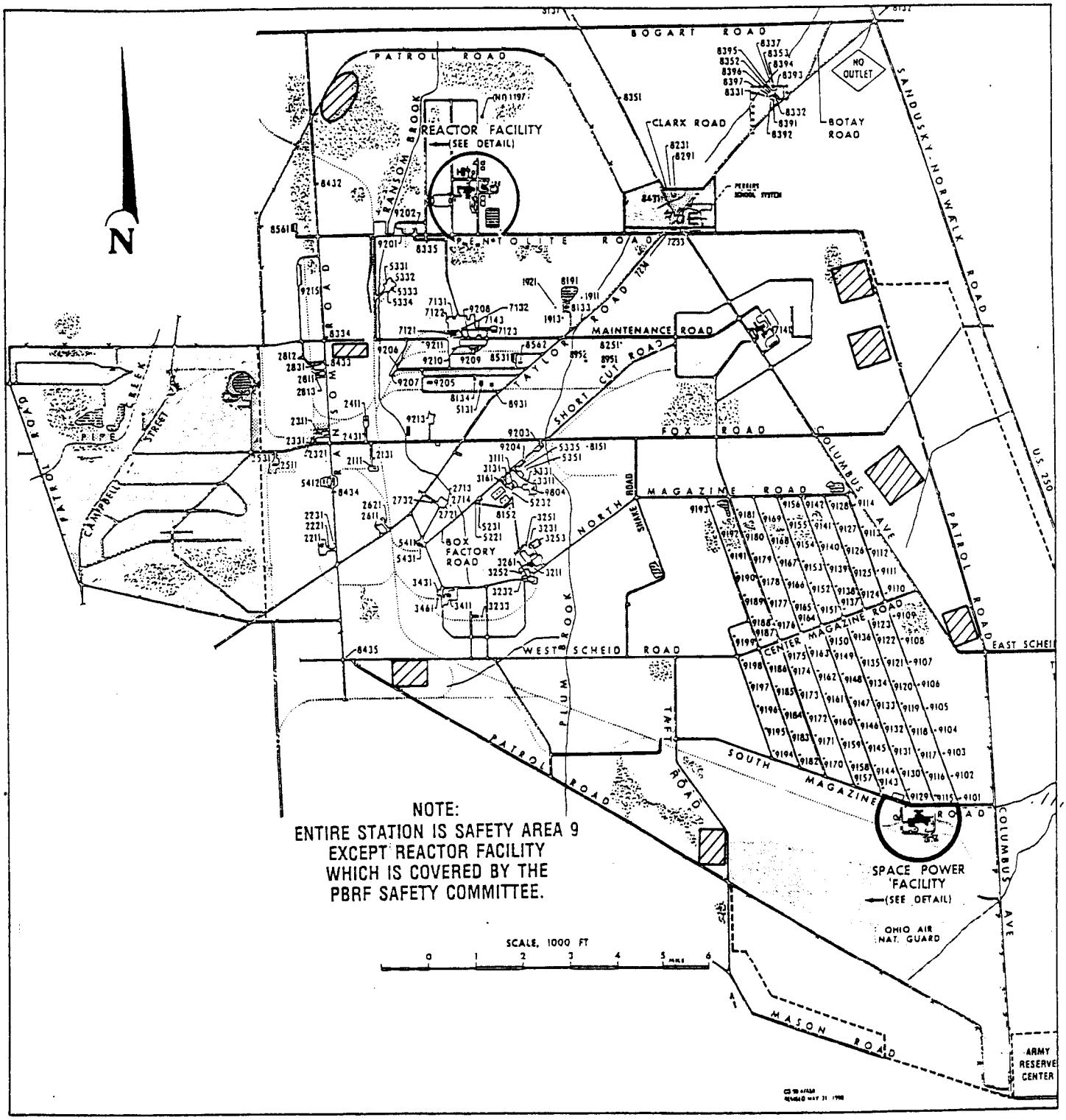
- ● 10-Foot Boring
- ■ 5-Foot Boring
- Existing Monitoring Well
- Proposed Monitoring Well

SOURCE: Base map is enlarged from a portion of the U.S.G.S. 1:24,000 scale topographic map of "Sandusky, Ohio", 1969

Figure 3-21

PROPOSED SOIL SAMPLING LOCATIONS AND EXISTING AND PROPOSED MONITORING WELL LOCATIONS
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works

DAMES & MOORE



LEGEND:

Potential Areas Where Soil Background Samples May Be Collected

Figure 3-22

PROPOSED BACKGROUND SOIL SAMPLING LOCATIONS
Plum Brook Ordnance Works

DAMES & MOORE

APPENDIX B

SOIL BORING LOGS

BORING LOGS

5-FOOT HAND-AUGERED BORINGS

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S1

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: PENTOLITE ROAD RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-31-94 / 11. DATE COMPLETED: 10-31-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE/WELL NO. PB PR-S1-

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty fine Sand w/Roots				Some vegetation @ surface w/Roots
	0.5	Roots Grade out				
	1.0	Grades to Brownish orange				Sample Collected @ PR-S1-0.0/2.0 @ 1100
	1.5					
	2.0		H.V.O = 0			
	2.5					
	3.0					
	3.5					Sample PB-PR-S1-2.0/5.0 Collected @ 1110
	4.0	Grades to Mottled Gray and Brownish orange Sandy Clay				
	4.5					
	5.0	Grades to Gray w/ less sand	H.V.O = 0			

PROJECT Boring terminated @ 5.0 ft
No GW encountered @ 1110
Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S3

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: PENTOLITE ROAD RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11-1-94 / 11. DATE COMPLETED: 11-1-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S3

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Silty Fine Sand w/ Roots				Some Vegitation @ Surface w/ Roots
	0.5	Grade to Brown				
	1.0	Grades to Brownish orange to tan Roots Grade out				
	1.5					Sample PR-S3-0.0/2.0 collected @ 1733
	2.0		HNU=0			
	2.5	Grades to Brownish orange w/ Trace Clay				
	3.0	Grades w/ Gray				
	3.5					Sample PR-S3-2.0/5.0 collected @ 1740
	4.0					Bones noted
	4.5	Mottled Gray and Brownish orange Fine Sandy clay @ 4.5 feet				
	5.0		HNU=0			

PROJECT: Plum Brook Ordnance Works

Terminated @ 5.0 ft
No GW Encountered 17:40

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S 8

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: PENTOLITE ROAD RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-31-94 / 11. DATE COMPLETED: 10-31-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE/WELL NO. PB-PR 58

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown Silty Fine Sand w/ Root				Some Vegetation w/ Root
	0.5					
	1.0	Grades to Brown to Tan root Grade out				Sample PB-PR-S8-0.9/2.0 1215
	1.5					
	2.0		HNU=0			
	2.5					
	3.0					
	3.5					Sample PB-PR-S8-2.0/5.0 collected @ 1223
	4.0	Grades w/ occasional Gray				
		Brownish orange clayey Sand				
	4.5					
	5.0	Grades to Mottled Brownish yellow and Grey	HNU= 0			

PROJECT Boring Terminated @ 5 feet No GW encountered 1223

HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S17

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: PENTOLITE ROAD RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-31-94 / 11. DATE COMPLETED: 10-31-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.:

HTRW DRILLING LOG

HOLE/WELL NO. PR-S17

PROJECT Plum Brook Ordnance Works | INSPECTOR | SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty Sand w/ Roots				Some Vegetation @ surface w/ Roots
		Grades w/ Brownish orange				
	0.5	Grades to Brownish orange				
	1.0	Mottled Black and Gray silty sand w/ Roots				Possible Pond Material (sediment)
		Grades to Mottled Brownish orange, Gray, and DK Brown w/ some Clay				Sample PB-PR-S17-0/2.0 collected @ 1247
	1.5					
	2.0		HNU=0			
	2.5	Grades to Dark Brown w/ occasional Brownish yellow				
	3.0	Grades to Brownish yellow Clayey sand				
	3.5	Grades w/ occasional Gray Clay lenses				Sample PB-PR-S17-2.0/5.0 collected @ 1257
	4.0	Mottled Brownish orange and Gray Fine Sandy Clay				
	4.5					
	5.0		HNU=0			

PROJECT Boring Terminated @ 5 feet No GW was encountered 1257 | HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S18

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: PENTOLITE ROAD RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S18

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown silty Fine Sand	HNU=0			Some Vegetation @ Surface w/ Root
		Grades to Brownish Tan w/ occassional Brownish orange				
	0.5					
		Roots Grade out				
	1.0					Sample PB-PR-S18-0.0/2.0 collected @ 1620
	1.5					
	2.0	Grades w/ occasional Gray Clay lenses				
	2.5	Grades w/ More Clay	HNU=0			
		- Mottled Gray and Brownish orange Clayey Sand/Sandy Clay				
	3.0					
	3.5	— Sandy Clay — - -	- - - -	-	—	Moist — - -
						Sample PR-S18-2.0/5.0 collected @ 1630
	4.0					
	4.5					
	5.0		HNU=0			

PROJECT: Boring Terminated @ 5ft 1630
No GW encountered

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S20

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: PENTOLITE ROAD RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		- Dark Brown to Brown Silty Sand w/ Root				Some Vegetation @ Surface w/ Roots
	0.5	- Grades to mottled Gray and Brownish yellow w/ Roots				
		Roots Grade out				
	1.0	Grades to Dark Brown				Sample PR-S20-0.0/2.0 Collected @ 1700
	1.5					
	2.0		HNU=0			
	2.5	Grades w/ some Clay				
		Grades to Gray + Brownish yellow sandy (S.S.) Clay w/ Trace fine sand				
	3.0					
	3.5					Sample PR-S20-2.0/5.0 Collected @ 1710
	4.0	Grades w/ occasional Brownish orange				
	4.5					
	5.0		HNU=0			

PROJECT: Boring Terminated @ 5.0 ft
No GW encountered 1710

HOLE NO.

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-521

SHEET 1 OF SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: E. Samuels	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: hand trowel	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE:	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

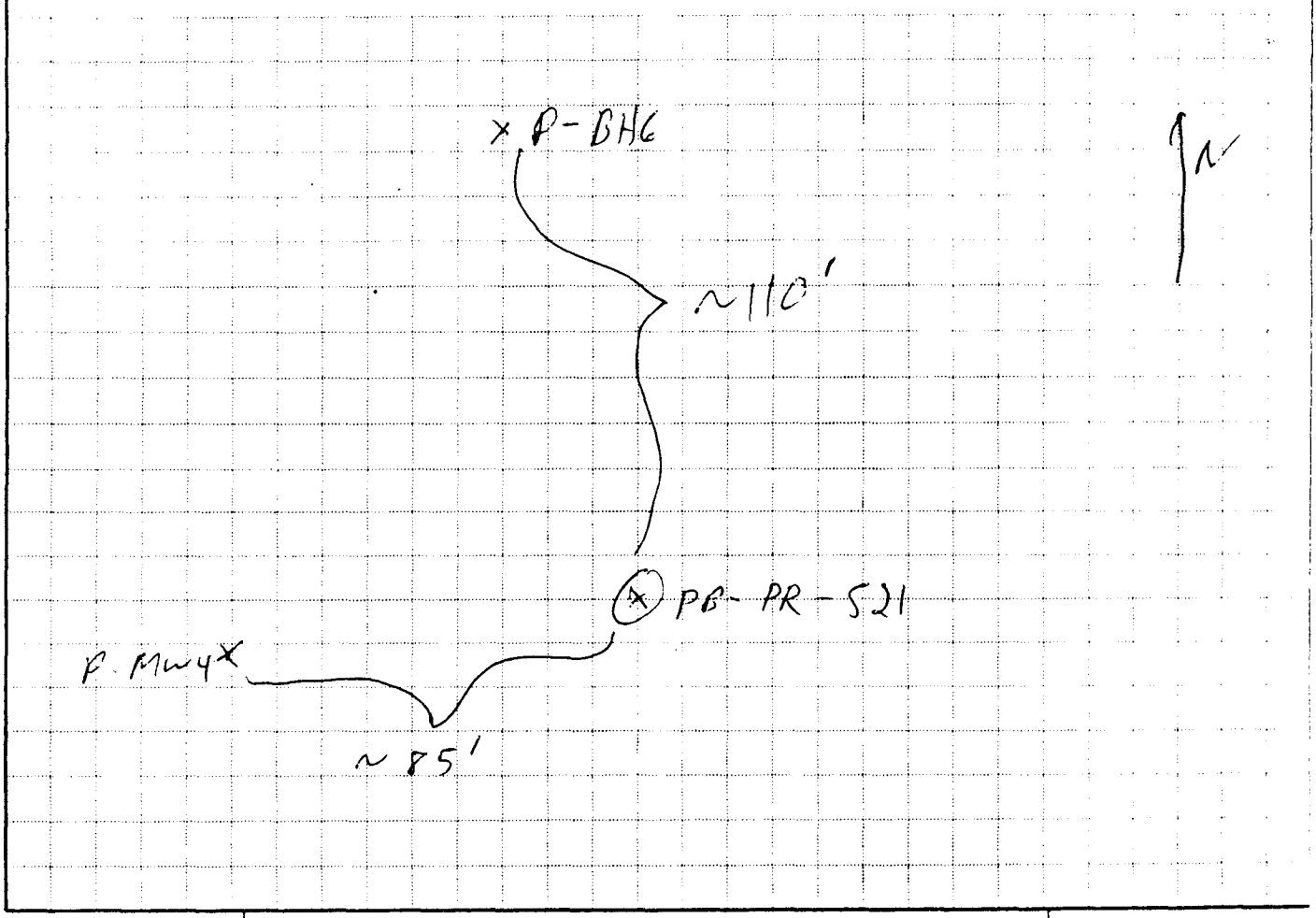
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-PR-521

HTRW DRILLING LOG

HOLE NUMBER PB-PR-521

PROJECT Plum Brook Ordnance Works

INSPECTOR ES/WS

SHEET 2 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0'	yellow-brown silty sand with dark red deposits				
		brown silty sand				
	0.5'	dark brown silty clay with sand				

PROJECT Plum Brook Ordnance Works

HOLE NO. PB-PR-521

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-522

SHEET 1 OF SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: E. Samuels	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: hand trowel	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 0.5 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

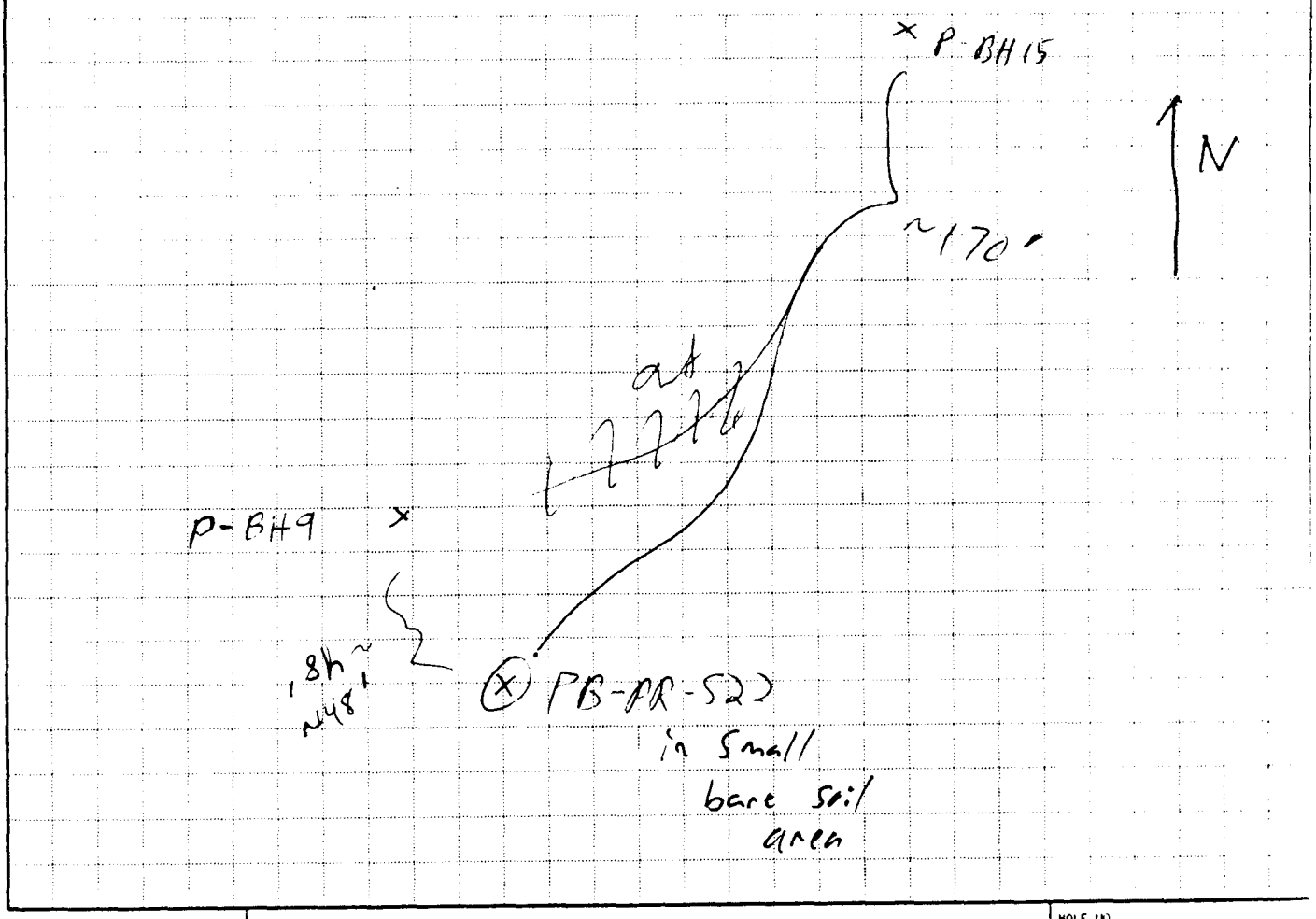
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB PR-522

HTRW DRILLING LOG

HOLE NUMBER PB-PR-522

PROJECT Plum Brook Ordnance Works

INSPECTOR ES/LS

SHEET 2 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0'	yellowish brown silty sand with dark red spots	hNu reading = 0.0			
		as above, brown				
		as above, dark brown				
	0.5'					

PROJECT Plum Brook Ordnance Works

HOLE NO. PB-PR-522

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-523

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
SHEET 1 OF SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: E. Samuels	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: hand trowel	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 0.5 ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

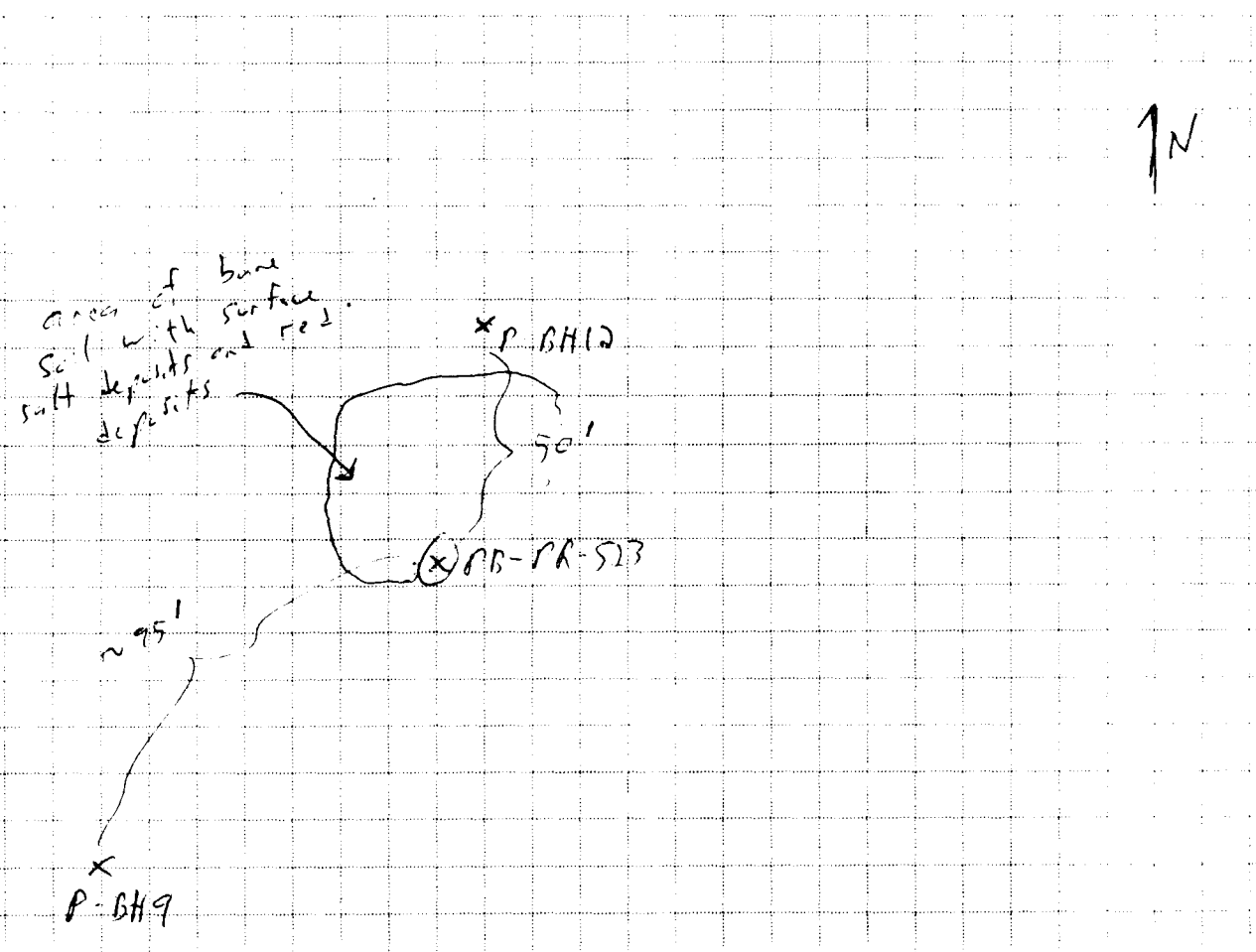
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-PR-523

HTRW DRILLING LOG

HOLE NUMBER PB-PR-523

PROJECT Plum Brook Ordnance Works

INSPECTOR ES/WS

SHEET 2 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0'	yellowish brown silty sand with dark red spots	HNU =0.0			Sampled in duplicate (and split) - PB-PR-530
		~~tenses of dari~~ and dark brown silty sand intergrading with brown silty sand				
	0.5'					

PROJECT Plum Brook Ordnance Works

HOLE NO. PB-PR-523

HTRW DRILLING LOG

HOLE NUMBER: PB PR-524

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
SHEET 1 OF SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: E. Samuels	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: hand trowel	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 0.5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

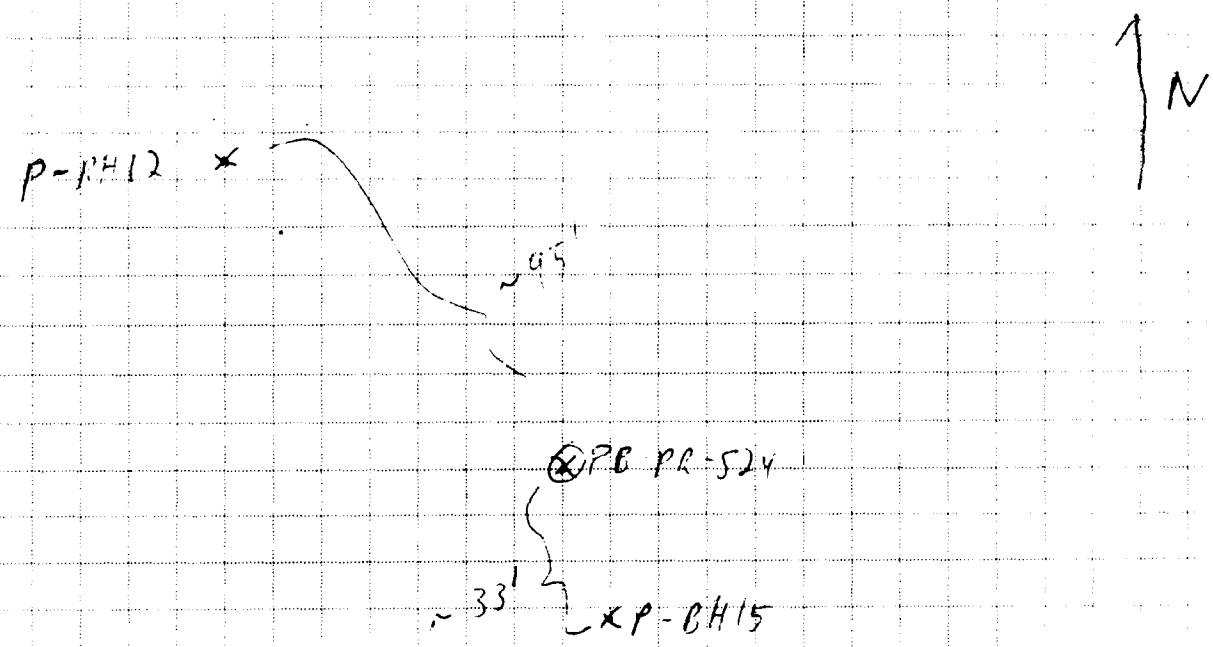
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY) Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-PR-524

HTRW DRILLING LOG

HOLE NUMBER PB-PR-524

PROJECT Plum Brook Ordnance Works | INSPECTOR WS/ES | SHEET 2 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	yellow-brown colors and wht. salt crystals on surface brown silty sand				
	.5	as above with lenses (½' thick) of dark brown clayey silt				

PROJECT Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S5

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/17/94 — 11. DATE COMPLETED: 10/17/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS — SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: LOA-SS

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown sandy clay				no visible [illegible]
	0.5	sand grades out some yellow brown mottling				
	1.0					soil is very tight
						sample
	1.5	moist grades to brown				PB-LOA SS-00/02 collected at 1509
						roots
	2.0	yellow brown stripe				becomes more moist
	2.5					sample LOA-SS-20/30 collected at 1552
	3.0	color grades to brown, yellow with gray mot/streaks				
	3.5					saturated consisting fine medium recovery (standing water in hole)
	4.0					water in hole
	4.5					
	5.0	Being terminated at 5 feet 10/12/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO. LOA-SS

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S6

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/17/94 — 11. DATE COMPLETED: 10/17/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE ID.

HTRW DRILLING LOG

HOLE NUMBER: WA-S6

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown clay orange streaks and olive gray mottling				soil is moist
	0.5	grades to olive gray with orange and brown mottling				
	1.0					WA-S6-0.0/2.0 collected at 1728
	1.5					
	2.0					
	2.5	grades to brown with orange and gray mottling				becomes more moist
	3.0					
	3.5					WA-S6 2.0/5.0 collected at 1744
	4.0					
	4.5					
	5.0	Being terminated at 5ft 10/17/94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: WA-S6

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S7

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/18/94 / 11. DATE COMPLETED: 10/18/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-	✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.:

HTRW DRILLING LOG

HOLE NUMBER: WA-S7

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown clayey fine sand			-	Spin x digitation soil is dry
	0.5					
		gradis to lt brown				sample WA-S7-0.0/2.0 collected at 1451
	1.0	brownish-yellow streaks some light grey mot				
	1.5					
	2.0	some dark brown flecks	0ppm			
	2.5					
						WA-S5 collected at 1505
	3.0					
	3.5					
	4.0					becomes moist
	4.5	color gradis to grey with brown mottling	0ppm			
	5.0	boring terminated at 5ft				

PROJECT: 10-15-94

HOLE NO.: WA-S7

Plum Brook Ordnance Works

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S8

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/18/94 — 11. DATE COMPLETED: 10/18/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS — SCALE:

PROJECT: Plum Brook Ordnance Works — HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: [illegible] - 58

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown clay/fine sand with brown spots				no vegetation at surface; some roots; soil is dry
	0.5					
						19 roots
		brown/lt brown spots				
	1.0					sample WA-SS-00/3.0 collected at 1530
		Brownish-yellow flecks				
	1.5					
		orangish-yellow streak				
	2.0	silt grades in	(ppm)			
		Brown silt with some clay				
	2.5	streak of orange				
	3.0	color gradates to yellow brown				soil is tighter
						sample WA-SS-3.0/ collected at 1541
	3.5	clay grades back in color gradates to brown				
		orangish streak				split taken (S22)
	4.0					
		color gradates to yellow brown				
	4.5	clay grades out				
		dark brown spots				
	5.0	clay grades in color gradates to brown	(ppm)			

PROJECT: Plum Brook Ordnance Works

HOLE NO. WA-58

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S 9

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-18-94 / 11. DATE COMPLETED: 10-18-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.:

HTRW DRILLING LOG

HOLE NUMBER: WA-S9

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand with some lt gray flecks and decaying vegetative matter				grass and surface roots
	0.5	Light gray sandy clay with brownish yellow streaks				ants
	1.0	some shale color gradients to dark brown with lt gray flecks				sample WA-S9-0.0/2.0 collected at 1648
		color gradients to olive gray				
	1.5	lt gray mottling with streaks present dark brown silty material				
	2.0	lt gray clay streak	0 ppm			
	2.5	streaks of lt gray clay continue				
	3.0	clear brown or black spots (decaying organic material?)				sample WA-S9-2.0/5.0 collected at 1707
	3.5	roots - slightly damp (decaying?)				
	4.0	brown and light clays alternate				
	4.5	↓ black decaying leaves	0 ppm			becomes more moist swampy smell
	5.0	Olive gray silty sand, some clay				water in boring

PROJECT: Boring terminated at 5 feet
Plum Brook Ordnance Works

HOLE NO.: WA-S9

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S11

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-25-94 / 11. DATE COMPLETED: 10-25-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-	✓	Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-WA-S11

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage / Steve Susten | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown sandy organic material; moist				Some Vegetation, fine roots
	0.5	Dark Brown Sandy Clay w/ gray mottling & Some brownish yellow streaks.				
	1.0	Brown to Brownish yellow sandy clay w/ gray mottling				Soil becomes tighter
	1.5					Sample PB-WA-S11-0.0-2.0 from 0-2ft at 11:43
	2.0	Brownish yellow silty sand w/ some clay	Hnu = 0			
	2.5	Some Brown mottling				
	3.0	Silt grades out				
		Well graded Brownish Yellow fine sand				
	3.5					
	4.0					
	4.5					Sample PB-WA-S11-2.0/5.0 collected from 2-5' at 12:04
		Brown well graded fine sand; moist to wet	Hnu=0			
	5	Boring Terminated at 5.0ft 10-25-94				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S12

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-25-94 / 11. DATE COMPLETED: 10-25-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER [redacted]-WA-S12

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	DARK Brown SANDY organic WITH ROOTS and yellow Red STREAKS				Some Vegetation, fine Roots
	0.5	Brown Coarse sand with YELLOW Red STREAKS				
	1.0	Clay grades in				Sample PB-WA-S12-0.0/2.0 collected @ 1000
	1.5	Clay grades out				
		Color grades to Light Brown				
	2.0	WEATHERED SHALE OLIVE Gray w/ GRAY MOTTLING and Brownish yellow streaks	0ppm on HNU			
	2.5					
		Gray Weathered SHALE w/ Brown Yellow streaks				
	3.0					Sample PB-WA-S12-2.0/5.0 collected @ 1020
	3.5					becomes moist
	4.0	Gray to Olive gray Clay w/ BROWNISH YELLOW and Yellow Red Mottling				
		Coarse Sand w/ some Gravel				
	4.5	Gray Clay w/ some Shale and yellowish Red to PINK MOTTLING				
	5.0	Boring terminated @ 5.0 feet on 10/25/94				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

PB-WA-S14

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-25-94 / 11. DATE COMPLETED: 10-25-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S14

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Steve Systen

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown sandy organic material w/roots; dry				Some vegetation, small roots at surface
		grades to brown w/ some clay				
	0.5	Clay grades out; brownish yellow flex				
	1.0					Sample PB-WA-S14-0.0/2.0 collected from 0-2ft at 09:05
	1.5					
	2.0	Brown well graded sandy clay w/ brownish yellow flex; dry	Hnu=0		PB-WA-S14-0.0/2.0	
	2.5	Olive gray sandy clay, well graded w/ yellowish red flex				
	3.0					
	3.5	Olive gray grades out. Gray shale present.				
	4.0	Brown to Brownish yellow course sand w/ gravel mix; poorly graded				Sample PB-WA-S14-2.0-5.0 collected from 2-5' at 09:30
	4.5	Gray sandy clay w/brownish yellow streaks				
	5	Dark gray shale mix			PB-WA-S14-2.0/5.0	Boring terminated at 5ft

10/2SMA

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S15

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-24-94 / 11. DATE COMPLETED: 10-24-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives ✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

PROJECT	INSPECTOR	SHEET OF SHEETS
Plum Brook Ordnance Works		

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		DARK Brown Sandy Organic material			Oppm	Very fine roots
	0.5	Grades to Brown Silty Fine Sand				
	1.0					
		Brownish Yellow Flecks				Simple PBLA-S.5 0.0/2..
	1.5	Some Clay				
	2.0	[illegible] Yellow [illegible]				[illegible] 1.5
	2.5					
	3.0					
	3.5					[illegible] Brownish tinted
	4.0					
	4.5					
	5.0	[illegible]				

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S16

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-18-94 / 11. DATE COMPLETED: 10-18-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE ID:

HTRW DRILLING LOG

HOLE NUMBER WA-S16

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty fine sand				grass at surface
		some grey spots (clays)				Bugs
	0.5	grey clay grades in				
		yellowish brown streaks				sample
	1.0	chunk of glass-like object some spots				WA-16-0.0/2.0 collected at 1746
		yellowish brown streaks increase				
	1.5					
		Dark brown clay with brown (and + grey) mottling	0 ppm			
	2.0					
	2.5	color grades to olive grey				sample WA-S16 collected at 1812
	3.0					moist
	3.5	dark brown to black rotting vegetation				
	4.0	auger refusal at 4 feet				hollow sound
		Boring terminated at 4 feet on				
	4.5					
	5.0					

PROJECT Plum Brook Ordnance Works

HOLE NO. WA-S16

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S19

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVEN SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION: WEST AREA RED WATER PONDS
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-24-94 / 11. DATE COMPLETED: 10-24-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: NOT ENCOUNTERED
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	GROUTED			Steven J. Susten

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.:

HTRW DRILLING LOG

HOLE NUMBER: WA-S19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		DARK Brown Sandy organic SANDY Clay			0ppm	Some vegetation surface
	0.5	GRADES TO BROWN				
	1.0	GRADES To Olive Gray w/ Some Brown MOTTLING + YELLOWISH RED FLECKS				Sample PB WA-S19-0/20 collected at 1535
	1.5					
	2.0	Brownish yellow STREAKS some Black FLECKS				
		Well GRADED Sandy Clay			0ppm	
	2.5	Grades to Brown w/ Olive Gray MOTTLING				Sample PB WA-S19-20/50 collected @ 1355
	3.0					
	3.5					
		Less Sand				
	4.0	Olive Gray MOTTLING Grades out				
	4.5					
	5.0	Boring Terminated 5 feet on 10/24/94			0ppm	

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PG-S1

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND Auger	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5.0 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

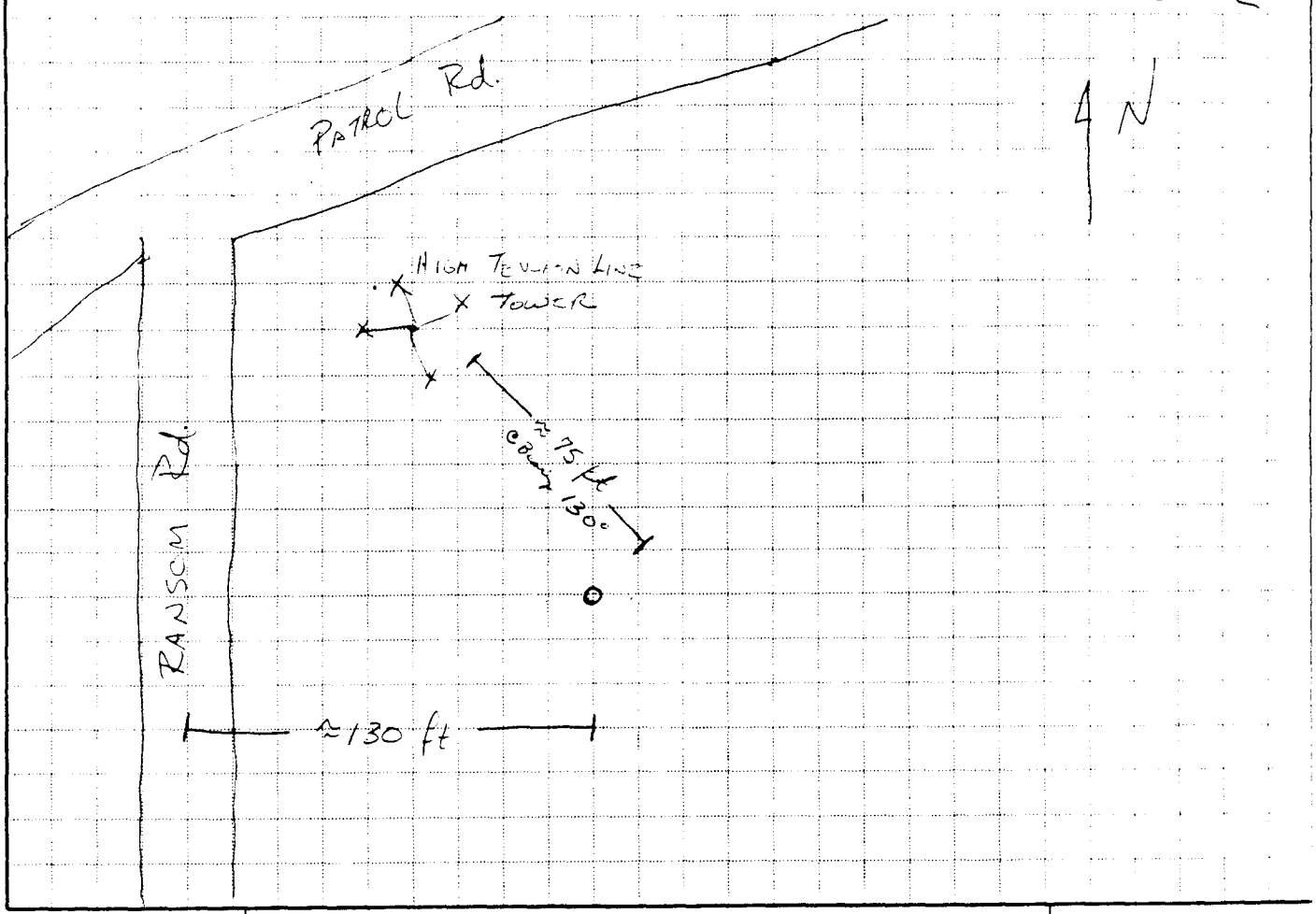
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	2 x 120 ml	1 x 250	Explosives 1 x 120	BNA 1 x 250 ml		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: BGS-1

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dk brown silty fine sand with roots				with roots
	0.5					
		grades to brown .75				
	1.0					
	1.5	grades to brownish yellow				Sample BG-S1-0.5/3.0 Collected @ 1039
	2.0	grades with occasional gray clay lenses				
	2.5					
	3.0	grades with increased clay	HNU=0			
	3.5	grades with occasional brownish orange				Sample BG-S1-3.0/5.0 Collected @ 1100
	4.0					
		gray sandy clay with brown mottling & brownish-orange streaks				1st Vac
	4.5					
		grades with brownish-yellow				
	5.0		HNU=0			2nd Vac

PROJECT: Boring Terminated @ 5 feet 1100

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S2

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Steve Susten	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger (SS)	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5.0 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

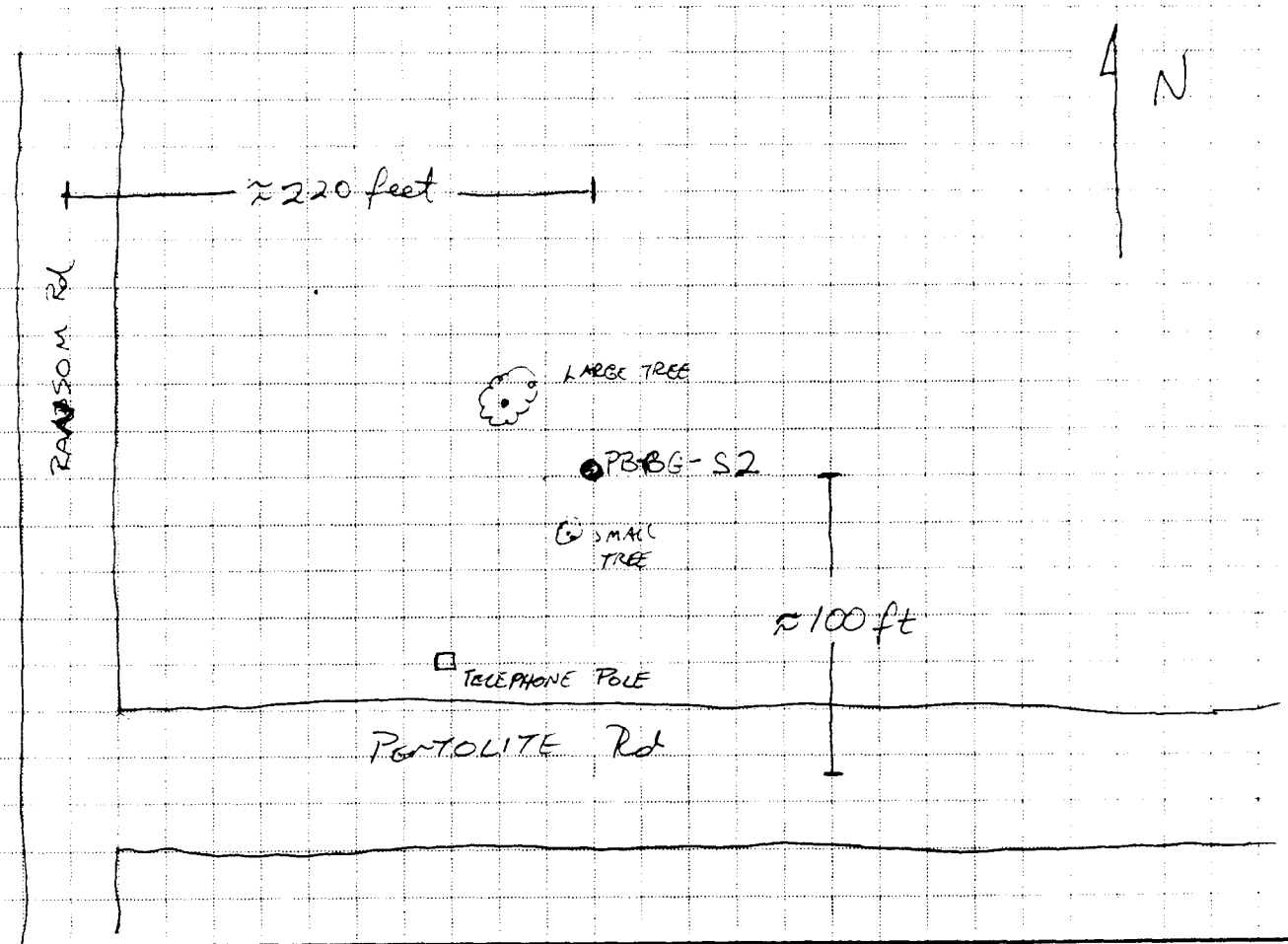
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	2 x 120 mL	1 x 250 mL	1 x 120 mL	BNA 1 x 250 mL		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: Not To Scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: BG-S2

PROJECT: Plum Brook Ordnance Works | INSPECTOR: SS | SHEET 1 OF 1 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown silty sand with roots	(-)			roots
	0.5					
	1.0	grades with brownish-yellow				
		grades to brownish-yellow				
	1.5	grades with occasional gray clay lenses				
	2.0					VOC 1 Sample BG-S2-0.5/3.0 Collected @ 1140
	2.5					
		grades with more clay grades to brownish-tan with brownish-orange streaks	(-)			
	3.0					
	3.5	grades to brownish-gray				
						Sample BG-S2-3.0/5.0 Collected @ 1205
	4.0					
		gray sandy clay with brownish orange mottling				
	4.5					VOC 2 sample
	5.0	grades with brownish orange	HNU = 0			

Boring Terminated @ 5.0 feet (1205)

PROJECT: Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S3

SHEET 1 OF 2 SHEETS

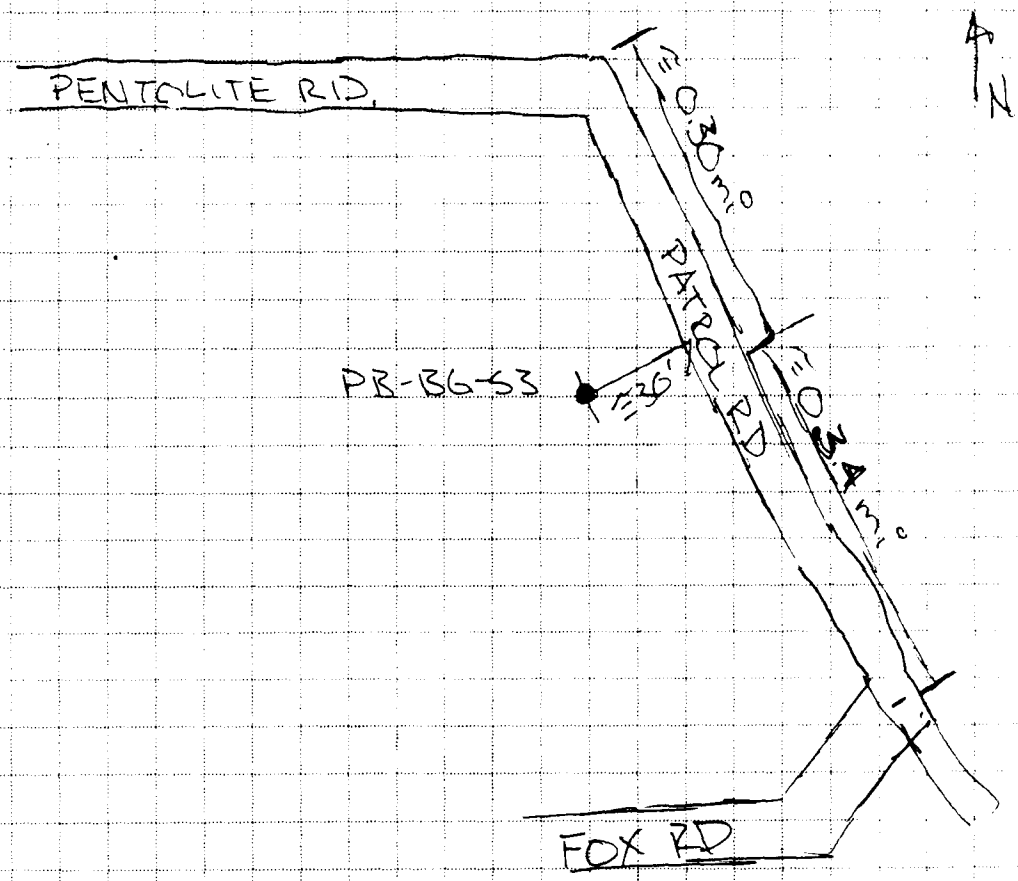
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Endres/S. Systen	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S3
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 11/1/94 — 11. DATE COMPLETED: 11/1/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 4.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	✓ Explosives	B/NA		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				J Endres

LOCATION SKETCH/COMMENTS — SCALE: Not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE/WELL NO. PB-BG-S3

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		DK Brown silty fine Sand w/ Gravel and Shale Fragments				Some Vegetation @ surface w/ Roots
	0.5	Gravel + Shale grade out				
		Grades to Brownish orange				
	1.0					VOCs
	1.5					
						Sample PB-PR-BG-SS-0.5/30 0815
	2.0					
	2.5	Grades to Light Brown to tan				
		Mottled Gray + Brown Clayey Sand				
	3.0		HNU=0			
		~~Shale~~				Auger Becomes Difficult
	3.5					Sample PB-PR-BG-SS-3.0/40 collected @ 0900
						VOC's
	4.0	Boring Terminated @ Auger Refusal	HNU=0 4 ft @ 4 feet			Shale
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S4

SHEET 1 OF 7 SHEETS

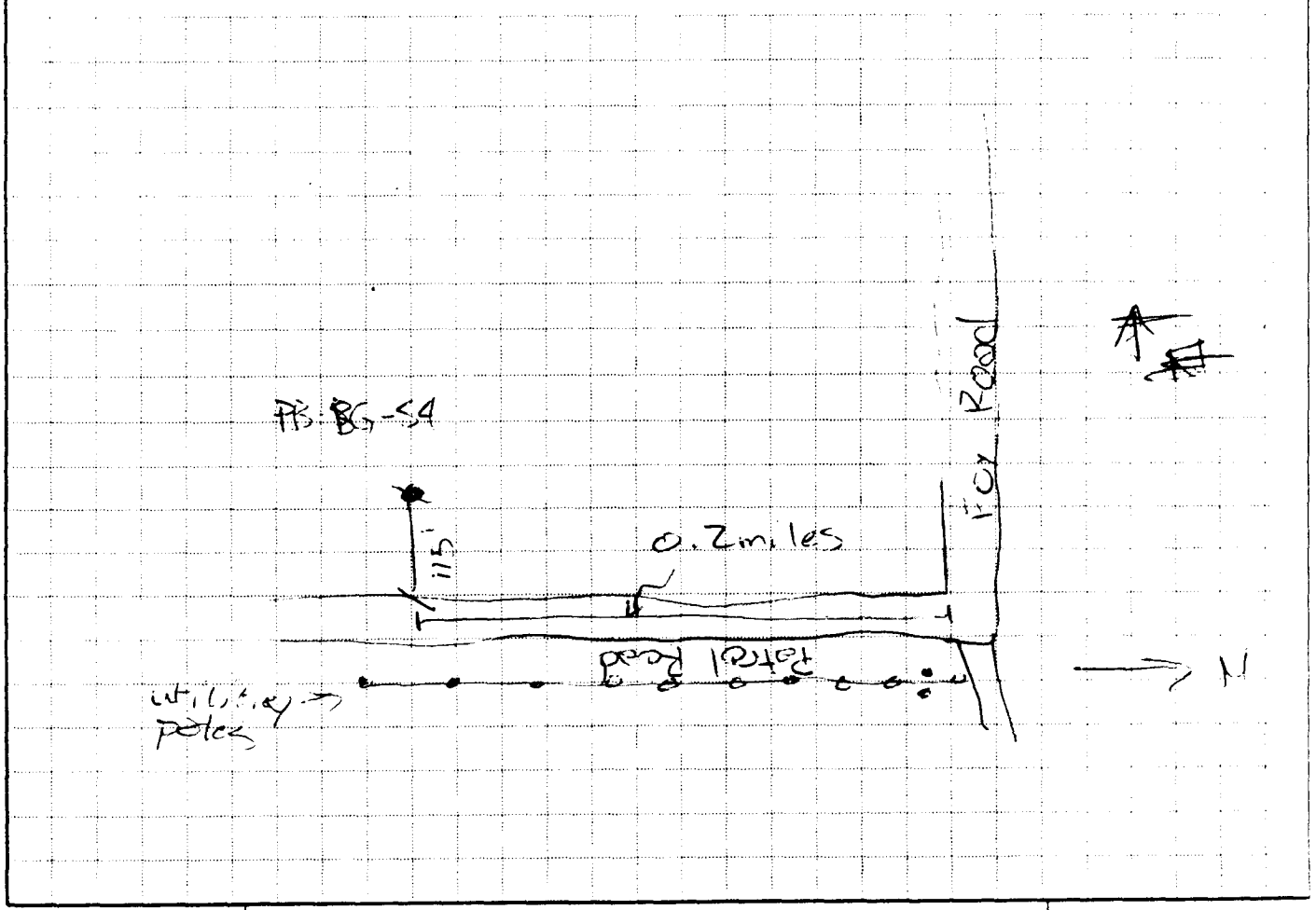
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Endres / B. Startel	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S4
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/30/94 — 11. DATE COMPLETED: 10/30/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 3.3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Explosives ✓	RNA		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				J Endres

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PBBG-S4

PROJECT: Plum Brook Ordnance Works

INSPECTOR: J Endres / B. Starkel

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dk Brown ~~silty sand~~ w/roots sandy silt				
	.5	~~Brownish yellow~~				
		~~Greater~~ Brownish yellow fine sandy silt w/ roots				Sample PB-BG-S4-0.5/3.0 PB-BG-S8-0.5/3.0 PB-BG-S8-~~0.5~~/3.0-S 10/30/94 10:30
	1					
	1.5	Grades w/ gravel br orange				
	2.0					
		Grades to brown				
	2.5					
		Weathered shale				
	3.0	Refusal on weathered shale encountered @ 3.0' on 10/30/94				offset 4' west NO SAMPLE ~~PB-BG-S4-3.0~~
	3.5	Refusal encountered @ 3.3' in offset hole on 10/30/94				
	4.0					
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S5

SHEET 1 OF 2 SHEETS

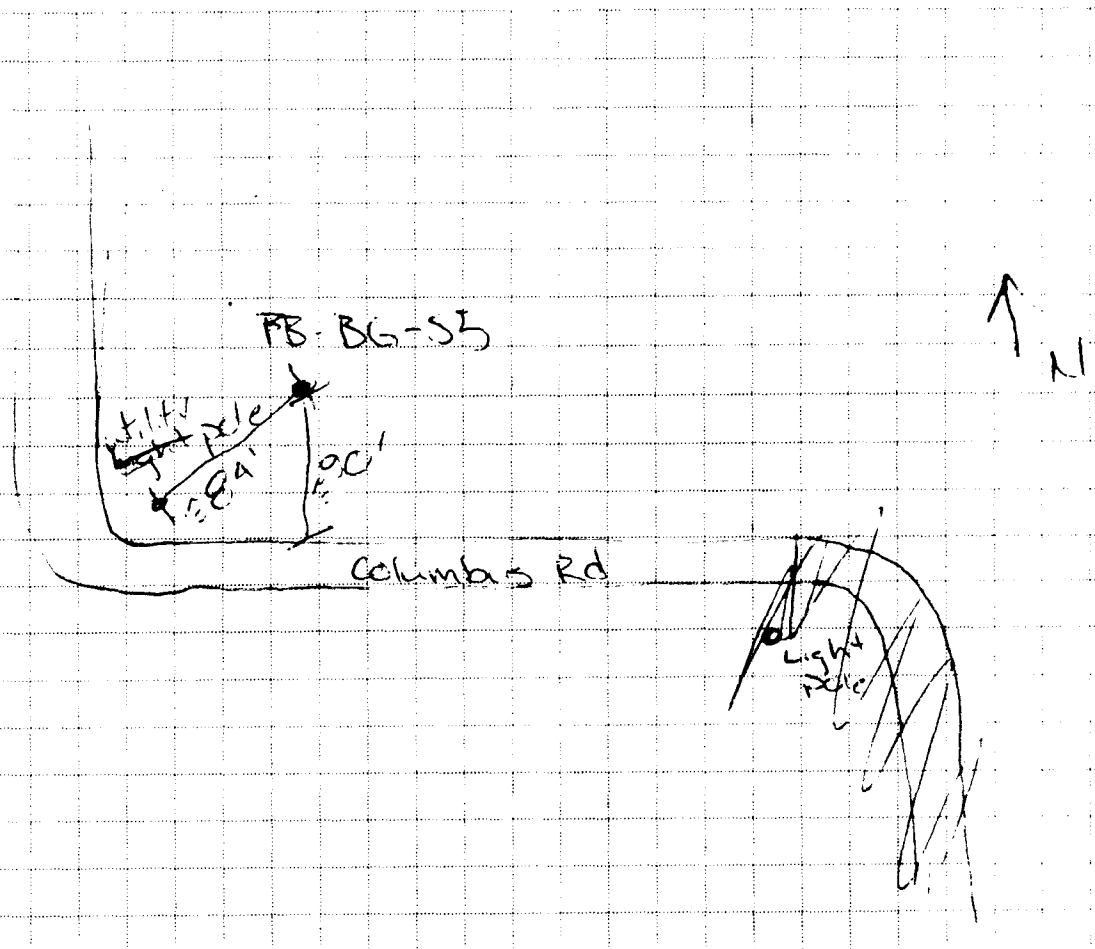
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: B. Starkel / J Eardley	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S5
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/30/94 — 11. DATE COMPLETED: 10/30/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY) B/NA	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	✓			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				J Eardley

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BG-5.5

PROJECT Plum Brook Ordnance Works | INSPECTOR | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark brown silty fine sand w/ roots				
		Grades to brown to tan				
	.5					
	1.0	Grades w/ brownish orange				Sample PB-BG-5-0.5/3.0 10/30/94 1200
	1.5	Grades w/ rounded gravel & shale layer				
				VOC's @ 2.6'		
	2.0	Mottled Grey & Brown silty clay w/ trace fine sand & rounded gravel				
	2.5					
	3.0	Same				
	3.5					
						Sample PB-BG-5-3.0/5.0
	4.0					
	4.5					
	5.0	Boring term @ 5' on 10/30/94 @ 12:25				

PROJECT Plum Brook Ordnance Works | HOLE NO.

HNU Background throughout

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S6
SHEET 1 OF 2 SHEETS

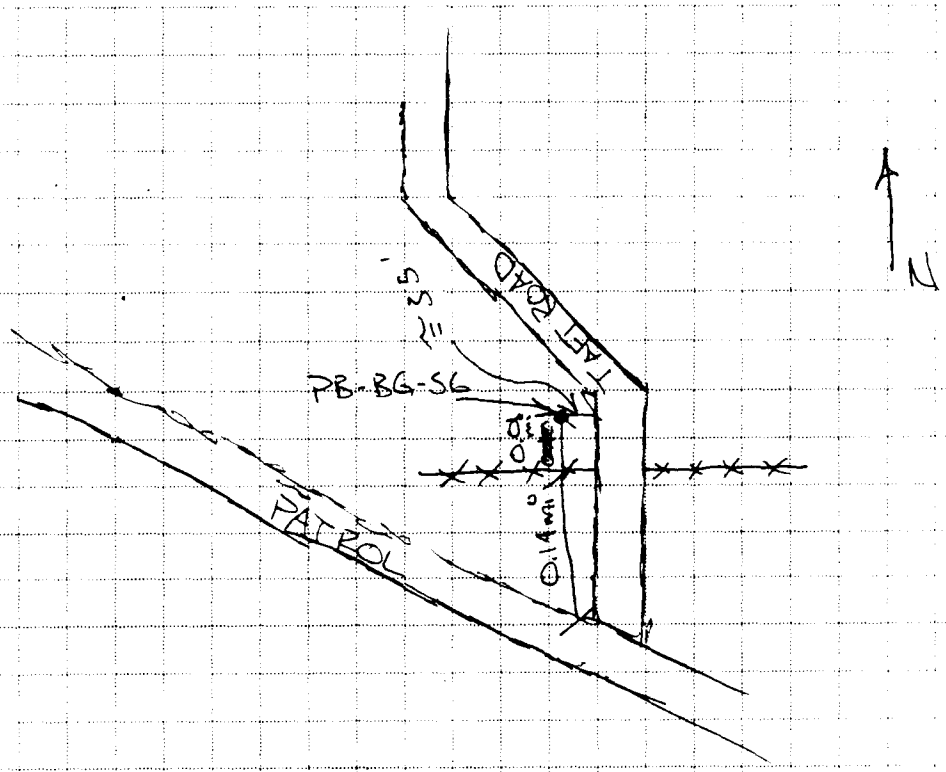
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Entes/S. Susten	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Hand Auger	8. HOLE LOCATION: PB-BG-S6
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 11/1/94 — 11. DATE COMPLETED: 11/1/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: Not Encountered
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 4.5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	✓ Explosives	B/NA		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grout				[signature]

LOCATION SKETCH/COMMENTS — SCALE: Not to Scale



PROJECT: Plum Brook Ordnance Works — HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BG-S6

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Light Brown silty sand w/ Roots				Some Veg @ surface
		Roots grade out				
	0.5					
		Grades to Mottled Brownish orange Brown-yellow + Gray clayey sand				
	1.0					
						Sample PB-BG-S6-0.5/3.0 collected @ 0930
	1.5	Grades w/ occasional Gray Clay lenses				
	2.0					VOCs
	2.5					
		Grades w/ less Clay	HNU=0			
	3.0					
	3.5					VOC's
						Sample PB-BG-S6 3.0/4.5 collected @ 0954
	4.0	Mottled Brownish orange and Gray Clay w/ some sand				
			HNU=0			Augering Became Difficult
	4.5	Grades w/ weathered Shale	Auger Refusal @ 4.5 feet Boring Terminated @ 4.5 feet 0954			
	5.0					

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-S7

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: STEVE SUTTEN/JEFF ENDRES	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 3 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

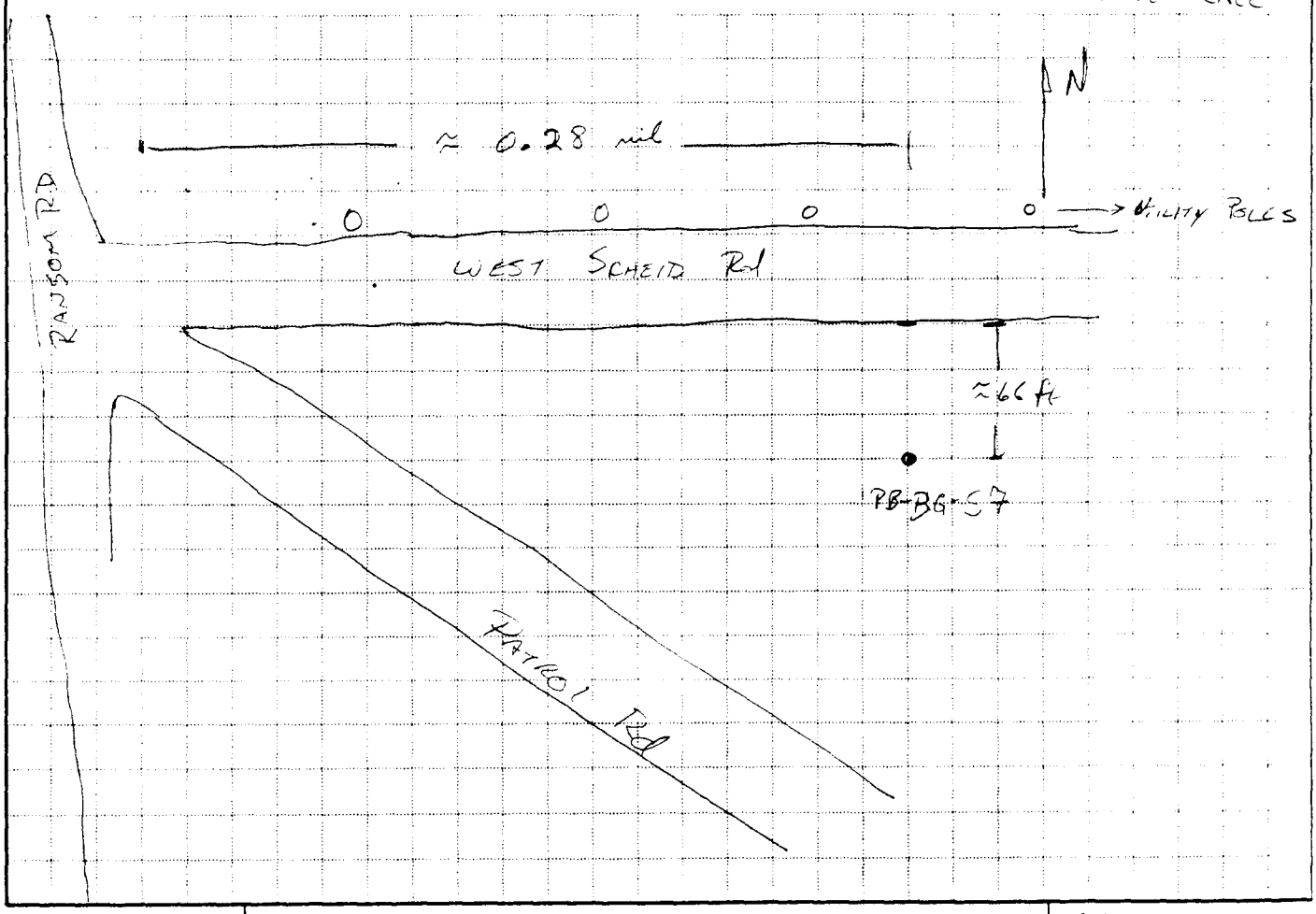
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0.5/3.0 feet (comb)	2x 120 ml	1 x 250	1 x 120 ml	BNA 1x 250 ml		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE/LOCATION: PB-BB-S7

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brownish Gray Silty Sand w/ Roots	HNU=0			Some Vegetation @ surface w/ Some Roots
	0.5					
		Root Grade out				
	1.0					weathered shale
						VOC's
	1.5	Mottled Gray and Brownish orange Clayey Sand				Sample PB-~~BB~~-S7-0.5/3.0 collected @ 1020
	2.0					
						Auger Becomes Difficult
	2.5	more Shale				
			HNU=0			
		HAND Auger Refusal @ 3 feet				
	3.0	Boring Terminated @ 3 feet 1035				
	3.5					
	4.0					
	4.5					
	5.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-BG-59

SHEET ___ OF ___ SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: JEFF ENDLES/STEVE SUSTEN	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HAND AUGER	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS:	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK:	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 5 feet	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

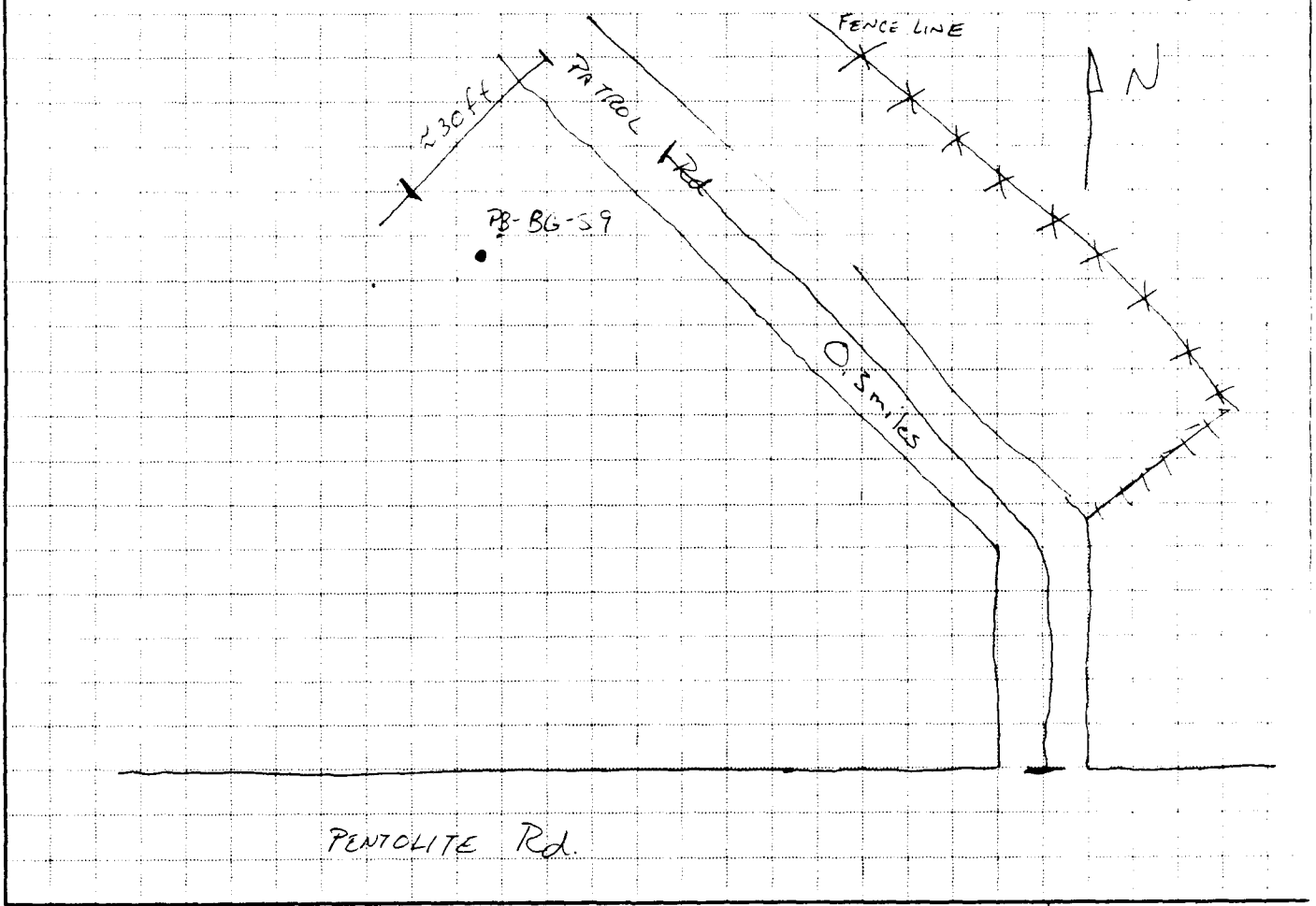
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
0.5/3.0 + 3.0/5.0 each	2 X 120 ml	1 X 250 ml	1 X 120 ml	B.NA 1x250 ml		

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE: NOT TO SCALE



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-BG-S9

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dk Brown silty fine sand w/ roots				Some veg @ surface w/ some roots
	0.5	Roots & Grade out				
		Grades to Brownish orange				
	1.0					
	1.5					Sample PB-BG-S9-0.5/3.0 collected @ 1145 } VOC's
	2.0		HNU=0			
	2.5					
	3.0	MOTTLED Brownish orange + Gray sandy Clay				
	3.5					
	4.0					moist sample PB-BG-S9-3.0/5.0 collected @ 1215 } VOC's
	4.5					
		Grades w/ less sand				
	5.0		HNU=0			

PROJECT Boring Terminated @ 5 ft 1215
No GW encountered

MOLE NO.

Plum Brook Ordnance Works

BORING LOGS

10-FOOT DRILLED BORINGS

HTRW DRILLING LOG

HOLE NUMBER: PB-PA-S2

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon. 140lb drop hammer; Stainless steel bowl & spoons	8. HOLE LOCATION: Pentalite Road
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-28-94 / 11. DATE COMPLETED: 10-28-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: approx 8ft
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

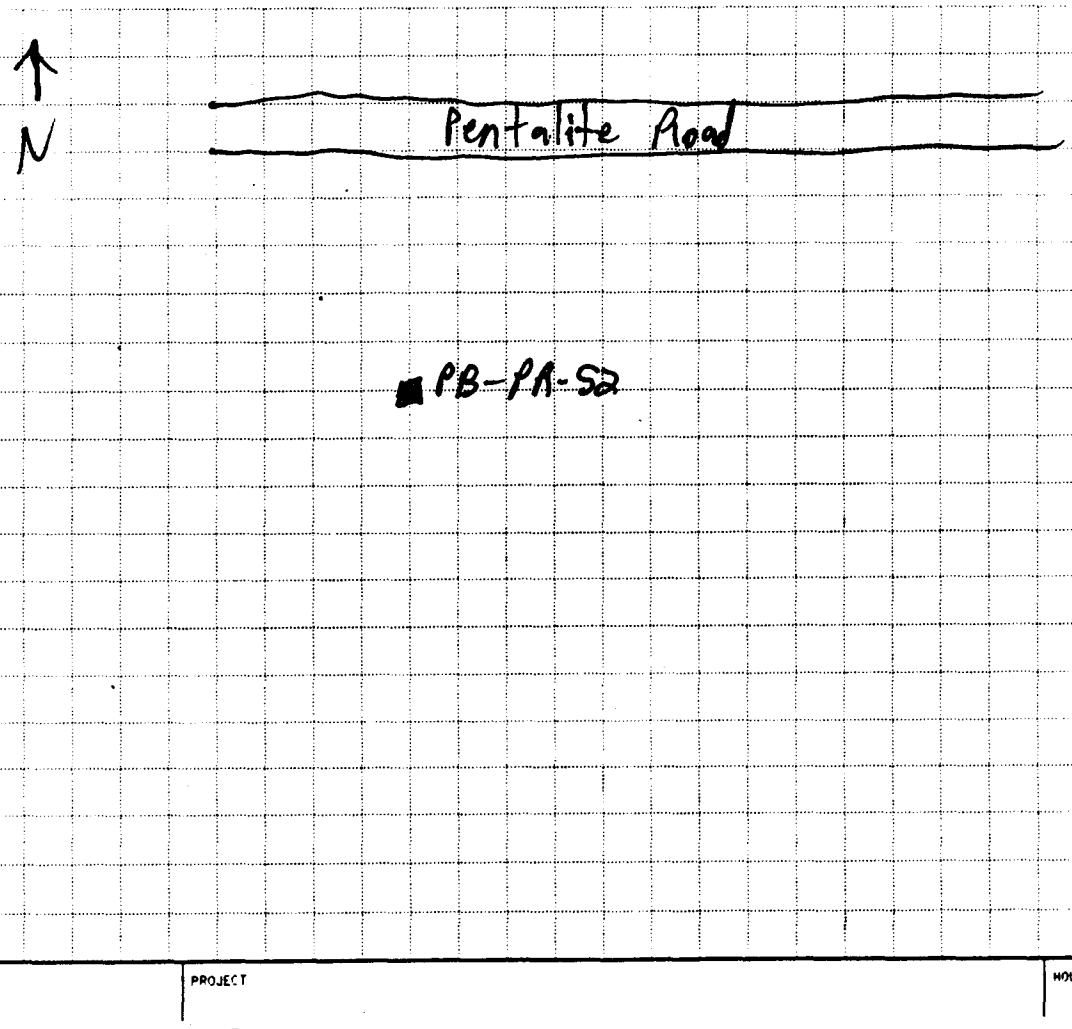
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Pettey

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S2

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy organic material	Hnu=0		PB-PR-S2-0.0/3.0	Blow Count: 2,3,3,4 Pen: 2.0 Rec: 2.0 Lost: 0
	1	Brownish yellow well graded sand; Some silt; moist				
	2		Hnu=0			Blow Count: 4,3,3,4 Pen: 2.0 Rec: 1.2 Lost: 0.8
	3	Brownish yellow well graded Silty Sand			----	
		gray sandy clay w/ brownish yellow mottling; moist			PB-PR-S2-3.0/5.0	
	4					
		Gray sandy clay w/ brownish yellow mottling; moist	Hnu=2 (Background =0)			Blow Count: 3,4,5,5 Pen: 2.0 Rec: 2.0 Lost: 0
	5				----	
		becomes a bit more plastic			PB-PR-S2-5.0/10.0	
	6					
		Gray sandy clay w/ Brownish yellow mottling; moist	Hnu=3 (Background =0)			Blow Count: 4,5,7,6 Pen: 2.0 Rec: 2.0 Lost: 0
	7					
	8					
		Gray sandy clay w/ Brownish yellow mottling; wet	Hnu=3 (Background =0)			Blow Count: 3,3,7,7 Pen: 2.0 Rec: 2.0 Lost: 0
	9					
	10	Boring Terminated at 10 ft	on 10-28-94			

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: ~~PB-PR-5~~ PB-PR-5

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belcca Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless Steel bowls & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-28-94 / 11. DATE COMPLETED: 10-28-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10.0 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

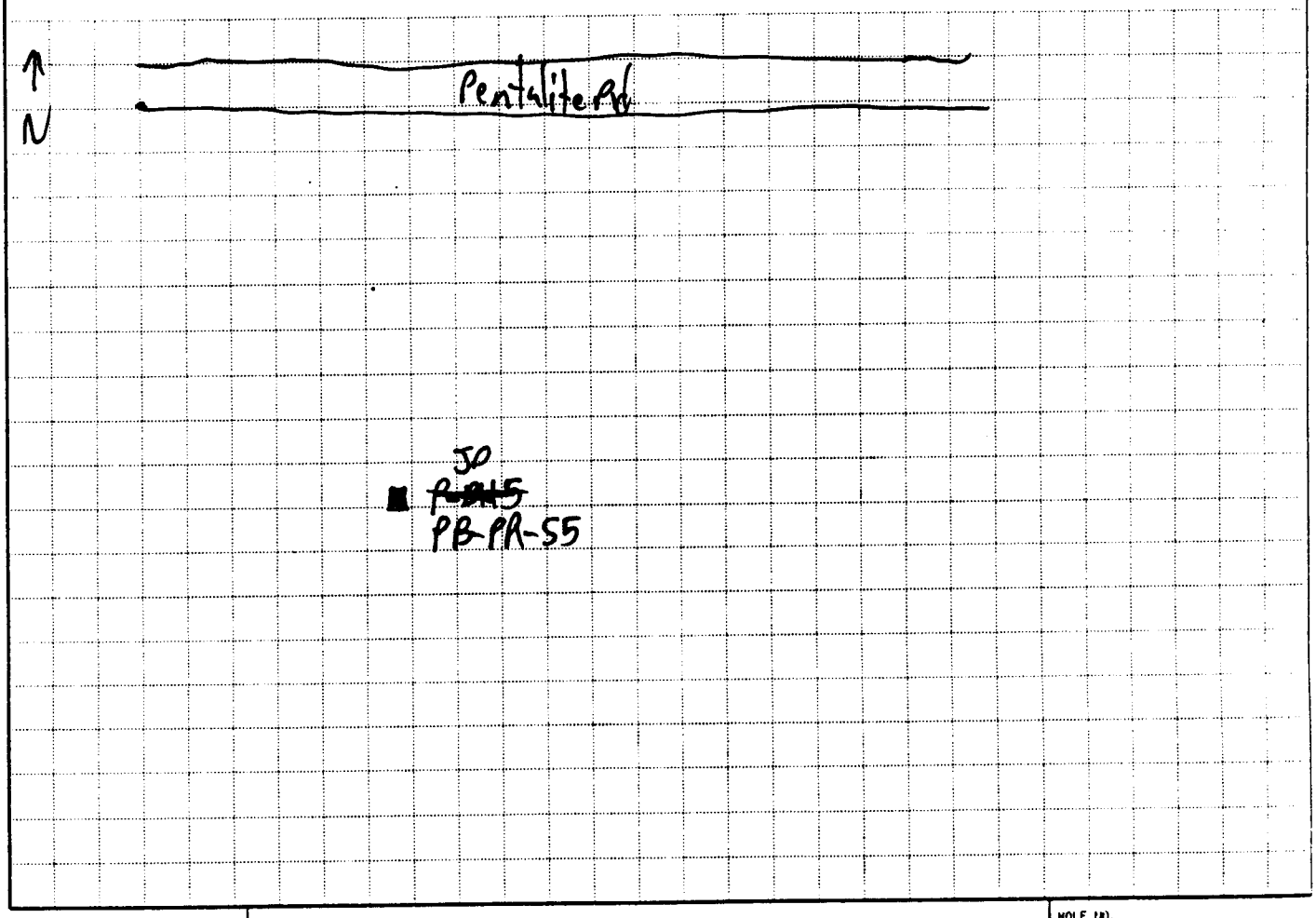
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deathrage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-PA-55

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deathy

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy organic material	Hnu=1 (Background =0)		PB-PA-55-001/3.0	Blow Count = 2,5,6,7 Ran: 2.0 Rec: 1.6 Lost: 0.4
	1	Brownish yellow well graded silty fine sand w/ Dark Brown specs				
		Brown well graded silty fine sand; moist				
	2	Brown well graded sand w/ Brownish yellow mottling	Hnu=1 (Background =0)			Blow Count: 3,4,5,5 Ran: 2.0 Rec: 1.6 Lost: 0.4
	3	Brown to gray Sandy clay with Brownish yellow mottling; moist			PB-PA-	
	4	Brown sandy clay w/ brownish yellow mottling; soft; moderate plasticity; moist	Hnu=1 (Background =0)		SS-30/3.0	Blow Count = 3,3,5,6 Ran: 2.0 Rec: 2.0 Lost: 0.0
	5				PB-PA-SS-3.0/10.0	
	6	Brown Sandy clay w/ reddish brown mottling	Hnu=3 (Background =0)			Blow Count = 3,4,4,4 Ran: 2.0 Rec: 2.0 Lost: 0
	7	Gray clay; soft, w/ brownish yellow mottling moist to wet; slightly sandy				
	8	Gray Sandy clay; soft; no mottling; moist	Hnu=1 (Background =0)			Blow Count: 1,2,3,4 Ran: 2.0 Rec: 2.0 Lost: 0.0
	9					
	10	Boring terminated at 10 ft on	10/28/94			

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-56

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140lb drop hammer; Stainless steel bowls & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-29-94 / 11. DATE COMPLETED: 10-29-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

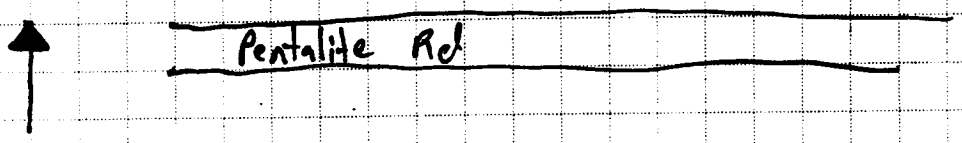
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

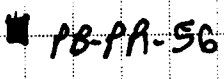
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:





PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

TEST NUMBER: PB-PR-56

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic material Dark Brown sandy clay w/ brown mottling; dry	Hnu: 0		PB-PR-56-0.0/3.0	Blow Count: 3,3,4,3 Ran: 2.0 Rec: 1.2 Lost: 0.8
	2	Dark brown sandy clay w/ brown mottling	Hnu=0			Blow Count: 2,1,2,2 Ran: 2.0 Rec: 1.7 Lost: 0.3
	3	Brown clay with brownish yellow specs; wet			PB-PR-56-3.0/5.0	
	4	Brown sandy clay w/ brownish yellow mottling; moist to wet	Hnu=4 (Background =0)			Blow Count: 1,3,3,4 Ran: 2.0 Rec: 1.8 Lost: 0.2
	5				PB-PR-56-5.0/6.0	
	6	Gray Sandy clay w/ brownish yellow mottling; moist to wet	Hnu=0			Blow Count: 3,3,4,3 Ran: 2.0 Rec: 2.0 Lost: 0
	7					
	8		Hnu=0			Blow Count: 2,1,3,3 Ran: 2.0 Rec: 1.1 Lost: 0.9
	9	Gray Sandy clay w/ brownish yellow mottling; moist to wet				
	10	Boring Terminated at 10ft on 10-29-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-57

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless steel bowl & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-28-94 / 11. DATE COMPLETED: 10-28-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: approx 5 feet
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

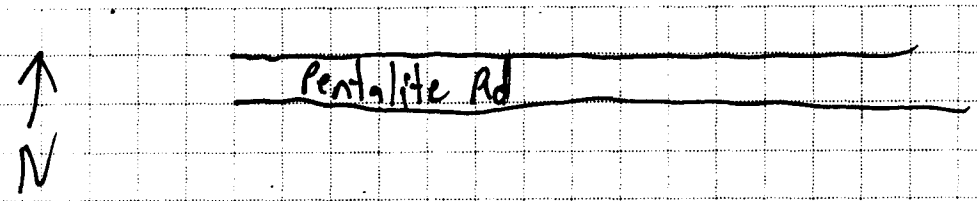
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-					N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			grouted	Joe Peatherson

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-57

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic material Brown to Brownish yellow fine grained sand; moist	Hnu=1 (Background =0)		PB-PR-57-0.0/3.0	Blow Count: 2,3,4,4 Ran: 2.0 Rec: 1.3 Lost: 0.7
	2	Brown sandy clay; moist	Hnu=0			Blow Count: 2,2,2,3 Ran: 2.0 Rec: 1.6 Lost: 0.4
	3	Brownish yellow mottling			PB-PR-57-3.0/5.0	
	4	Brown sandy clay w/ Brownish yellow mottling; moist	Hnu=1 (Background =0)			Blow Count: 1,2,2,2 Ran: 2.0 Rec: 2.0 Lost: 0
	5	Brown to gray sandy clay w/ brownish yellow mottling; wet			PB-PR-57-5.0/10.0	
	6	Gray Sandy clay w/ Brownish yellow layers; moist to wet	Hnu=1 (Background =0)			Blow Count: 3,4,7,6 Ran: 2.0 Rec: 2.0 Lost: 0
	7					
	8	Gray clay with a little brownish yellow mottling; moist	Hnu=1 (Background =0)			Blow Count: 2,1,3,4 Ran: 2.0 Rec: 2.0 Lost: 0
	9					
	10	Boring Terminated at 10ft on 10-28-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-PR-S7

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	3.0					
		HAND Auger Boring installed Next to 10 feet Boring				
	5.5					
	6.0					
	6.5					PB-PR-S7-3.0/10.0 Sample Collected for BIOLOGICAL @ 1430
	7.0					
	7.5					
	8.0					
	8.5					
	9.0					
	9.5					
	10	Boring Terminated @ 10 feet 1430				Moist Clays but GW Not Encountered

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-59

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless steel bent strewers	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-29-94 / 11. DATE COMPLETED: 10-29-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

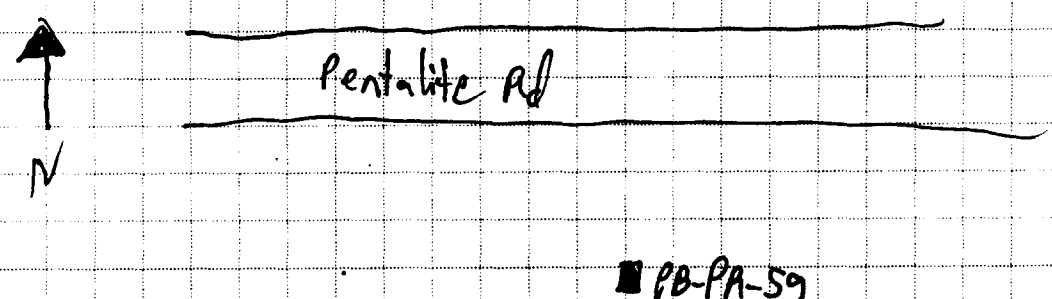
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: N/A
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY): Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY): Grouted	23. SIGNATURE OF INSPECTOR: Joe Pratt

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S9

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic material Brown Sandy clay w/ dark Brown mottling; dry	Hnu=0		PB-PR-S9-0.0/2.0	Blow Count=3,4,4,5 Ran: 2.0 Rec: 1.3 Lost: 0.7
	2 3	Brown Sandy clay w/ brownish yellow mottling Dark Brown layer Brown sandy clay w/ Brownish yellow mottling; moist	Hnu=0		PB-PR-S9-3.0/5.0	Blow Count: 2,1,2,2 Ran: 2.0 Rec: 1.8 Lost: 0.2
	4 5	Brown Sandy silty clay w/ brownish yellow mottling; moist to wet	Hnu=0		PB-PR-S-9-5.0/10.0	Blow Count: 1,2,3,2 Ran: 2.0 Rec: 1.3 Lost: 0.7
	6 7	Brown Sandy clay w/ brownish yellow mottling; moist to wet Gray sandy clay w/ brownish yellow mottling; moist to wet	Hnu=0			Blow Count: 3,3,4,5 Ran: 2.0 Rec: 2.0 Lost: 0
	8 9	Brown to gray Sandy clay Gray clay; moderate Plasticity; soft; moist to wet	Hnu=0			Blow Count: 2,2,4,4 Ran: 2.0 Rec: 2.0 Lost: 0
	10	Boring Terminated at 10ft on 10-27-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S10

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2½" split spoon ; 140 lb drop hammer ; Stainless Steel bowl & spoon	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-29-94 / 11. DATE COMPLETED: 10-29-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: approx 3.5 feet
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

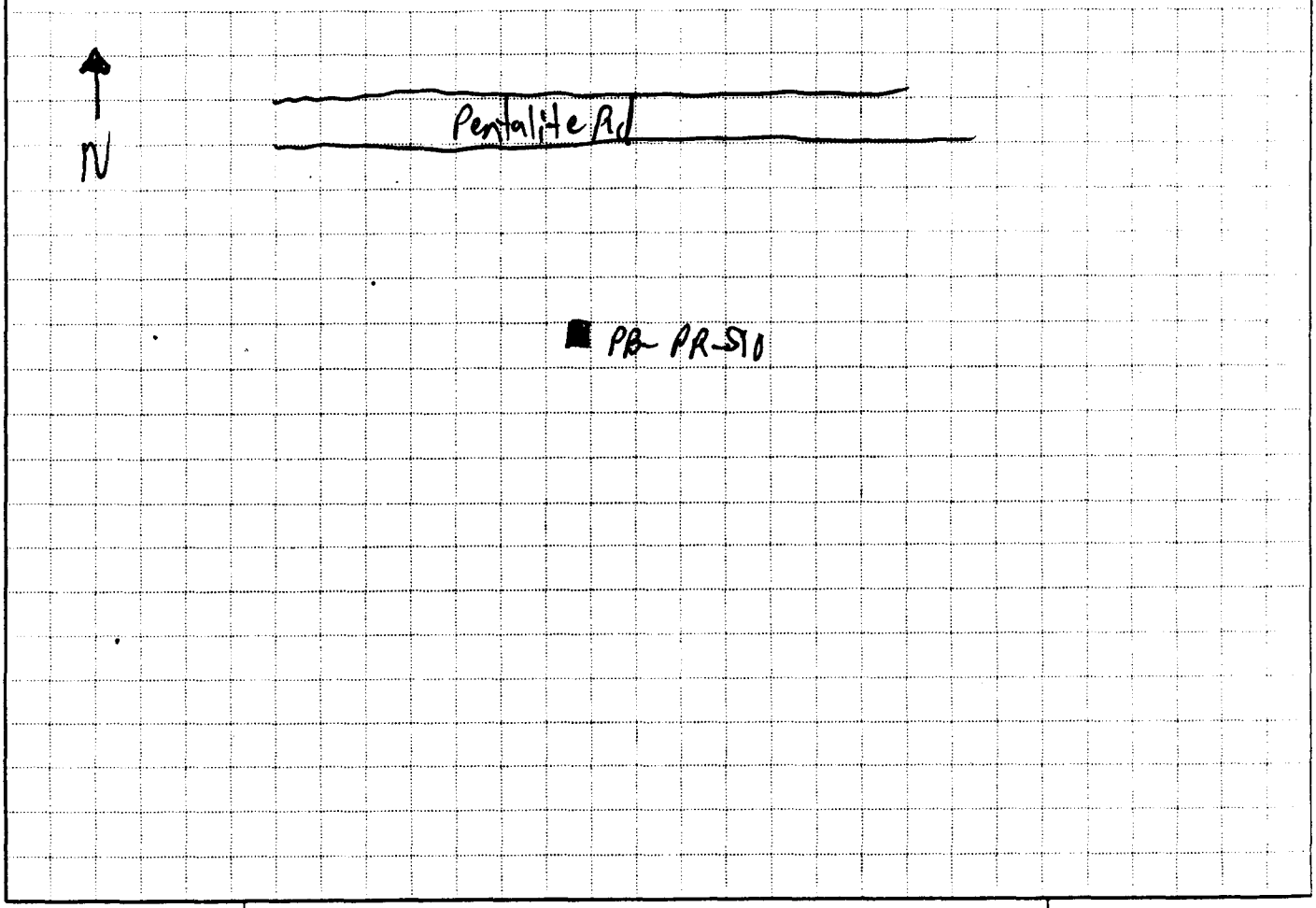
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			grouted	Joe Dentler

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S10

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1 2	Dark Brown sandy organic material Brown well graded silty sand; slightly moist	Hnu=4 (Background ≈0)		PB-PR-S10-0.0/3.0	Blow Count: 3,5,7,7 Ran: 2.0 Rec: 0.8 Lost: 1.2
	3 4	Brown sandy clay; moist Brown clay w/ gray mottling; wet	Hnu=2 (Background ≈0)		PB-PR-S10-3.0/5.0	Blow Count: 2,3,3,3 Ran: 2.0 Rec: 1.3 Lost: 0.7
	5 6	Brown clay w/ brownish yellow mottling; moderate plasticity; moist to wet	Hnu=0		PB-PR-S10-5.0/10.0	Blow Count: 1,1,3,2 Ran: 2.0 Rec: 1.6 Lost 0.4
	7	Gray sandy clay w/ brownish yellow mottling; wet	Hnu=0		PB-PR-S26-5.0/10.0	Blow Count: 3,4,4,5 Ran: 2.0 Rec: 2.0 Lost: 0
	8 9	Brown to gray clay; very soft; high plasticity; wet	Hnu=0		PB-PR-S26-5.0/10.0-S	Blow Count: 0 Ran: 2.0 Rec: 2.0 Lost: 0
	10	Boring Terminated at 10 ft on 10-27-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S11

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drophammer; stainless steel buckets & trowels	8. HOLE LOCATION: Pentolite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-29-94 / 11. DATE COMPLETED: 10-29-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

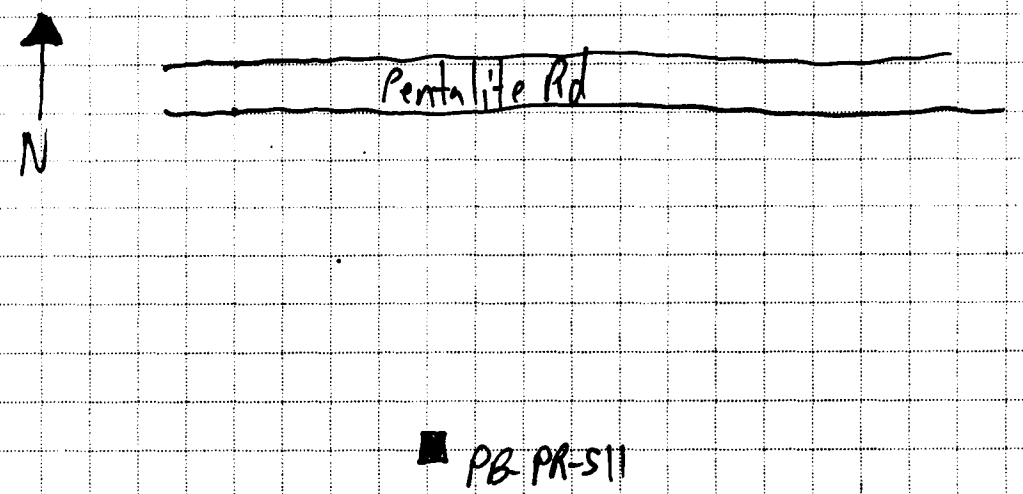
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PA-S11

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy, organic material Brown well graded silty fine sand; dry	Hnu=1 (Background =0)		PB-PA-S11-0.0/3.0	Blow Count: 3,5,11,11 Pen: 2.0 Rec: 1.2 Lost: 0.8
	2 3	Brown well graded silty fine sand Brown sandy clay w/ brownish yellow mottling; moist	Hnu=5 (Background =0)		PB-PA-S11-2.0/5.0	Blow Count: 7,5,4,5 Pen: 2.0 Rec: 1.1 Lost: 0.9
	4 5	Gray sandy silty clay w/ brownish yellow mottling; moist	Hnu=6 (Background =0)		PB-PA-S11-5.0/10.0	Blow Count: 3,3,5,5 Pen: 2.0 Rec: 1.0 Lost: 1.0
	6 7	Brown sandy clay w/ brownish yellow mottling; moist to wet	Hnu=0		PB-PA-S26-5.0/10.0 PB-PA-S26-5.0/10.0-S	Blow Count: 4,5,7,8 Pen: 2.0 Rec: 2.0 Lost: 0
	8 9	Gray clay; no mottling; moderate plasticity; soft; moist to wet	Hnu=3 (Background =0)			Blow Count: 2,3,4,4 Pen: 2.0 Rec: 2.0 Lost: 0
	10	Boring Terminated On 10-20-94 at 10 ft				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S12

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless steel bowls & spoons	8. HOLE LOCATION: Pentalite
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

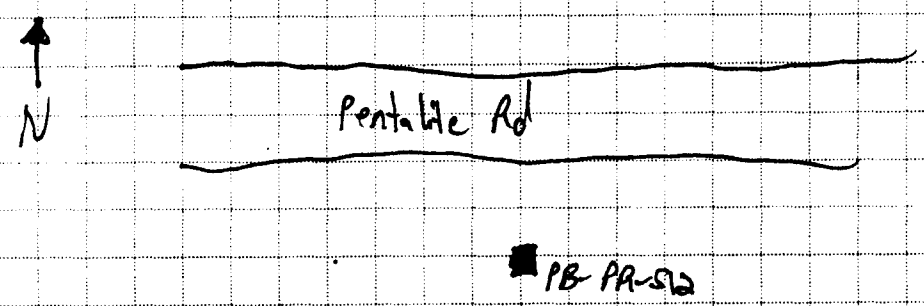
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY) Grouted	23. SIGNATURE OF INSPECTOR: Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S12

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic material w/ brown mottling; dry	Hnu=0		PB-PR-S12-0.0/3.0	Blow Count: 3,4,6,7 Ran: 2.0 Rec: 1.3 Lost: 0.7
	2	Brown to Dark brown sandy organic	Hnu=6 (Background =0)			Blow Count: 2,5,5,5 Ran: 2.0 Rec: 1.4 Lost: 0.6
	3	Dark Brown sandy clay Brown sandy clay w/ brownish yellow mottling; moist			---- PB-PR-S12-3.0/5.0	
	4	Brown sandy clay w/ brownish yellow mottling	Hnu=4 (Background =0)			Blow Count: 1,1,2,2 Ran: 2.0 Rec: 1.7 Lost: 0.3
	5	Dark brown strip Brown sandy clay w/ brownish yellow mottling			---- PB-PR-S12-5.0/10.0	
	6	Brown to gray sandy clay w/ brownish yellow mottling and dark brown specs; moist. also some red streaks on outside (red water?)	Hnu=19 (Background =0)		PB-PR-S27-5.0/10.0 PB-PR-S27	Blow Count: 2,3,4,4 Ran: 2.0 Rec: 2.0 Lost: 0
	7					
	8	Gray sandy clay w/ brownish yellow and reddish brown mottling; moist to wet	Hnu=12 (Background =0)		5.0/10.0-S	Blow Count: 2,2,3,3 Ran: 2.0 Rec: 2.0 Lost: 0
	9					
	10	Boring Terminated at 10 ft on 10-30-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S13

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; stainless steel bowls & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-31-94 / 11. DATE COMPLETED: 10-31-94
12. OVERBURDEN THICKNESS: NA	15. DEPTH GROUNDWATER ENCOUNTERED: approx 7ft
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

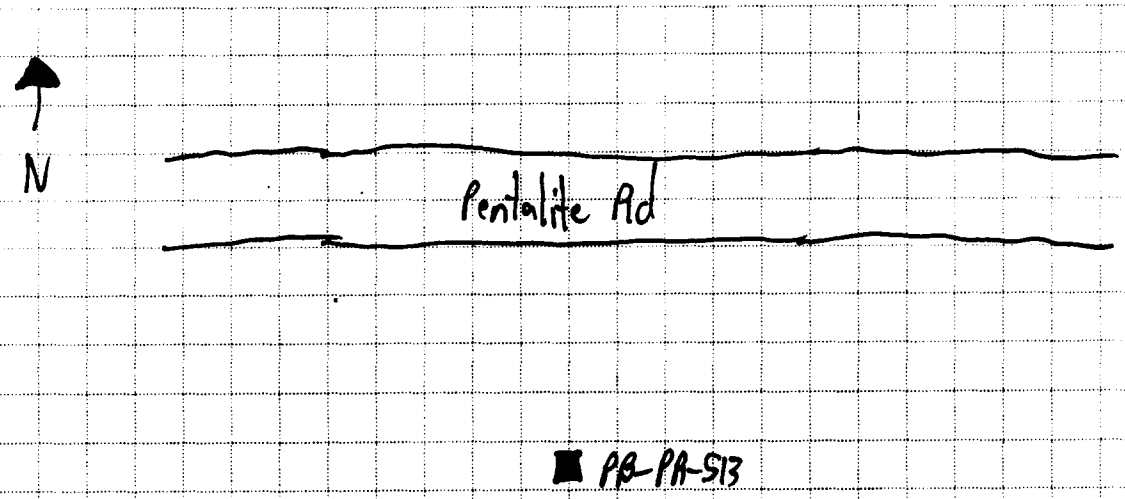
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Peatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PA-S13

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berr,

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic Brownish yellow wellgraded sand	Hnu=1 (Background =1)		PB-PA-S13-0.0/3.0	Blow Count: 1,4,6,10 Ran: 2.0 Rec: 0.7 Lost: 1.3
	2		Hnu=6 (Background =1)			Blow Count: 6,9,7,5 Ran: 2.0 Rec: 1.1 Lost: 0.9
	3	Brownish yellow wellgraded Silty sand Brown wellgraded silty sand w/ dark brown specs			--- PB-PA-S13-3.0/5.0	
	4		Hnu=3 (Background =1)			Blow Count: 2,5,6,7 Ran: 2.0 Rec: 1.1 Lost: 0.9
	5	Brownish yellow wellgraded silty sand Dark Brown to black layer of sandy clay gray sandy clay w/ reddish brown streaks			---	
	6		Hnu=5 (Background =1)		PB-PA-S13-5.0/10.0	Blow Count: 2,2,2,3 Ran: 2.0 Rec: 1.7 Lost: 0.3
	7	Brown sandy clay w/ Brownish yellow mottling: moderate plasticity; soft; wet				
	8		Hnu=10 (Background =1)			Blow count: 2,1,4,7 Ran: 2.0 Rec: 1.8 Lost: 0.2
	9	Brown clay w/ sandy brownish yellow mottling; some dark specs; wet				
	10	Boring terminated at 10ft on 10-31-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER DB-PR-S13

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	3.0	– Hand Auger Boring installed next to 10 foot Boring				
	3.5					
	4.0					Samples collected for: Biological General Chem EOC K (Potassium) 1035
	4.5					
	5.0					
	5.5					
	6.0					
	6.5					
	7.0	Hand Auger Boring Terminated @ 7.0 feet 1035				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-515

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless Steel Bowls & Spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: NA
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: [redacted] approx 8 ft
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

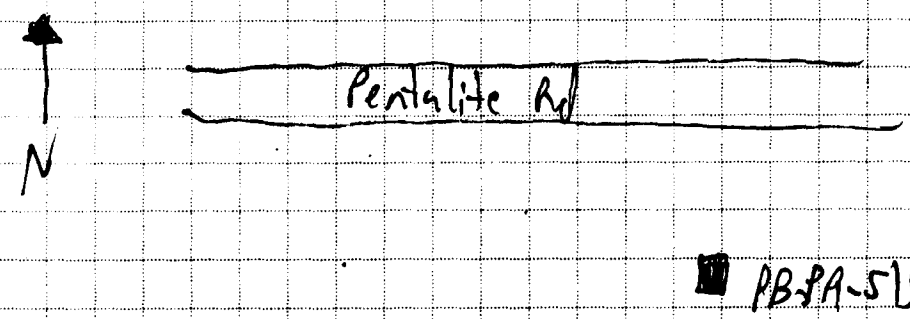
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	-		Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-515

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Brownish yellow well graded silty fine sand w/ some clay mix; dry	Hnu=0		PB-PR-515-0.0/2.0	Blow Count: 2,3,4,7 Ran: 2.0 Rec: 1.7 Lost: 0.3
	2					
	3	Brown to brownish yellow sand w/ some clay	Hnu=0		---	Blow Count: 3,4,3,4 Ran: 2.0 Rec: 1.4 Lost: 0.6
		Brownish yellow well graded silty sand w/ some clay			PB-PR-515-3.0/5.0	
	4					
	5	Brownish yellow well graded silty sand w/ some clay Black stained clay w/ some sand Brown sandy clay w/ brownish yellow mottling; moist	Hnu=0		---	Blow Count: 2,3,4,6 Ran: 2.0 Rec: 1.7 Lost: 0.3
	6	Brown sandy clay w/ some brownish yellow streaks; moist	Hnu: 11 (Background ≈0)		PB-PR-515-5.0/10.0	Blow Count: 2,3,4,4 Ran: 2.0 Rec: 2.0 Lost: 0
	7					
	8	Brown sandy clay with reddish brown streaks; wet	Hnu=11 (Background =0)			Blow Count: 1,2,2,4 Ran: 2.0 Rec: 2.0 Lost: 0
	9					
	10	Boring Terminated at 10 ft	on 10-30-94			

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S16

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless Steel bowls & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-30-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

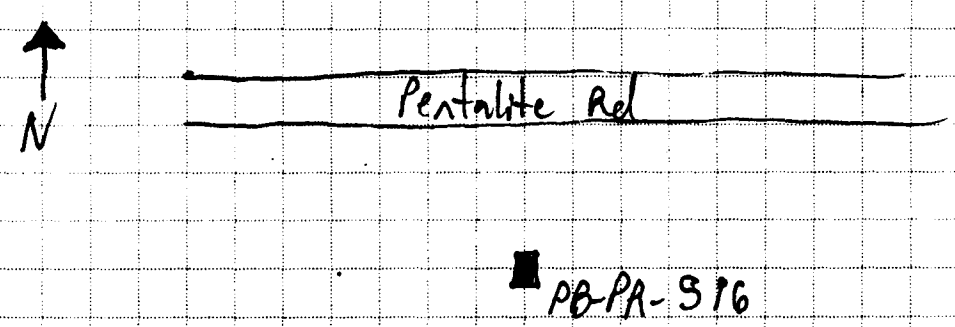
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deathrage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-S16

PROJECT: Plum Brook Ordnance Works | INSPECTOR: Joe Deatherage | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic Brownish yellow well graded silty fine sand; moist	Hnu=20 (Backgrand =0)		PB-PR-S16-0.0/3.0	Blow Count: 1,5,9,17 Ran: 2.0 Rec: 1.8 Lost: 0.2
	2 3	Brownish yellow well graded Silty fine Sand w/ silt; moist	Hnu=3 (Backgrand =0)		---	Blow Count: 12,10,10,9 Ran: 2.0 Rec: 2.0 Lost: 0
	4	Gray sandy clay w/ dark gray mottling			PB-PR-S16-3.0/5.0	
	5	Gray sandy clay with numerous layers of Black staining; moist	Hnu=16 (Backgrand =0)		---	Blow Count: 4,4,5,7 Ran: 2.0 Rec: 1.2 Lost: 0.8
	6 7	Brown sandy clay w/ brownish yellow streaks and some dark staining; soft; moderate plasticity; moist to wet	Hnu=14 (Backgrand =0)		PB-PR-S16-5.0/10.0	Blow Count: 1,2,2,3 Ran: 2.0 Rec: 1.5 Lost: 0.5
	8 9	Brown clay w/ brownish yellow mottling; moist to wet; soft; moderate plasticity	Hnu=20 (Backgrand =0)			Blow Count: 1,2,3,4 Ran: 2.0 Rec: 1.8 Lost: 0.2
	10	Boring terminated at 10 ft on 10-30-94				

PROJECT: Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-WA-S017

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic material: dry Brown sandy clay: dry	Hnu=2 (Backgrand)		PB-WA-S17-0.0/3.0	Blow Count: 7, 8, 8, 10 Ran: 2.0 Rec: 1.0 Lost: 1.0
	2 3	Brown sandy clay; dry to slightly moist; wellgraded	Hnu=2 (Backgrand)		PB-WA-S17-3.0/5.0	Blow Count: 4, 8, 9, 10 Ran: 2.0 Rec: 1.2 Lost: 0.8
	4 5	Brown sandy clay; moderate plasticity; well graded; moist to wet	Hnu=2 (Backgrand)		PB-WA-S17-5.0/10.0	Blow Count: 3, 4, 4, 4 Ran: 2.0 Rec: 1.9 Lost: 0.1
	6 7	Brown sandy clay; moderate plasticity; well graded; wet	Hnu=2 (Backgrand)		PB-WA-S24-5.0/10.0	Blow Count: 1, 2, 1, 4 Ran: 2.0 Rec: 1.8 Lost: 0.2
	8 9 10	Brown sandy clay: moderate Plasticity; wet Gray clay; high plasicity; soft; wet	Hnu=2 (Backgrand)		PB-WA-S24-5.0/10.0-S	Blow Count: 3, 1, 1, 2 Ran: 2.0 Rec: 1.5 Lost: 0.5

PROJECT | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-51

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: N/A	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: stainless steel spoon & bowl	8. HOLE LOCATION: red water pond area
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-27-94 / 11. DATE COMPLETED: 10-27-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 0.5 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

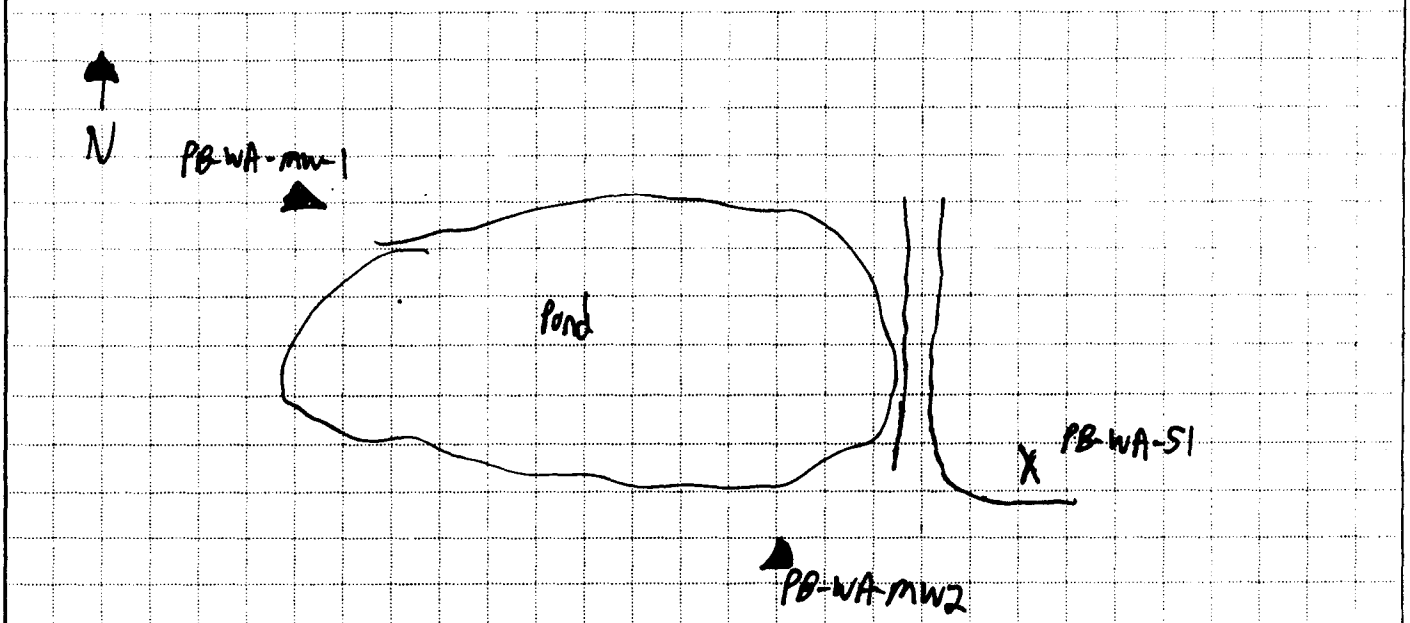
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.:

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S1

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deutherage / Rick Samuels

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark Brown Sandy organic material.				Leaves on surface; roots beneath.
		Brown sandy material; Slightly moist				
		Reddish Brown specs				
		Brown sandy clay w/ fines; slightly moist	thn=0			sample PB-WA-S1-0.0-0.5 collected at 10:30
	0.5					Boring Terminated at 0.5 ft
	1.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-52

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: N/A	6. MANUFACTURER'S DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Stainless steel hand dig spoon	8. HOLE LOCATION: Red water pond area
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-27-94 / 11. DATE COMPLETED: 10-27-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: wet soil beneath surface
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 0.5ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

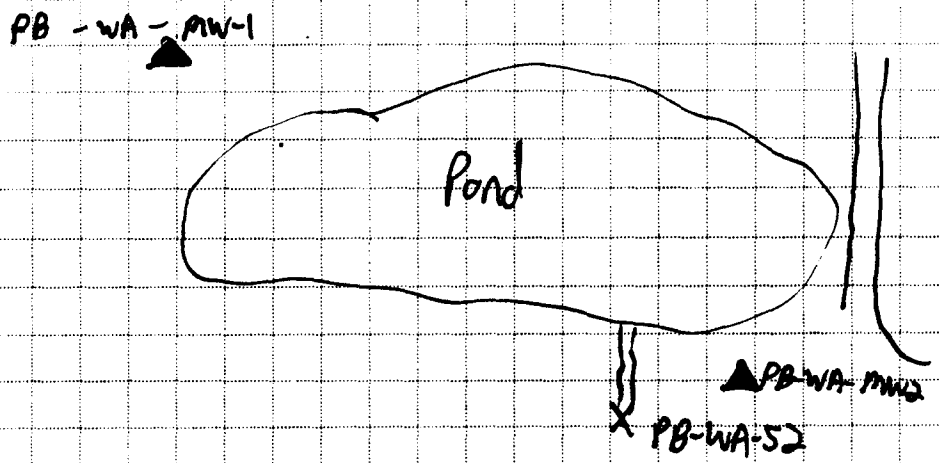
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S2

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Rick Samuels

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Brown clay on surface; wet; sandy; very soft			PB-WA-S2-0.0/0.5	Leaves on surface; some roots beneath
		Gray sandy clay; very soft; wet				Sample PB-WA-S2-0.0-0.5 collected at 10:55
	0.5	gravel grades in	Hnu=0			
						Boring Terminated at 0.5 ft
	1.0					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-53

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Dentrance

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0.1	Brown Sandy Clay; some dark brown mottling; Slightly moist			PB-WA-S1-0.0/0.5	Leaves on surface: roots beneath
	0.2					
	0.3					
	0.4					Sample PB-WA-S3-0.0/0.5 collected at 14:20
	0.5		Hm=0			Boring Terminated at 0.5ft

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S13

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon 140 lb drop hammer; stainless steel & spoon, stainless steel bowl	8. HOLE LOCATION: West Area Pond
	9. SURFACE ELEVATION
	10. DATE STARTED: 10-18-94 / 11. DATE COMPLETED: 10-18-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: approx 6 ft.
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

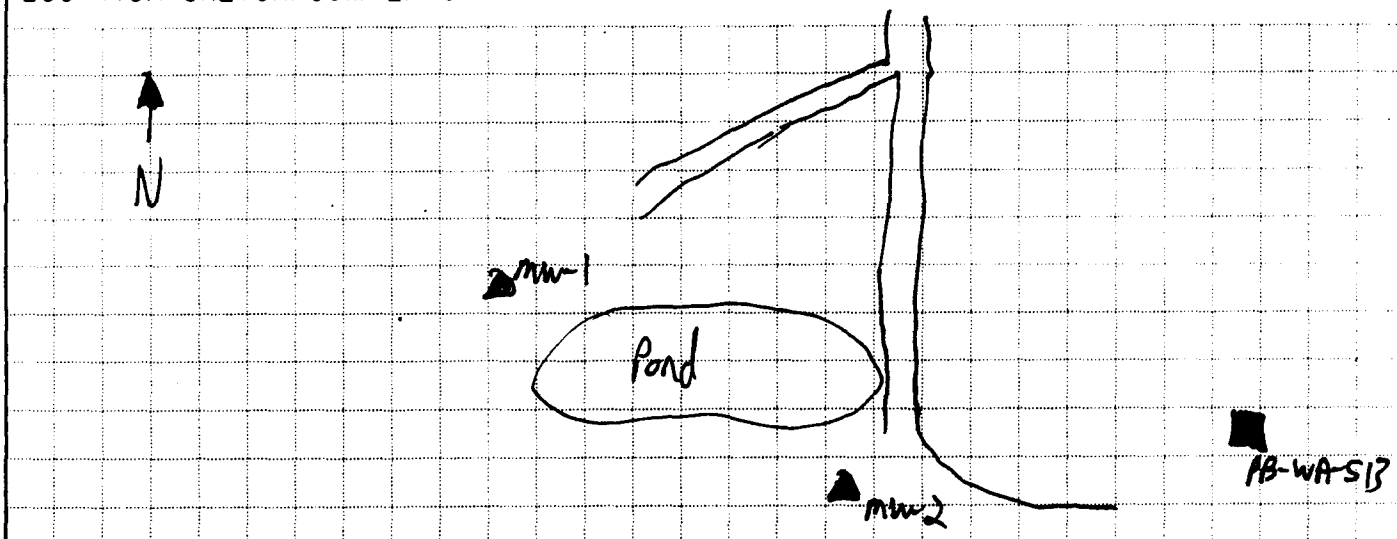
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S13

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deathridge

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic material; dry Brown sandy clay; well graded; dry	Hnu=1 (Backgrand)		PB-WA-S13-	Blow Count=3,6,5,3 Ran: 2.0 Rec: 1.3 Lost: 0.7
	2 3	Dark Brown sandy organic material Brown sandy clay; well graded; wet	Hnu=1 (Backgrand)		0.0-3.0 PB-WA-S13-	Blow Count= 2,3,1,3 Ran: 2.0 Rec: 1.2 Lost: 0.8
	4 5	Brown Clay; moderate plasticity; moist	Hnu=2 (Backgrand)		3.0-5.0	Blow Count=1,1,3,3 Ran: ~~Rec~~ 2.0 Rec: 2.0 Lost: 0
	6 7	Brown Clay; moderate plasticity; gravel mix on bottom of spoon; wet	Hnu=2 (Backgrand)		PB-WA-S13-5.0-10.0	Blow Count=2,4,4,10 Ran: 2.0 Rec: 1.7 Lost: 0.3
	8 9 10	Gray Clay; moderately stiff; moderate plasticity; wet	Hnu=2 (Backgrand)			Blow Count=4,7,14,26 Ran: 2.0 Rec: 1.2 Lost: 0.8

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S18

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D50 Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless steel bowls & spoons	8. HOLE LOCATION: West Area Pond
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-18-94 / 11. DATE COMPLETED: 10-18-94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: approx 5ft
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 10ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

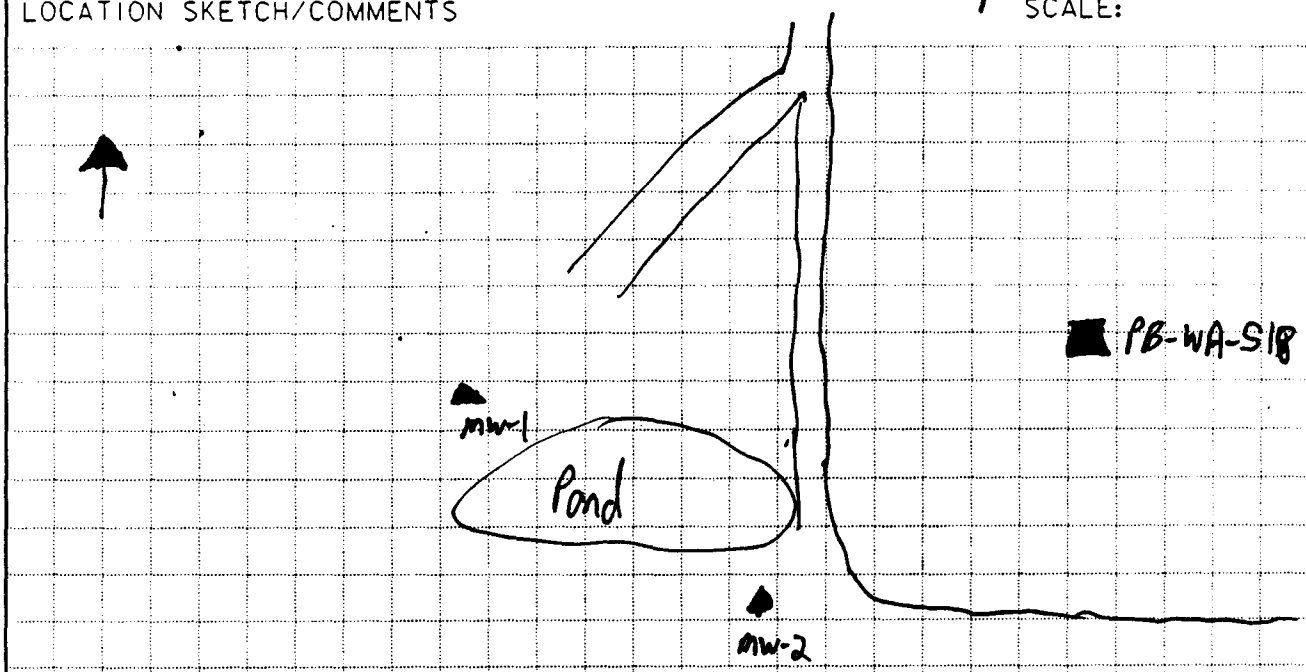
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
			Grouted	Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-S18

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Dealheras

SHEET ___ OF ___ SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown sandy organic material; dry Brown Sandy Clay; moist	Hnu=1 (Background)		PB-WA-	Blow Count: 4,4,5,5 Run: 2.0 Rec: 1.2 Lost: 0.8
	2 3	Dark Brown sandy organic; dry Brown sandy clay; moderate plasticity; wet	Hnu=1 (Background)		S18-0.0-3.0 PB-WA-S18-	Blow Count = 3,2,2,3 Run: 2.0 Rec: 1.1 Lost: 0.9
	4 5	Gray sandy clay; moderate plasticity; moist to wet; sandy	Hnu=2 (Background =1)		3.0-5.0	Blow Count = 1,1,1,1 Run: 2.0 Rec: 1.8 Lost: 0.2
	6 7	Gray clay; high plasticity; wet; soft	Hnu=1 (Background)		PB-WA-S18-5.0-10.0	Blow Count: ~~1,33,25,5~~ 1,1,1,1 Run: 2.0 Rec: 2.0 Lost: 0
	8 9 10	Gray clay; high plasticity; soft; wet; tight in middle	Hnu=1 (Background)			Blow Count: 1,33,25,5 Run: 2.0 Rec: 1.3 Lost: 0.7

PROJECT: Plum Brook Ordnance Works

HOLE NO.

APPENDIX C

MONITORING WELL BORING LOGS

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-MW1

SHEET 1 OF 4 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: D-50 Diesel
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ⌀ 5 ft lens hollow stem auger; 2" split spoon; 140 lb drop hammer	8. HOLE LOCATION: West Area Pond
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-17-94 / 11. DATE COMPLETED: 10-18-94
12. OVERBURDEN THICKNESS: 22.3 ft	15. DEPTH GROUNDWATER ENCOUNTERED: approx 17 feet
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 22.3 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

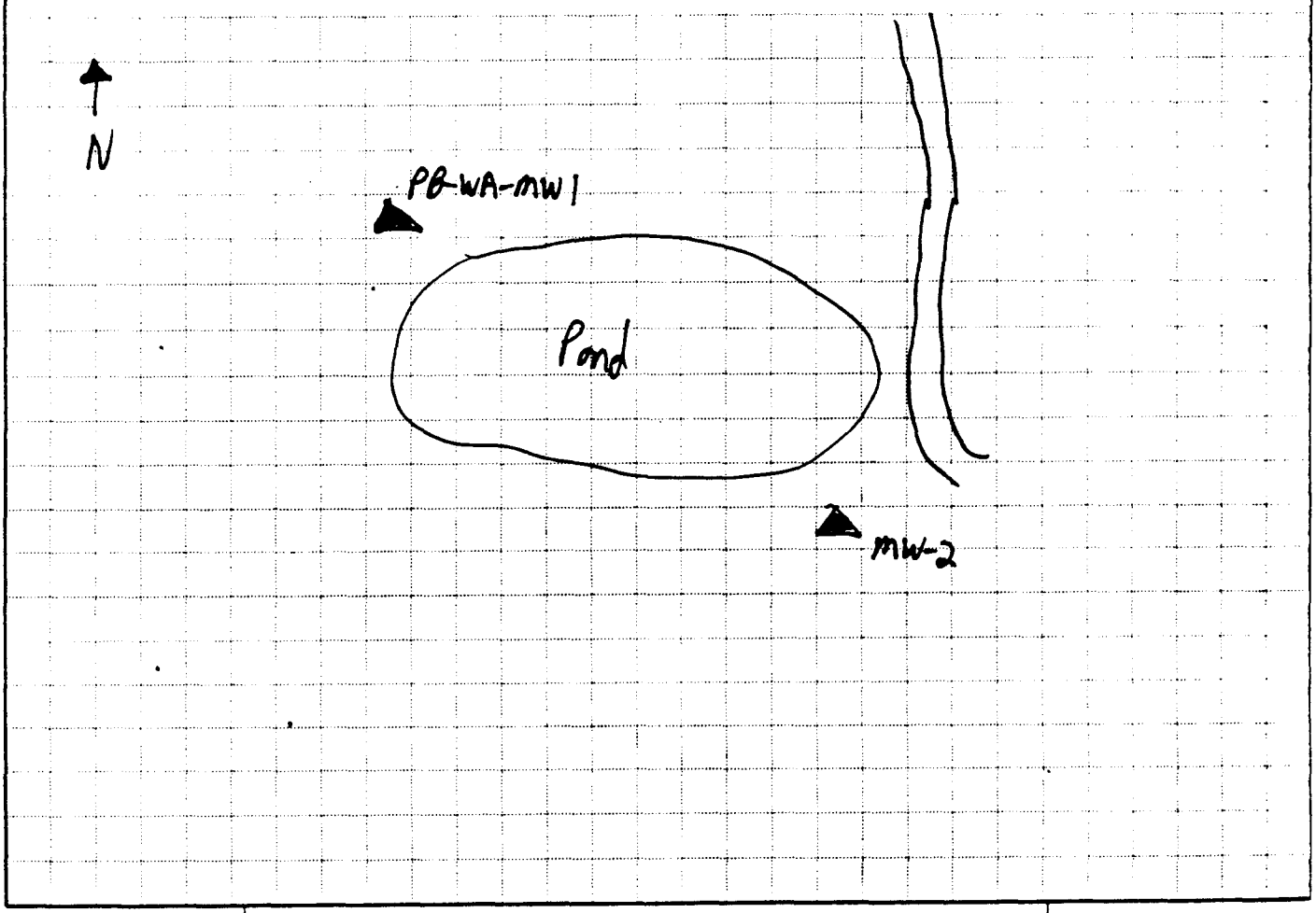
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Deatherage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

PROJECT: Plum Brook Ordnance Works | INSPECTOR: Joe Deatherage | HOLE NUMBER: PB-WA-MW1 | SHEET 4 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Dark brown well graded sandy organic material; dry	Hnu=1 (Background)			Blow Count = 5,11,9,7 Ran: 2.0 Rec: 2.0 Lost: 0
	1	Brownish yellow well graded sand; dry				
	2	Yellowish red very sandy clay; well graded; ~~dry~~ moist	Hnu=1 (Background)			Blow Count: 5,9,11,15 Ran: 2.0 Rec: 1.4 Lost: 0.6
	3					
	4	Brownish yellow weathered Shale; moist, well graded	Hnu=1 (Background)			Blow Count: 6,8,7,11 Ran: 2.0 Rec: 1.3 Lost: 0.7
	5					
	6	Brown to brownish yellow sandy weathered Shale; moist	Hnu=1 (Background)			Blow Count: 3,9,13,14 Ran: 2.0 Rec: 1.9 Lost: 0.1
	7					
	8	Brownish yellow sandy weathered Shale; moist	Hnu=1 (Background)			Blow Count: 2,3,3,4 Ran: 2.0 Rec: 2.0 Lost: 0
	9	Gray sandy clay; soft; moist; wet traces in spoon				
	10					

PROJECT: Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

PB-WA-MW1

PROJECT	INSPECTOR	SHEET
Plum Brook Ordnance Works	Joe Deathrage	3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10 11	Gray soft clay w/ weathered shale; moist w/ traces of wetness in spoon	Hnu=1 (Background)			Blow Count: 2,2,3,3 Ran: 2.0 Rec: 1.8 Lost: 0.2
	12 13	Gray, soft, sandy clay w/ weathered shale; moist w/ traces of wetness.	Hnu=1 (Background)			Blow Count= 2,2,3,2 Ran: 2.0 Rec: 2.0 Lost: 0
	14 15	Gray, soft sandy clay w/ weathered shale; moist with traces of wetness	Hnu=1 (Background)			Blow Count: 3,3,3,3 Ran: 2.0 Rec: 1.9 Lost: 0.1
	16 17	Gray, very soft clay; moist to wet; high plasticity	Hnu=1 (Background)			Blow Count= 1,1,1,1 Ran: 2.0 Rec: 2.0 Lost: 0
	18 19 20	Gray very soft clay; wet; high plasticity	Hnu=1 (Background)			Blow Count= 1,1,3,2 Ran: 2.0 Rec: 2.0 Lost: 0

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-MW1

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Gray soft clay; moist to wet; high plasticity	Hnu=1 (Background)			Blow Count: 0, 1, 6, 12 Ran: 2.0 Rec: 1.5 Lost: 0.5
	21	Gray soft clay w/ weathered shale mix; moist to wet				
	22	Gray soft clay with limestone at base; moist to wet.	Hnu=1 (Background)			Blow Count = 7, 50 over 3" Ran: 0.7 Rec: 0.4 Lost: 0.3 * Refusal at 22.3' *
	23					
	24					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-WA-MW2 & PB-WA-S10

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Betasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2¼" split spoon; 140 lb drop hammer; stainless steel bowls & spoons	8. HOLE LOCATION: Red Water Pond area
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-27-94 / 11. DATE COMPLETED: 10-27-94
12. OVERBURDEN THICKNESS: 12.0 ft	15. DEPTH GROUNDWATER ENCOUNTERED: approx 1.5 ft
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 12.0 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

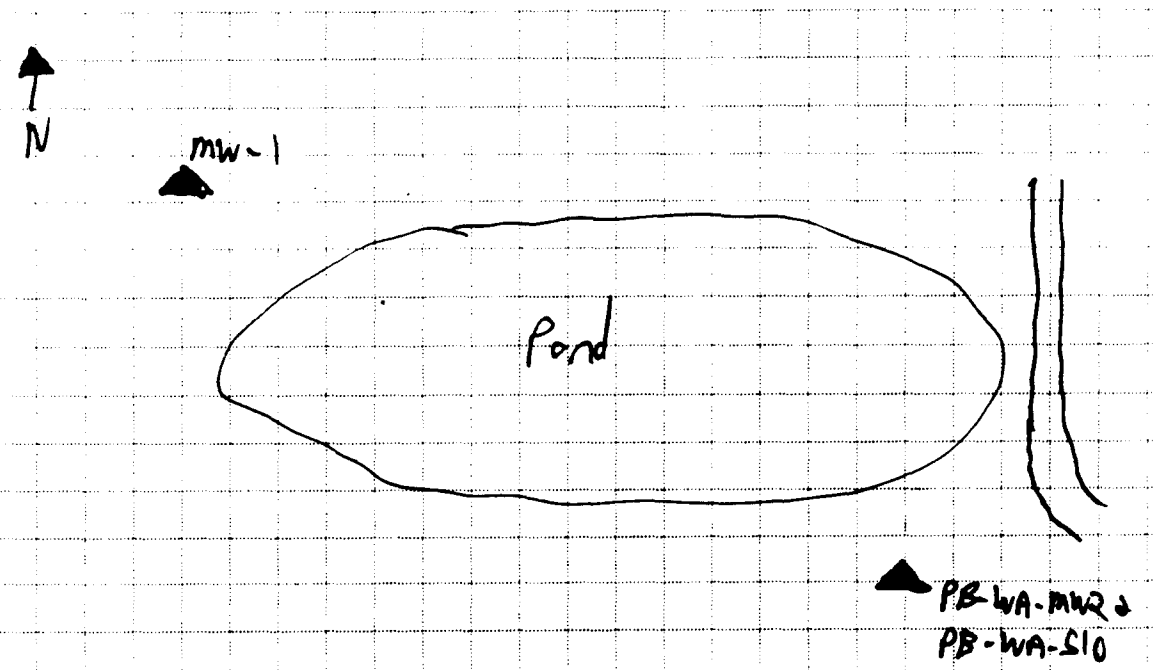
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Jose Deathenage

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-WA-510

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deathridge | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown sandy organic material	Hnu=2 (Background =0)			Blow Count = 2,4,2,2 Ran: 2.0 Rec: 1.6 Lost: 0.4
	1.0	Brown well graded sand w/ some clay mix; wet at 1.5ft				
	2.0	Brown sandy, well graded, some clay mix and brownish yellow flakes; wet	Hnu=2 (Background =0)			Blow Count: 1,1,1,1 Ran: 2.0 Rec: 2.0 Lost: 0
	3.0				PB-WA-510-	
	4.0	Brown to gray sandy clay; wet	Hnu=20 (Background =0)		3.0/5.0	Blow Count = 1,1,1,1 Ran: 2.0 Rec: 2.0 Lost: 0
	5.0	Gray clay; very soft; moderate plasticity; very moist				
	6.0	Gray clay with brownish yellow mottling; very soft; high plasticity; very moist	Hnu=50 (Background =0)		PB-WA-510- 8.0/10.0	~~Blow~~ Blow Count: 0,1,1,1 Ran: 2.0 Rec: 2.0 Lost: 0
	7.0					
	8.0	Gray clay; very soft; high plasticity; moist to wet. Brownish yellow mottling	Hnu=50 (Background =0)			Blow Count: 1,2,6,7 Ran: Rec: Lost:
	9.0					
	10.0					

PROJECT Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-WP-510

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage | SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Gray Clay; very soft; high plasticity; wet; brownish yellow mottling	Hnu = 1 (Background = 0)			Blow Count = 2, 19, 10, 50 over 5"
		Weathered Shale; gray				Run: 1.9'
	11					Rec: 1.0'
						Lost: 0.9'
	12					Boring terminated at 12.0 ft due to auger refusal
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					

PROJECT | HOLE NO.

Plum Brook Ordnance Works

PB-PR-54

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-MW

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: ~~Belasco~~ Belasco Drilling Services
SHEET 1 OF 1 SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2 1/4" split spoon; 140 lb drop hammer; Stainless steel bowls & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 10-31-94
12. OVERBURDEN THICKNESS: 22.0 ft	15. DEPTH GROUNDWATER ENCOUNTERED: approx 10.5 ft
13. DEPTH DRILLED INTO ROCK: 0.3 ft	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 22.3 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

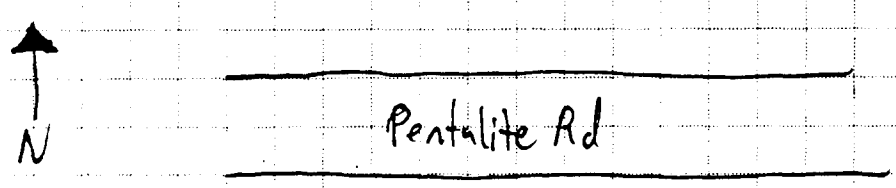
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Joe Dentlinger

LOCATION SKETCH/COMMENTS

SCALE:



PB-PR-MW 054

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-MW9

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic material; dry	Hnu=18 (Backgrand =0)		PB-PR-S4-0.0/3.0	Blow Count: 1,2,3,4 Ran: 2.0 Rec: 1.2 Lost: 0.8
	2	Brown to dark Brown Sandy organic material; dry				
	3	Brownish yellow well graded sand w/ Silt; moist	Hnu=2 (Backgrand =0)			Blow Count: 3,3,3,4 Ran: 2.0 Rec: 2.0 Lost: 0
	4	Brown sandy clay w/ brownish yellow mottling; moist; moderate Plasticity			PB-PR-S4-3.0/5.0	
	5	Brown Clay w/ brownish yellow sandy mottling; soft; moderate plasticity; moist to wet	Hnu=2 (Backgrand =0)			Blow Count: 1,1,1,4 Ran: 2.0 Rec: 2.0 Lost: 0
	6					
	7	Brown sandy clay w/ brownish yellow mottling; moist to wet	Hnu=7 (Backgrand =0)		PB-PR-S4-5.0/7.0	Blow Count: 1,3,5,4 Ran: 2.0 Rec: 2.0 Lost: 0
	8	Gray clay w/ some brownish yellow mottling				
	9	Gray clay w/ some brownish yellow mottling; moist to wet; very soft; high plasticity	Hnu=3 (Backgrand =0)			Blow Count: 3,2,4,4 Ran: 2.0 Rec: 2.0 Lost: 0
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

PB-PR-MW-8 S4

PROJECT: Plum Brook Ordnance Works | INSPECTOR: Joe Deatherage / Ted Berry | SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10 – 11	Gray clay; soft; high plasticity; wet with some red water noted; wet	Hnu=0			Blow Count: 0, 2, 2, 5 Ran: 2.0 Rec: 1.6 Lost: 0.4
	12 – 13	Gray soft clay, high plasticity; wet w/ ~~red~~ ~~water brown water~~ yellowish red water	Hnu=0			Blow Count: 2, 3, 4, 5 Ran: 2.0 Rec: 2.0 Lost: 0
	14 – 15	Gray very soft clay; high plasticity; wet w/ yellowish red water	Hnu=0			Blow Count: 2, 2, 3, 4 Ran: 2.0 Rec: 2.0 Lost: 0
	16 – 17	Gray clay, a bit more hard and tight; moderate plasticity; wet w/ brownish yellow water	Hnu=0			Blow Count: 4, 7, 10, 13 Ran: 2.0 Rec: 1.6 Lost: 0.4
	18 – 19	Gray clay; moderately hard; moderate plasticity; wet w/ brownish yellow water	Hnu=0			Blow Count: 3, 6, 14, 18 Ran: 2.0 Rec: 1.3 Lost: 0.7
	20					

PROJECT: Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-PR-MW7254

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage / Ted Bern | SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Gray sandy clay; hard; low plasticity; moist soil, wet spoon w/ brownish yellow water. Some shale fragments.	Hnu=0			Blow Count: 2, 12, 17, 20 Ran: Rec: Lost:
	22	Weathered Shale; dry w/ wet spoon refusal at 22.3 ft	Hnu=0			Blow Count: 19, 47, refusal Ran: 1.0 Rec: 0.7 Lost: 0.3

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-514/.

SHEET 4 OF 4 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services, Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: D120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoons; 140 lb drop hammer; stainless steel bowls & spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION
	10. DATE STARTED: 11-7-94 / 11. DATE COMPLETED: 11-7-94
12. OVERBURDEN THICKNESS: 27.5	15. DEPTH GROUNDWATER ENCOUNTERED: approx 7 Feet
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 27.5	17. OTHER WATER LEVEL MEASUREMENTS (SPECIF.): N/A

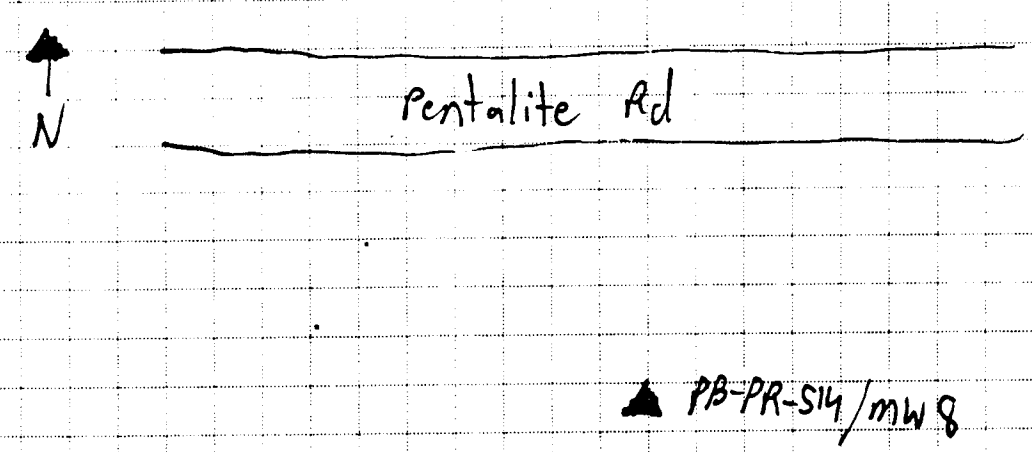
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIF.)~~ Explosives	OTHER (SPECIF.)	OTHER (SPECIF.)	21. TOTAL CORE RECOVERY: N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIF.)	23. SIGNATURE OF INSPECTOR
		X		Joe Dealling

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

PB-PR-S14/MW3

PROJECT: Plum Brook Ordnance Works | INSPECTOR: Joe Deatherage | SHEET 2 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark brown sandy organic material	Hnu=2 (Backgrnd)		PB-PR-S14-0.0/3.0	Blow Count: 2, 2, 8, 10 Ran: 2.0 Rec: 1.4 Lost: 0.6
	1	Brown well graded sand w/ brownish yellow flackes; slightly moist				
	2	Brown well graded sand w/ some brownish yellow mottling: slightly moist	Hnu=0		---	Blow Count: 7, 10, 7, 8 Ran: 2.0 Rec: 1.8 Lost: 0.2
	3				PB-PR-S14-3.0/5.0	
	4	Dark brown sandy clay: stained	Hnu=0			Blow Count: 2, 3, 5, 5 Ran: 2.0 Rec: 1.6 Lost: 0.4
	5	Brown sandy clay w/ some brownish yellow mottling; moist			---	
	6	Brown clay w/ some sand; brownish yellow mottling; soft: moderate plasticity; wet	Hnu=3 (Backgrnd =1)		PB-PR-S14-5.0/10.0	Blow Count: 2, 1, 2, 2 Ran: 2.0 Rec: 1.6 Lost: 0.4
	7					
	8	Dark Brown Stained layer				
	9	Brown clay w/ sand; yellowish brown and reddish brown mottling; soft: moderate plasticity; wet	Hnu=4 (Backgrnd =0)			Blow Count: 1, 2, 3, 4 Ran: 2.0 Rec: 2.0 Lost: 0
	10					

PROJECT: Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PA-S14/MW8

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage

SHEET 3 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Brown to gray clay w/ some sand; brownish yellow & reddish brown mottling; wet	Hnu=0			Blow Count: 2,2,2,4 Ran: 2.0 Rec: 2.0 Lost: 0
	11					
	12	Gray clay w/ reddish brown sand layers; soft; high plasticity; wet	Hnu=0			Blow Count: 1,2,4,4 Ran: 2.0 Rec: 2.0 Lost: 0
	13					
	14	Gray clay w/ reddish brown sand layers; wet	Hnu=0			Blow Count. 1,2,3,3 Ran: 2.0 Rec: 2.0 Lost: 0
	15					
	16	Gray clay w/ traces of shale; no mottling; moist to wet	Hnu=0			Blow Count: 2,2,7,8 Ran: 2.0 Rec: 2.0 Lost 0
	17					
	18	Gray soft weathered shale w/ traces of shale; moist	Hnu=0			Blow Count: 4,9,11,12 Ran: 2.0 Rec: 2.0 Lost: 0
	19					
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER PB-PR-SH/MW8

PROJECT Plum Brook Ordnance Works | INSPECTOR Joe Deatherage | SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Gray weathered shale; harder; moist	Hnu=0			Blow Count: 5, 12, 23, 28 Ran: 2.0 Rec: 1.8 Lost: 0.2
	21					
	22	Gray weathered shale w/ traces of sand and shale; moist	Hnu=0			Blow Count: 12, 17, 24, 27 Ran: 2.0 Rec: 2.0 Lost: 0
	23					
	24	Gray weathered shale moist	HNu 0			Blow Count: 5, 16, 21, 32 Ran: 2.0 Rec: 2.0 Lost: 0
	25					
	26	Gray weathered shale large shale fragments present.	HNu 0			Blow Count: 11, 28, 50/5 Ran: 1.4' Rec: 1.4' Lost: 0
	27					
	28					Well terminated at 27.5 ft

PROJECT | HOLE NO.

Plum Brook Ordnance Works

PB/PR-MWS

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-MW19

SHEET 1 OF 3 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services Inc.
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Darryl	6. MANUFACTURER'S DESIGNATION OF DRILL: CME 45 ATV
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 24" split spoon; 140 lb drop hammer; Stainless Steel hand spoons	8. HOLE LOCATION: Pentalite Rd
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10-30-94 / 11. DATE COMPLETED: 11-1-94
12. OVERBURDEN THICKNESS: 19.0	15. DEPTH GROUNDWATER ENCOUNTERED: approx 9 ft
13. DEPTH DRILLED INTO ROCK: N/A (0)	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 19.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

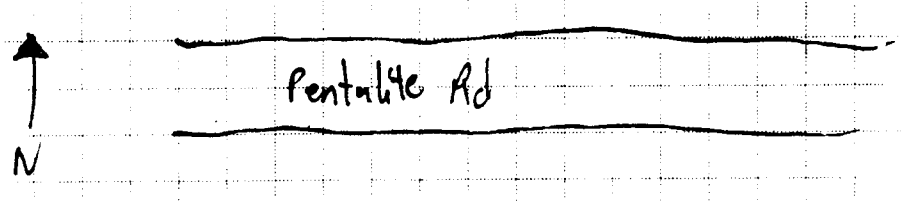
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY) Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						N/A

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
				Joe Dietrich

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

PB-PA-MW 9

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Joe Deatherage / Ted Berry

SHEET 2 OF 2 SHEETS 3

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (g)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	1	Dark Brown Sandy organic material Brown to brownish yellow well graded sandy silty clay; slightly moist	Hnu=3 (Background =0)		PB-PA-S19-0.0/3.0	Blow Count: 1,2,5,5 Ran: 2.0 Rec: 1.8 Lost: 0.2
	2		Hnu=10 (Background =0)			Blow Count: 5,5,5,5 Ran: 2.0 Rec: 1.1 Lost: 0.9
	3	Brown sandy clay with dark Brown mottling Brown sandy clay -no mottling			--- PB-PA-S19-3.0/5.0	
	4	Brown sandy clay w/ brownish yellow mottling and some dark brown streaks.	Hnu=2 (Background =0)			Blow Count: 2,3,3,3 Ran: 2.0 Rec: 2.0 Lost: 0
	5				---	
	6	Brown sandy clay w/ brownish yellow mottling and some pink streaks	Hnu=8 (Background =0)		PB-PA-S19-5.0/10.0	Blow Count: 2,3,4,5 Ran: Rec: Lost:
	7					
	8	Brown Sandy clay w/ brownish yellow lenses; moist to wet	Hnu=4 (Background =0)			Blow Count: 3,3,3,4 Ran: 2.0 Rec: 2.0 Lost: 0
	9	Gray clay w/ brownish yellow sandy layers and reddish brown sandy layers; wet				
	10	[illegible]				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-PR-mw9

PROJECT: Plum Brook Ordnance Works | INSPECTOR: Joe Dentherose | SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Gray very soft clay; high plasticity; some sand traces; wet	Hnu=0			Blow Count: 0,2,2,3 Ran: 2.0 Rec: 2.0 Lost: 0
	11					
	12	Gray very soft clay; high plasticity; no sand; wet	Hnu=0			Blow Count: 2,2,3,4 Ran: 2.0 Rec: 1.7 Lost: 0.3
	13					
	14	Gray very soft clay; high plasticity; wetness on spoon	Hnu=0			Blow Count: 3,2,2,3 Ran: 2.0 Rec: 1.7 Lost: 0.3
	15					
	16	Gray soft clay; high plasticity	Hnu=0			Blow Count: 6,10,15,15 Ran: 2.0 Rec: 2.0 Lost: 0
	17	Gray clay, harder, with traces of shale; moist soil, wet spoon				
	18	Gray clay; hard, with traces of shale; moist soil; wet spoon	Hnu=0			Blow Count: 4,14,25,26 Ran: 2.0 Rec: 1.0 Lost: 1.0
	19					Auger refusal at 19.0 ft.
	20					

PROJECT: Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW14

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID HSA, 2' Split Spoons; 6¼" ID HSA; HQ Core Barrell, 6" Roller cone; NX Core Barrell	8. HOLE LOCATION: West Area Ponds
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-17-94 / 11. DATE COMPLETED: 11-12-94
12. OVERBURDEN THICKNESS: 24.5' BGS	15. DEPTH GROUNDWATER ENCOUNTERED: 18' BGS
13. DEPTH DRILLED INTO ROCK: 24.5' - 49.4' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 24.07' BTOC 48 hrs
14. TOTAL DEPTH OF HOLE: 52.2' BGS, 55.0' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 24.45' BTOC 11-16-94

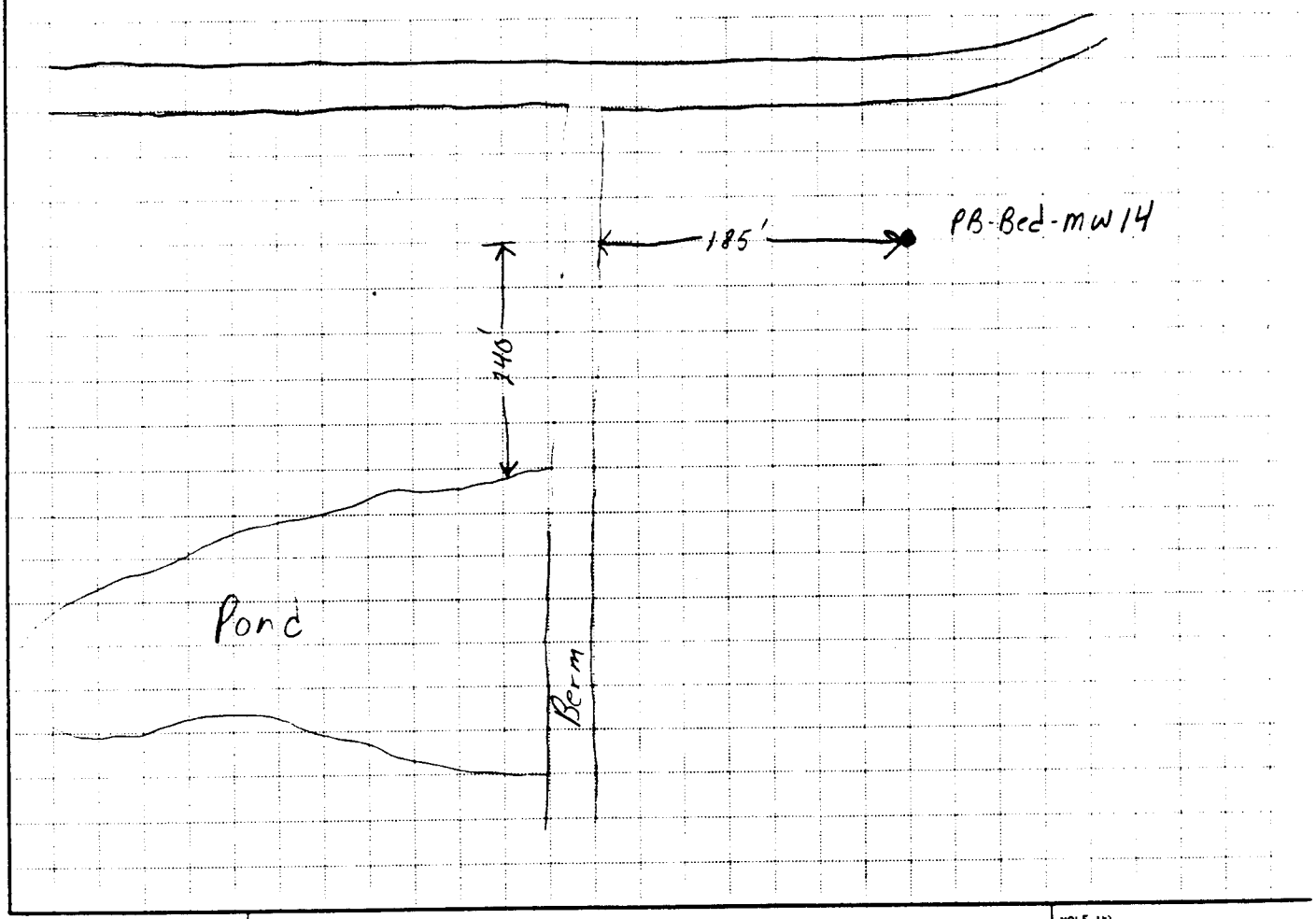
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		3

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
						97%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS

SCALE: Not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW14

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW14

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brown Silty Fine Sand with roots - Dry	HNu 0	1		20" Recovery
				2	H	
	1	Grades to Yellow Brown		2		
				3		
	2	Grades with trace clay-dry	HNu 0	3		20" Recovery
				5		
	3			7		
				7		
	4	Brownish Gray & Brownish Orange Clayey Silty Fine Sand dry-horizontal layering	HNu 0	3		22" Recovery
				4		
	5			6		
				7		
	6	Grades with ¼" Brownish Yellow Silty Fine Sand lenses about every 2 inches Dry	HNu 0	2		24" Recovery
				3		
	7			5		
				7		
	8	Brown & Brownish Yellow thinly layered silty Fine Sand	HNu 0	3		24" Recovery
				5		
	9			8		
				7		
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW14

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW14

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10		HNu	3		24" Recovery
		Gray Clayey Silt - moist	0	3		
	11			3		
				4		
	12	Gray Silty Clay - moist		2		24" Recovery
				3		
	13			4		
				4		
	14	Same as above		2		24" Recovery
				2		
	15			3		
				3		
	16	Gray Fat Clay - moist		1		24" Recovery
				1		
	17			2		
				2		
	18	Some as above moist to wet		wt of Hammer		24" Recovery
				1		
	19			1		
				1		
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW14

HTRW DRILLING LOG

HOLE NUMBER: PB-Red-MW14

PROJECT: Plum Brook Ordnance Works

INSPECTOR: Charles Way

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Same as above with fragments of weathered shale moist to wet	HNu 0	wt of Hammer 1 1 1		24" Recovery
	21					
	22	Same as above with lots of weathered shale	HNu 0	2 5 7 50/0		10" Recovery
	23					
	24					Auger Refusal at 24.5'
	25	Limestone, medium Dark Gray (N4) fine to medium crystalline, strong, fresh with occasional bivalve fossils		Box 1		Begin Run 1 at 24.5' HQ Core Barrel
	26					All breaks appear to be breaks from coring process
	27					Core 60" Rec 57" Lost 3"
	28					
	29					Set 4" casing to 29.0' End Run 1 at 29.3'
	30	Limestone, medium Dark Gray (N4), strong, fresh intermixed with zones of Limy Shale, Dark Gray (N3), weak, fresh to slightly weathered at open breaks, occasional fossils		Box 2		Begin Run 2 at 29.3' on 11-12-94 with NQ core barrell and clear water

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Red-MW14

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW14

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30	Ti Break				
		Ti Break — Limy shale zone 30.4 to 31.6				
		Ti Break				
	31	Ti Break				Core 60" Rec 54" Lost 6"
		Ti Break				
		Ti Break				
	32	Open Break — Limy shale zone 32.1 to 32.5				23 min/5 ft Lost about 30 gals at open breaks
		Open Break				
	33	Ti Break — Limy shale zon 33.0-33.1				
	34			Box 2		
		Gradesto Fossiliferous limestone, light Brownish Gray (5YR 6/1), finely crystalline, strong, fresh, with stylolitic surfaces, very slight petroleum odor 45° open Break				End Run 2 at 34.3' Begin Run 3 at 34.3'
	35					
						Core 112" Rec 112"
	36					35 min/9.3'
		Ti Break				
	37					
	38					
	39					
		Open Break				
	40					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW14

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW14

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (g)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40					
		Ti Break				
	41					
	42			Box 2		
		Ti Break				
	43					
						End Run 3 at 43.6'
						Begin Run 4 at 43.6'
	44	Begin vertical, partially rehealed fracture				
	45					Core 70" Rec 70"
		End vertical, partially rehealed fracture				17 min / 5.7'
	46	Open Break		Box 3		
	47	Ti Break				
		Begin vertical, partially rehealed fracture				
	48					
		Ti Break – small oil sheen				
	49					
						End Run 4 at 49.4'
		Add 25' screen, remainder riser 2.75' stickup				Boring terminated at 49.4' on 11-12-94
	50					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW14

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW.

SHEET 1 OF 1 SHEETS

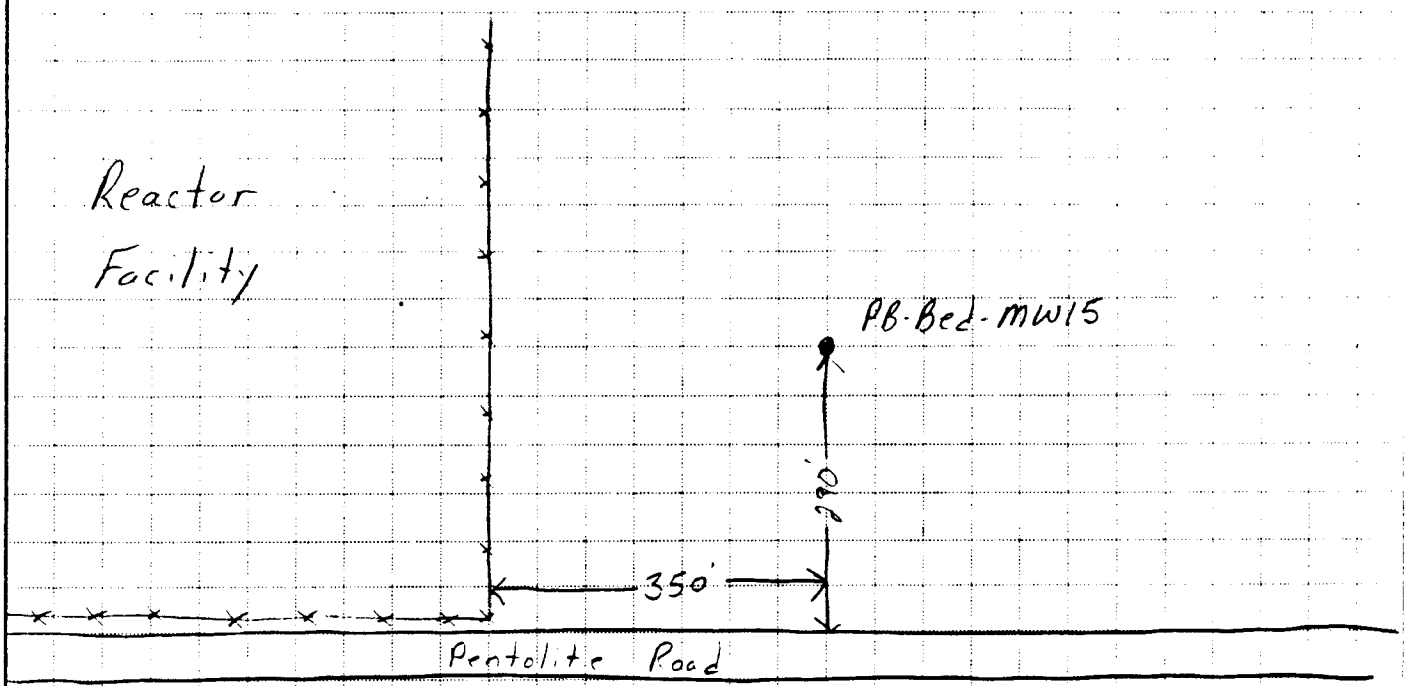
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼ ID HSAs, 6¼ ID HSAs; HQ Core Equipment; NX Core Equipment, 6" Roller Cone; 2' Split Spoons	8. HOLE LOCATION: Pentolite Road Ponds
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-18-94 / 11. DATE COMPLETED: 11-11-94
12. OVERBURDEN THICKNESS: 24.3' BGS	15. DEPTH GROUNDWATER ENCOUNTERED: 10.0' BGS
13. DEPTH DRILLED INTO ROCK: 24.3 - 74.4' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 25.89' BTOC 48 hrs
14. TOTAL DEPTH OF HOLE: 74.4' BGS, 77.0' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 37.41' BTOC 11-16-94

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: 4
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: 99%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Brown + Grayish Brown Silty Fine Sand - Dry		3		20" Recovery
			HNu	4		
	1		0			
				7		
				6		
	2	Grades with Brownish Yellow - Dry		6		24" Recovery
			HNu 0	6		
	3			7		
				7		
	4			5		24" Recovery
		Gray & Brown Clayey Silt with [illegible] of fine Sand - Dry	HNu 0	7		
	5			10		
				9		
	6			4		24" Recovery
			HNu 0	5		
	7	Gray Silty Clay - moist		5		
				7		
	8		HNu 0	2		24" Recovery
				3		
	9			4		
		Gray Clayey Silt - moist		6		
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Same as above moist to wet	HNu 0	3		24" Recovery
				2		
	11			3		
				4		
	12	Same as above moist to wet	HNu 0	1		24" Recovery
				2		
	13			2		
				4		
	14	Gray Silty Clay with fragments of weathered shale-moist	HNu 0	1		24" Recovery
				2		
	15			2		
				4		
	16	Same as above moist	HNu 0	1		20" Recovery
				2		
	17			3		
				4		
	18	Same as above few more shale fragments Becomes dryer	HNu 0	1		22" Recovery
				2		
	19			5		
				8		
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20	Same as above	HNu 0	4 7 7 13		24" Recovery
	21					
	22	Same as above, with larger shale fragments dryer	HNu 0	5 7 12 50/6		10" Recovery
	23					
	24					Auger Refusal at 24.3'
		Limestone, medium Dark Gray (N4), fine to medium crystalline, strong, Fresh with occasional bivalves				Begin Run 1 at 24.3'
	25		Rec 78.5/86	RQD 78.5/86		Core 86" Rec 78.5" Lost 7.5"
		Void 25.5'-26.0'				
	26			Box 1		
	27					
	28					
	29					
	30					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					set and grouted 4" casing to 31.5'
	31					Left .2' in Btm hole End Run 1 at 31.5'
						Roller Cone
	32	~~Fossiliferous~~ Limestone, medium Dark Gray (N4), Fine to medium crystalline, strong, fresh, with occasional stylolite surfaces and bivalve fossil Spin Slight Petroleum odor	Rec/core	74"/core		Begin Run 2 at 31.7 using 12'3" NQ core barrell and clear water 11-10-94
	33					
		Ti Break				Core 93" Rec 91" Lost 2"
	34	Ti Break	91"/93"	91"/93		
	35			Box 2		27min/7.7ft
	36	Ti Break				
	37					
		Ti Break				
	38					
	39	Ti Break, oil stain at stylolite				End Run 2 at 39.4' Begin Run 3 at 39.4' 11-11-94
	40					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF 6 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40					
	41					
	42					
		Ti fract at stylolite, black stain				Core 120"
						Rec [illegible]"
	43			Box 2		Gain 2"
	44					
		Ti Break				34min/10ft
	45	Open Break at shale seam				
	46	Ti Break at stylolite, black stain				
	47					
		Open Break - clay seam 1/2"				
	48			Box 3		
	49					
						End Run 3 at 49.4'
						Begin Run 4 at 49.4'
	50					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 7 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	50					
	51					
		Ti Break				
	52					
						Core 120"
	53					Rec 120"
				Box 3		
	54					4 l min/10 ft
		Ti Break				
		Ti Break				
	55					
		Ti Break				
	56					
	57					
	58					
	59					
						End Run 4 at 59.4'
						Begin Run 5 at 59.4'
		Partial rehealed vertical fracture begins				
	60					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 8 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	60					
	61			Box 3		almost entire run had partial rehealed vertical fracture which seperated when rock was broken to fit in core box
	62					Core 120'' Rec 120
	63					
	64	T. Break				39 min/10 ft
				Box 4		
	65					
	66					
	67	partial rehealed vertical fracture ends				
	68					
	69					End Run 5 at 69.4' Begin Run 6 at 69.4'
	70					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW 15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW15

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 9 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	70					No Breaks
	71					Core 60" Rec 59" Lost 1"
				Box 4		
	72					25 min/5 ft
	73					
	74					End Run 6 at 74.4'
						Boring terminated at 74.4' on 11-11-94
	75					
	76					
	77					
	78					
	79					
	80					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW15

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-mw.

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Belasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dudley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID HSA, 6¼" ID HSA; 2' Split Spoons, 6" Roller Cone; NQ Core Equipment	8. HOLE LOCATION: North of West Area Ponds
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11-8-94 / 11. DATE COMPLETED: 11-13-94
12. OVERBURDEN THICKNESS: 19.1'	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered until coring commenced
13. DEPTH DRILLED INTO ROCK: 19.1' BGS – 49.5' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 22.56' BTOC 15 hrs
14. TOTAL DEPTH OF HOLE: 49.5' BGS, 52.2' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 22.25' BTOC 11-16-94

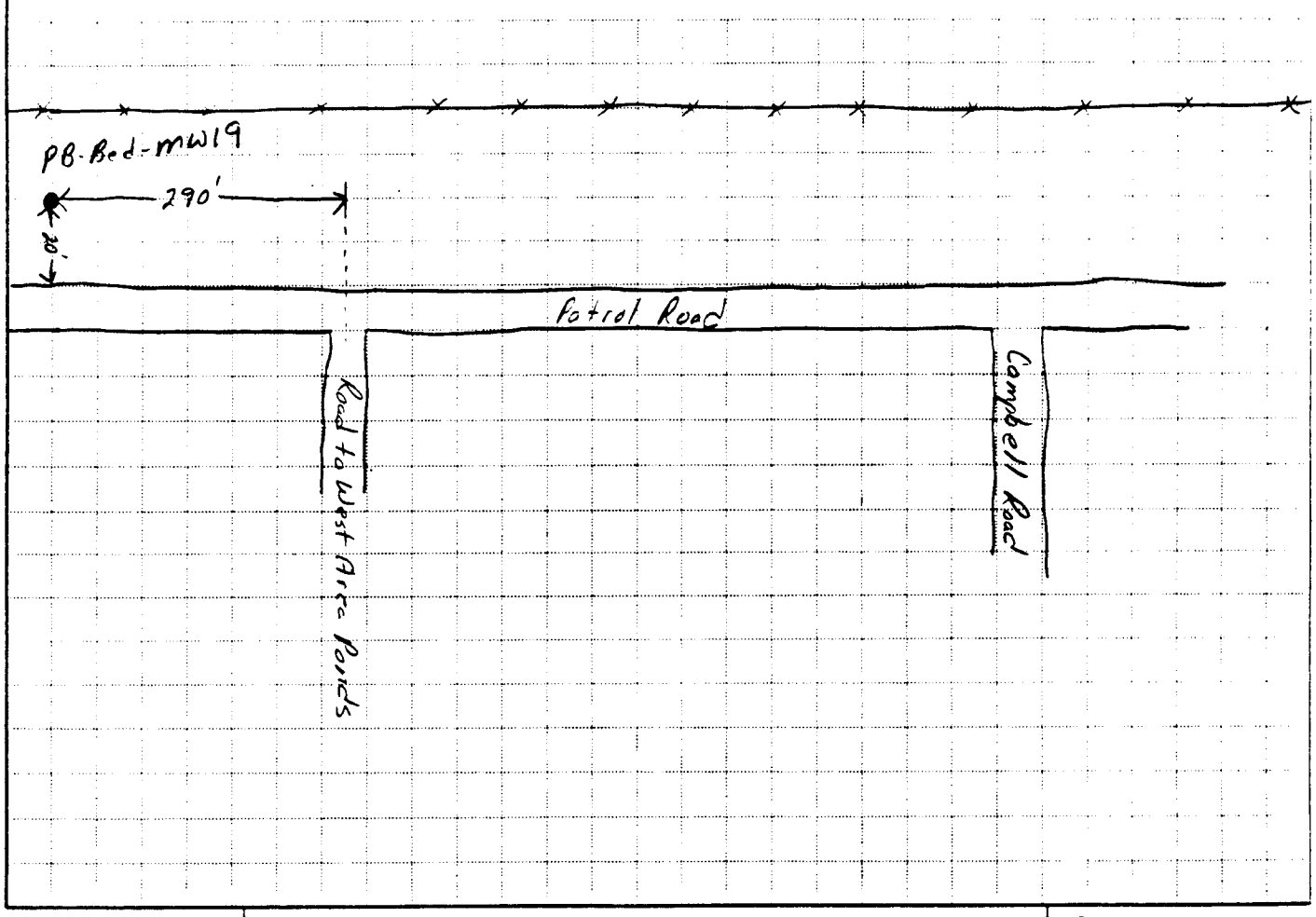
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		3

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			100%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS

SCALE: Not to scale



PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW19

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Dark Brownish Black Silty Fine Sand with roots	HNu 0	2 3		24" Recovery
	1	Grades to Brownish Yellow		4 6		
	2		HNu 0	3 3		20" Recovery
	3	Brownish Yellow and Gray Clayey Silt		5 6		
	4	Same as above	HNu 0	3 4		20" Recovery
	5			7 7		
	6	Grades mainly Brownish Yellow, some gray moist	HNu 0	2 4		24" Recovery
	7			5 7		
	8		HNu 0	3 3		24" Recovery
	9	Gray Silty Clay-moist		4 4		
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW19

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Same as above - moist	HNu 0	1 2		24" Recovery
	11			2 4		
	12	Same as above - moist Slight plasticity	HNu 0	2 2		24" Recovery
	13			2 3		
	14	Same as above with a few small fragments of weathered shale	HNu 0	1 1		24" Recovery
	15			2 2		
	16	Same with small fragments of weathered shale	HNu 0	1 2		24" Recovery
	17			2 4		
	18	Same as above	HNu 0	1 10		10" Recovery
	19	Weathered shale				Auger Refusal at 19.1'
		Limestone, medium Dark Gray (N4), finely crystalline, strong, fresh with occasional fossils		50/0 Box 1		Begin Run 1 at 19.1'
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW19

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF 4 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20					
		Open Break	Rec / Core	74" / Core		
	21					
	22					30 min/10 ft
		Grades to Fossiliferous limestone medium Dark Gray (N4), strong, fresh, with zones of weathered shale, Dark Gray (N3)	120" / 120"	106" / 120"		Core 120" Rec 120"
	23					
	24					Lost all return water
		Open Break				
	25					
		~~Open Break~~ Weathered shale + Brec				
	26	Fossiliferous limestone				
		Weathered shale Highly Broken up ↓				
	27	Fossiliferous limestone				
		Weathered shale with pyrite slabs				
		Fossiliferous limestone				
	28	Open Break				
	29					End Run 1 at 29.1'
						Roller cone ↓
	30					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW19

HTRW DRILLING LOG

HOLE NUMBER

PROJECT: Plum Brook Ordnance Works

INSPECTOR

SHEET 5 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					Roller cone
	31	Ti Break		Box 1		Begin Run 2 at 30.5' Core 15" Rec 15" End Run 2 at 31.75
	32					Roller cone Set 4" PVC casing to 32.0'
	33	Fossiliferous limestone, medium Dark Gray (N4), finely crystalline, strong, Fresh, with numerous stylolites Ti Break				Begin Run 3 at 32.4' on 11-13-94 with NQ core barrell and clear H_2O
		Open Break				Core 86" Rec 86"
	34	Open Break				
	35					19min/7.1ft
	36	Ti Break - Black Stained		Box 2		
	37	Ti Break				
	38	Open Break - Black stained				
	39	Ti Break				End Run 3 at 39.5' Begin Run 4 at 39.5'
	40					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW19

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW19

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40					
	41					core 120' Rec 120"
	42					
		T. Break				
	43			Box 2		
		T. Break				34 min/10 ft
	44					
		T. Break				
	45					
		Open Break				
	46					
	47					
	48			Box 3		
		Ti Break				H_2S odor after Run 4 completed, borehole bubbling
	49	Ti Break				End Run 4 at 49.5'
	50					Borehole Terminated at 49.5' on 11-13-94. Set 25' screen remainder riser

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW19

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

SHEET 1 OF 1 SHEETS

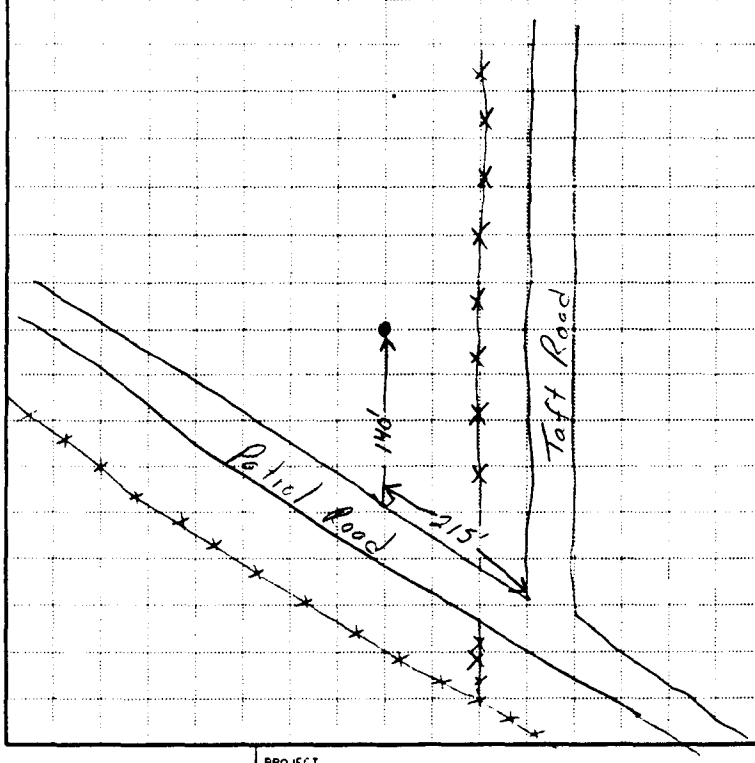
1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: Bebasco Drilling Services
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: Al Dadley	6. MANUFACTURER'S DESIGNATION OF DRILL: Diedrich D-120
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4¼" ID HSA, 6¼" ID HSA; 2' Split spoons, 6" Roller cone; NX core equipment	8. HOLE LOCATION: South Patrol Road - Background
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10-28-94 / 11. DATE COMPLETED: 11-13-94
12. OVERBURDEN THICKNESS: 21.5'	15. DEPTH GROUNDWATER ENCOUNTERED: Not encountered until coring commenced...
13. DEPTH DRILLED INTO ROCK: 21.5' BGS - 49.5' BGS	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 17.17' BTOC 24 hrs
14. TOTAL DEPTH OF HOLE: 49.5' BGS, 52.3' BTOC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): 18.69' BTOC 11-16-94

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: 93%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
		X		Charles Way

LOCATION SKETCH/COMMENTS SCALE:



PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Brownish Yellow and Gray Silty Clay with trace fine Sand and roots - dry	HNu 0	3		20" recovery
				5		
	1			8		
				12		
	2	Brownish Yellow and Tanish Gray Silty Fine Sand with trace clay	HNu 0	4		22" Recovery
				7		
	3			10		
				14		
	4		HNu 0	6		24" Recovery
				8		
	5	Grades Yellow Brown and Gray - moist, without Clay		6		
				9		
	6			22		
		Blackish Gray weathered shale		50/2		Straight Auger
	7					
	8					
	9					
	10					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 3 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	10	Grades to Gray weathered shale				Straight Auger
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					

PROJECT: Plum Brook Ordnance Works

HOLE NO. PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 4 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	20					
	21					Auger Refusal at 21.5'
	22	Shale, Dark Gray (N3) slightly weathered to Fresh non calcareous with occasional zones of shale, Dark greenish gray (5GY 4/1) intermixed	Rec/Core	74"/core		Begin Run 1 at 21.5'
			16/52"	0/52"		Core 52" Rec 16" Lost 36"
	23	Breaks to numerous to put of log				
	24			Box 1		
	25					End Run 1 at 25'10"
	26	Same as above				Begin Run 2 at 25'10"
		Breaks to numerous to put on Log	88"/58	71/58		30" from core Run 1
	27			Box 1		Core 58" Rec 88" Gain 30"
	28					
	29					
	30	Becomes weathered				

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-MW20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 5 OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	30					
		Becomes Fresh		Box 1		End Run 2 at 30.7'
	31	Same as above, with zones of pyrite deposition	51/57	51/57		Begin Run 3 at 30.7'
	32	T. Break				Left 6" in hole Core 57" Rec 51" Lost 6"
	33	T. Break		Box 2		
	34					
		T. Break				
	35					Set 4" PVC casing to 35.0'
		T. Break				End Run 3 at 35.5' Roller Cone
	36	T. Break Shale, Dark Gray (N3), non calcareous, strong, Fresh with occasional zones of Shale, Dark greenish gray (5GY 4/1) intermixed				Begin Run 4 at 36.0' on 11-13-94 with NO core barrel [illegible]
	37					Core 102" Rec 84" Lost 18"
	38	38.25-38.3 Pyrite deposition				31 min/8.5'
	39					
	40					

PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-MW20

HTRW DRILLING LOG

HOLE NUMBER: PB-Bed-mw20

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 6 OF 6 SHEETS

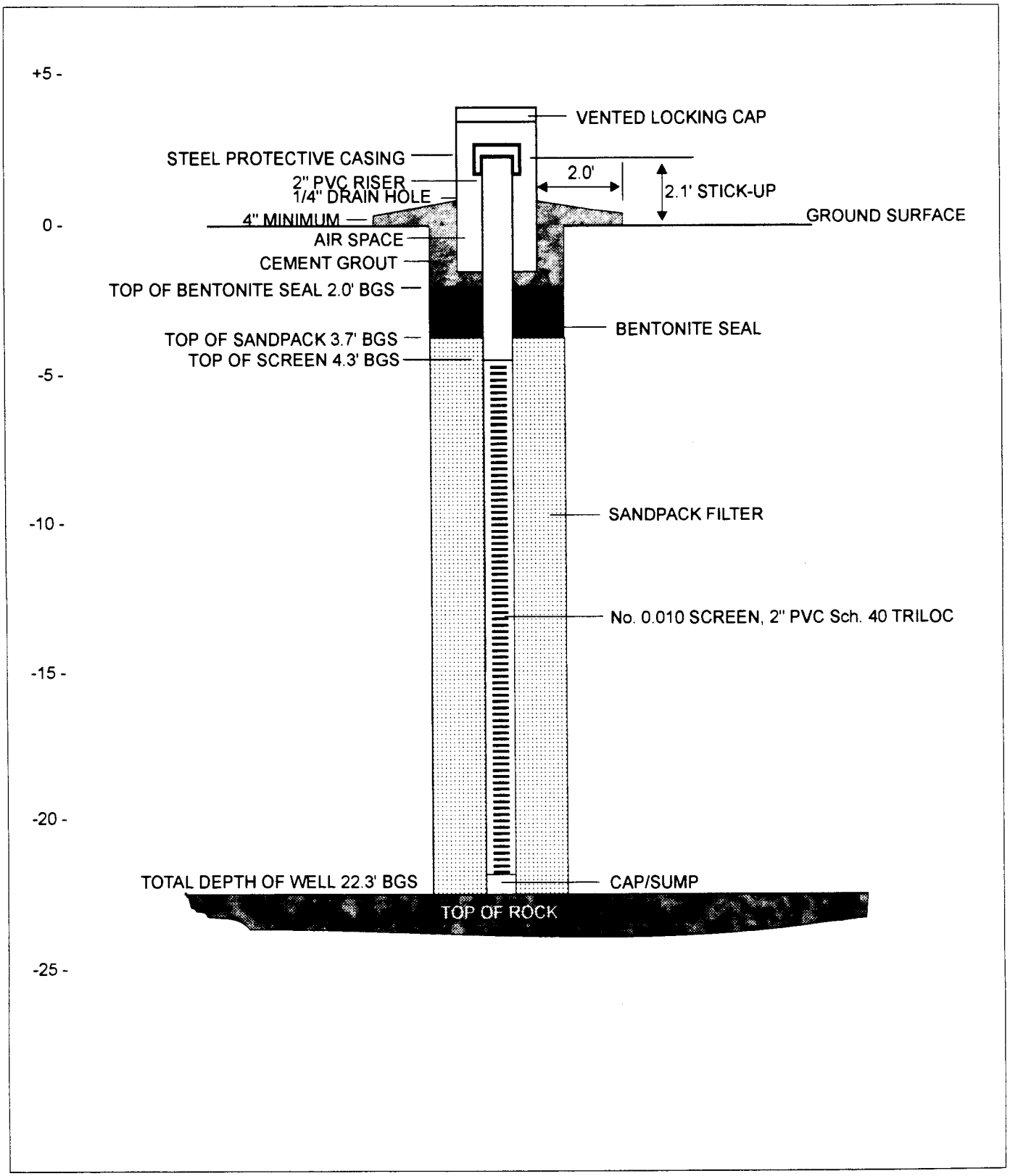
ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	40					
	41					
		Thin pyrite zone				
	42					
	43	Ti Break Becomes fissile, slightly weathered				
						Loss of 20-30 gals water
	44					
		Open Break				End Run 4 at 44.5'
						Begin Run 5 at 44.5'
	45					
						Core 60" Rec 67" Gain 7"
	46					
						22.5 min/5 ft
	47					measure H_2O at 26.42' at 11:30, take lunch, at 12:40 H_2O at 27.28'
		Open Break, black stained				Can hear bubbling in well
	48					
						Left 1' of core in borehole making Total depth 48.6'
	49					Install 20' screen, rest riser. 2.75' stickup
						End Run 5 at 49.5'
	50					

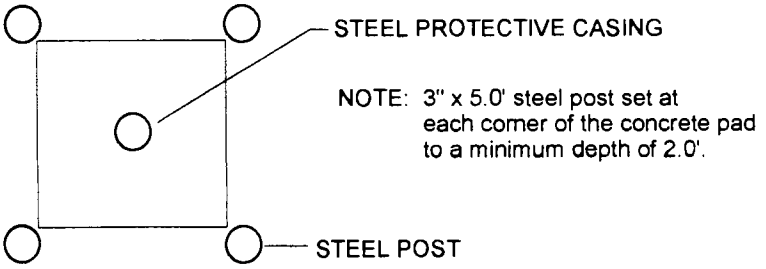
PROJECT: Plum Brook Ordnance Works

HOLE NO.: PB-Bed-mw20

APPENDIX D

MONITORING WELL CONSTRUCTION DIAGRAMS



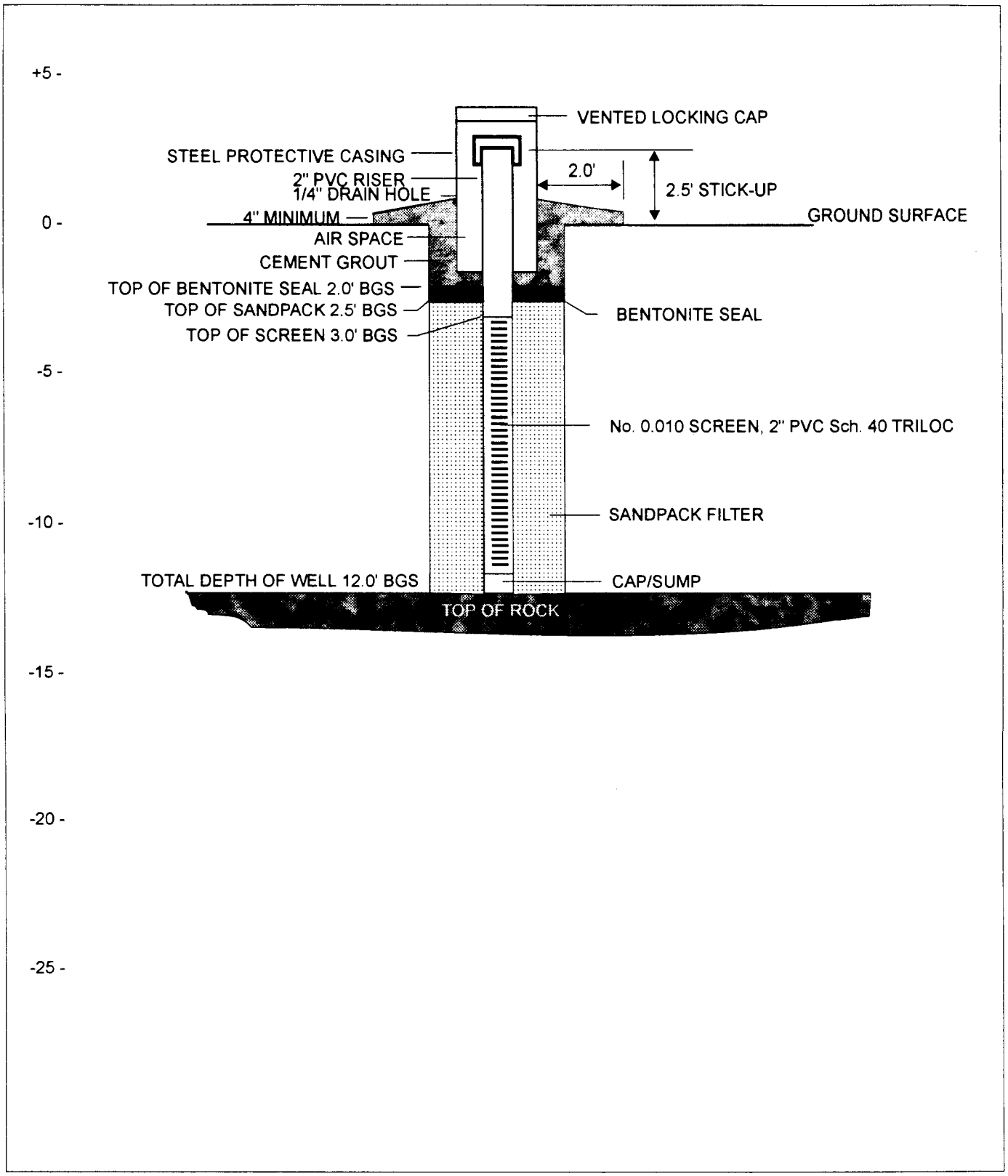


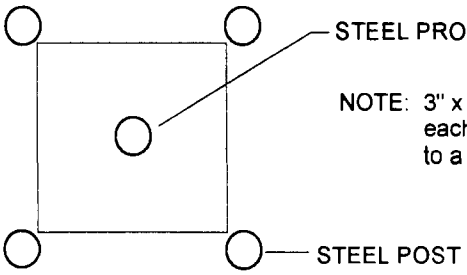
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-WA-MW1
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



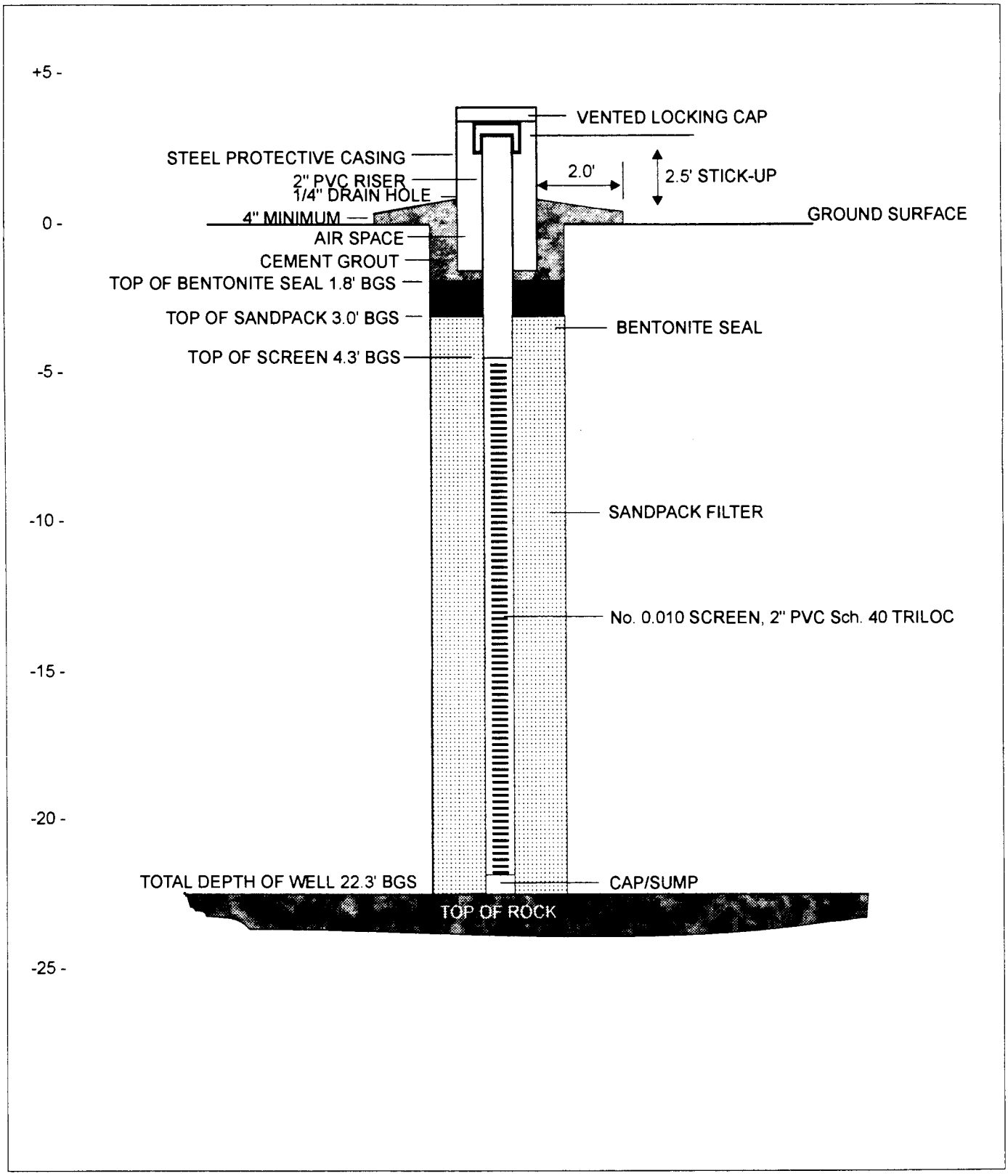


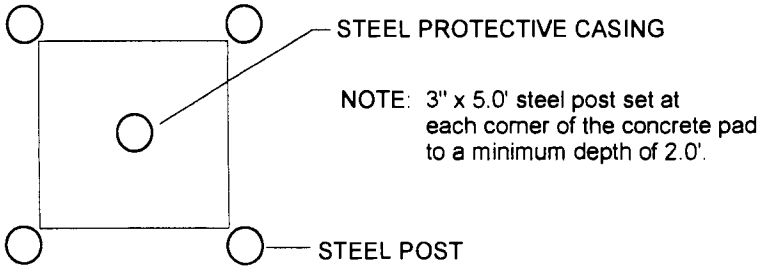
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-WA-MW2
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



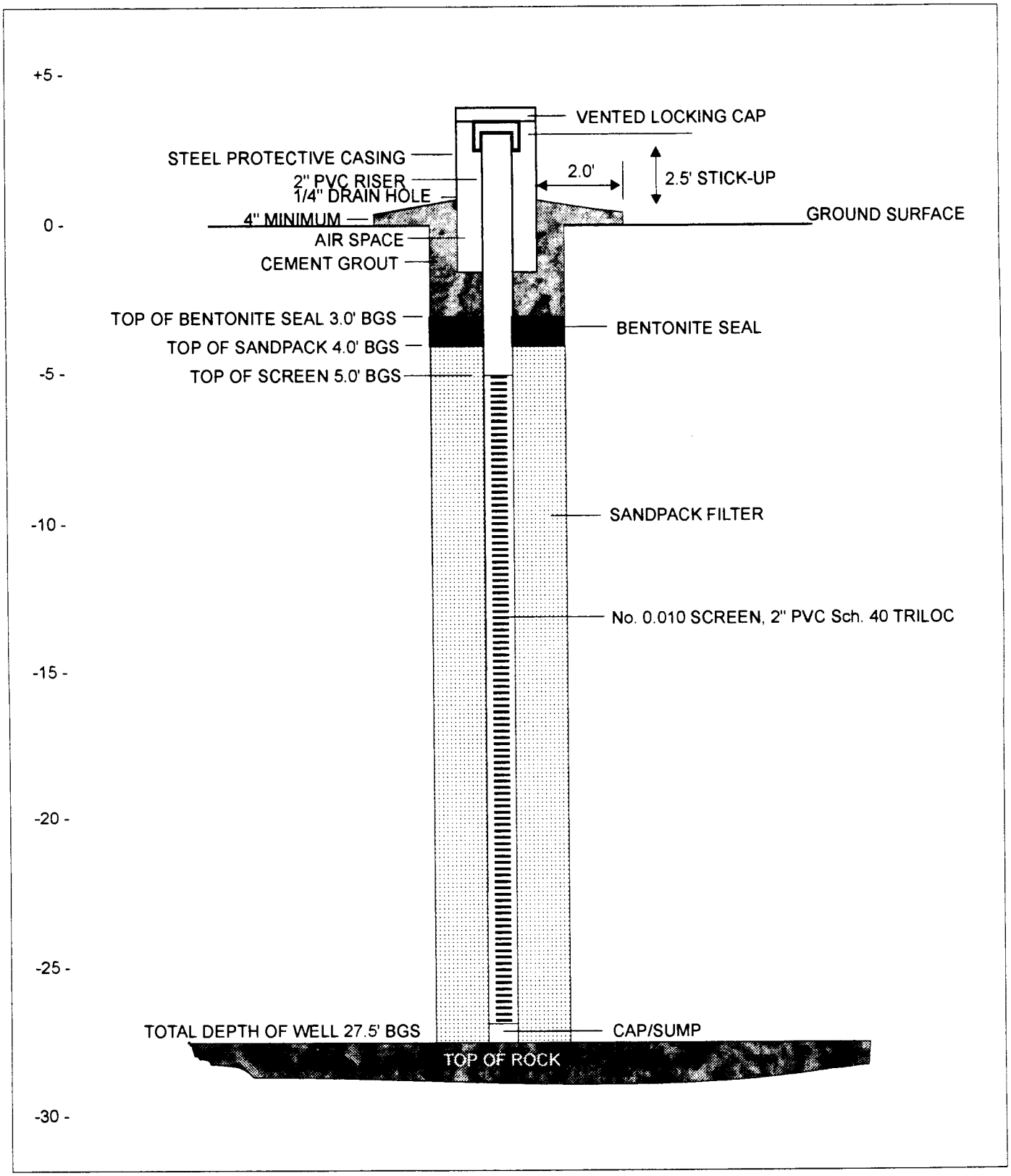


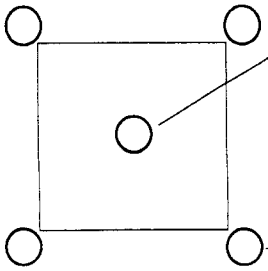
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-PR-MW7
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



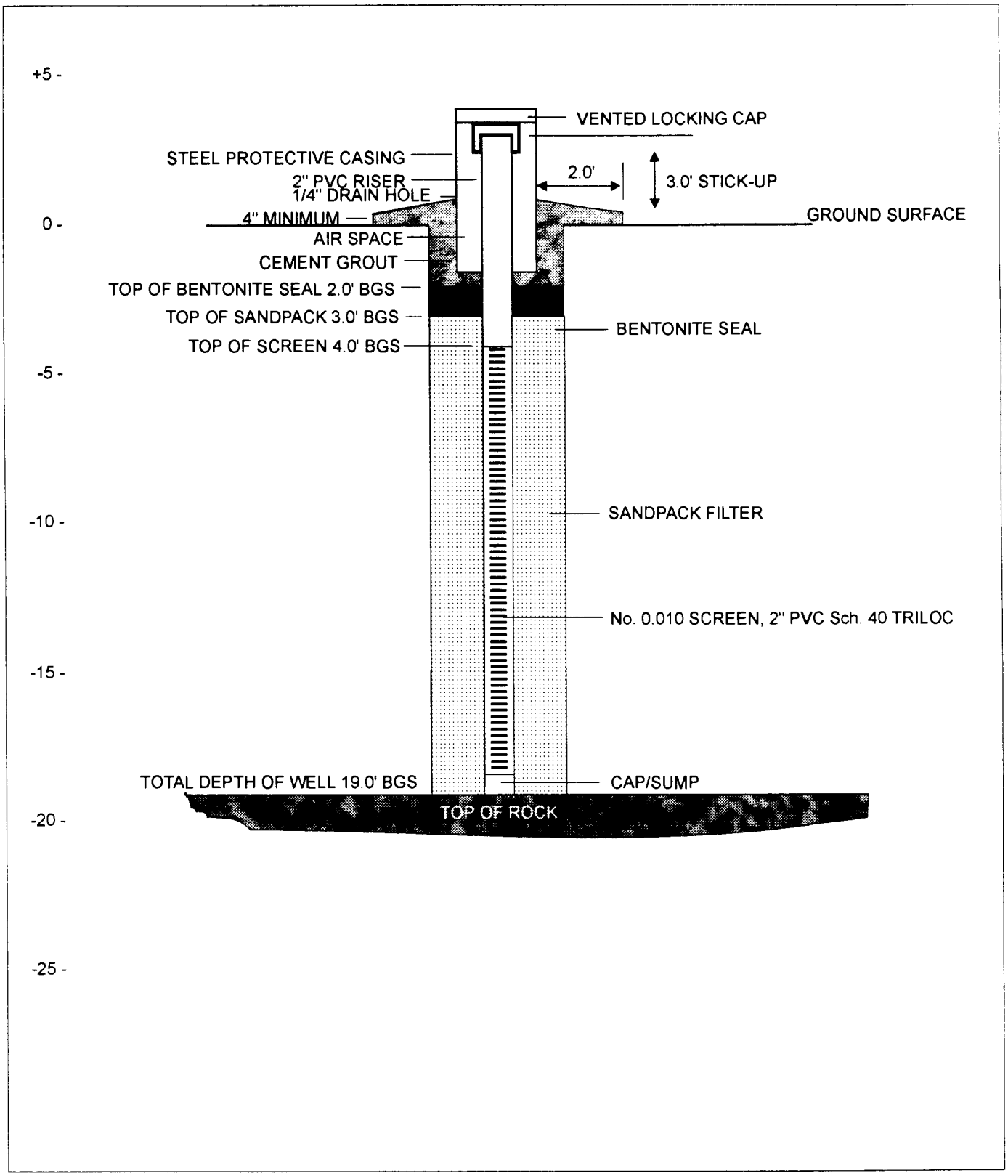


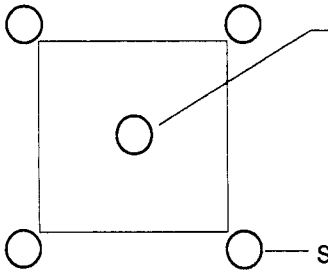
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-PR-MW8
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



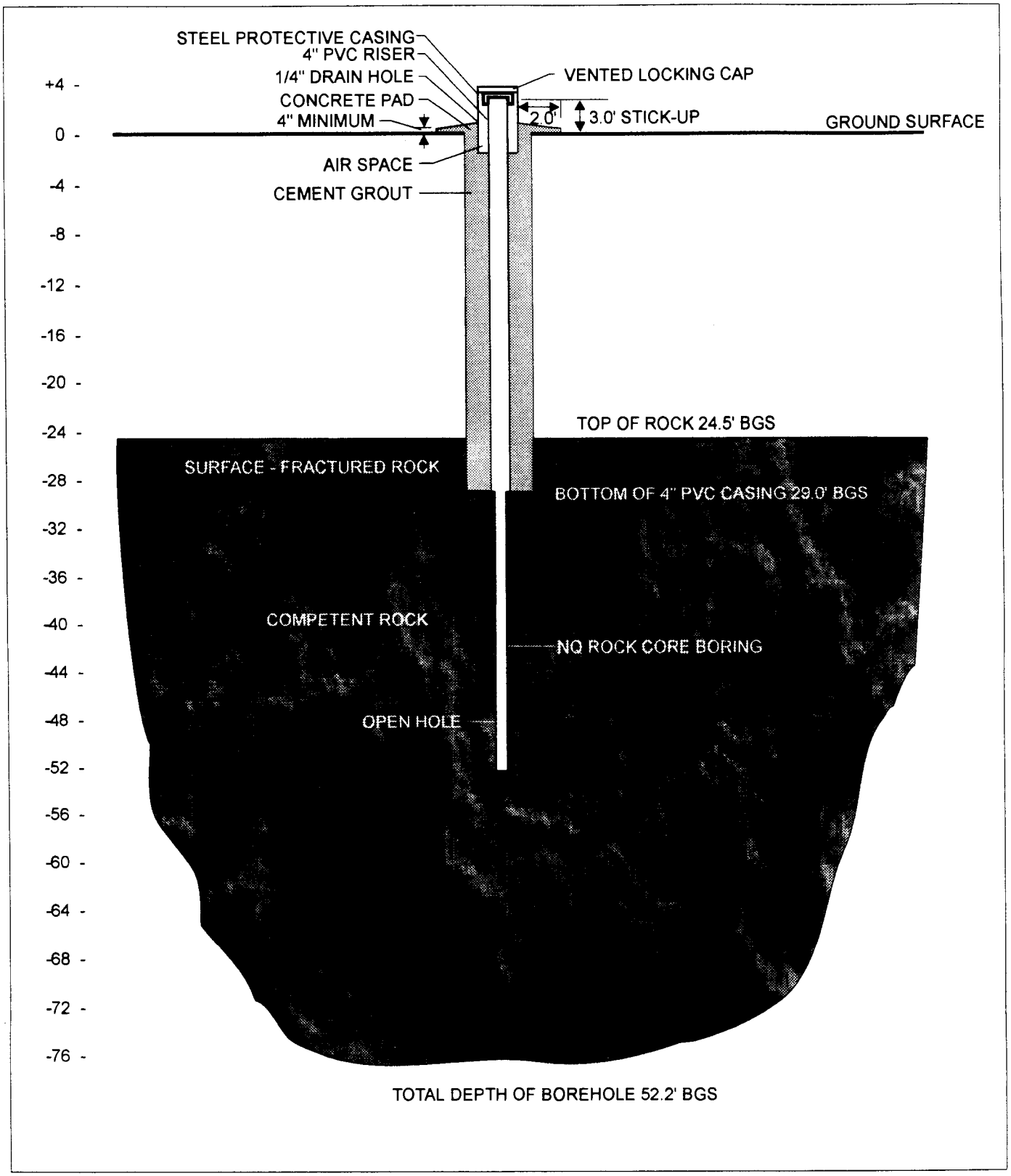


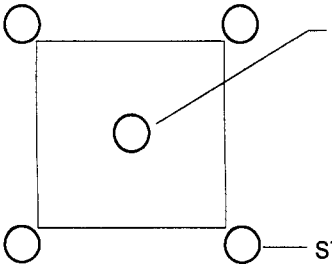
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-PR-MW9
OVERBURDEN WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



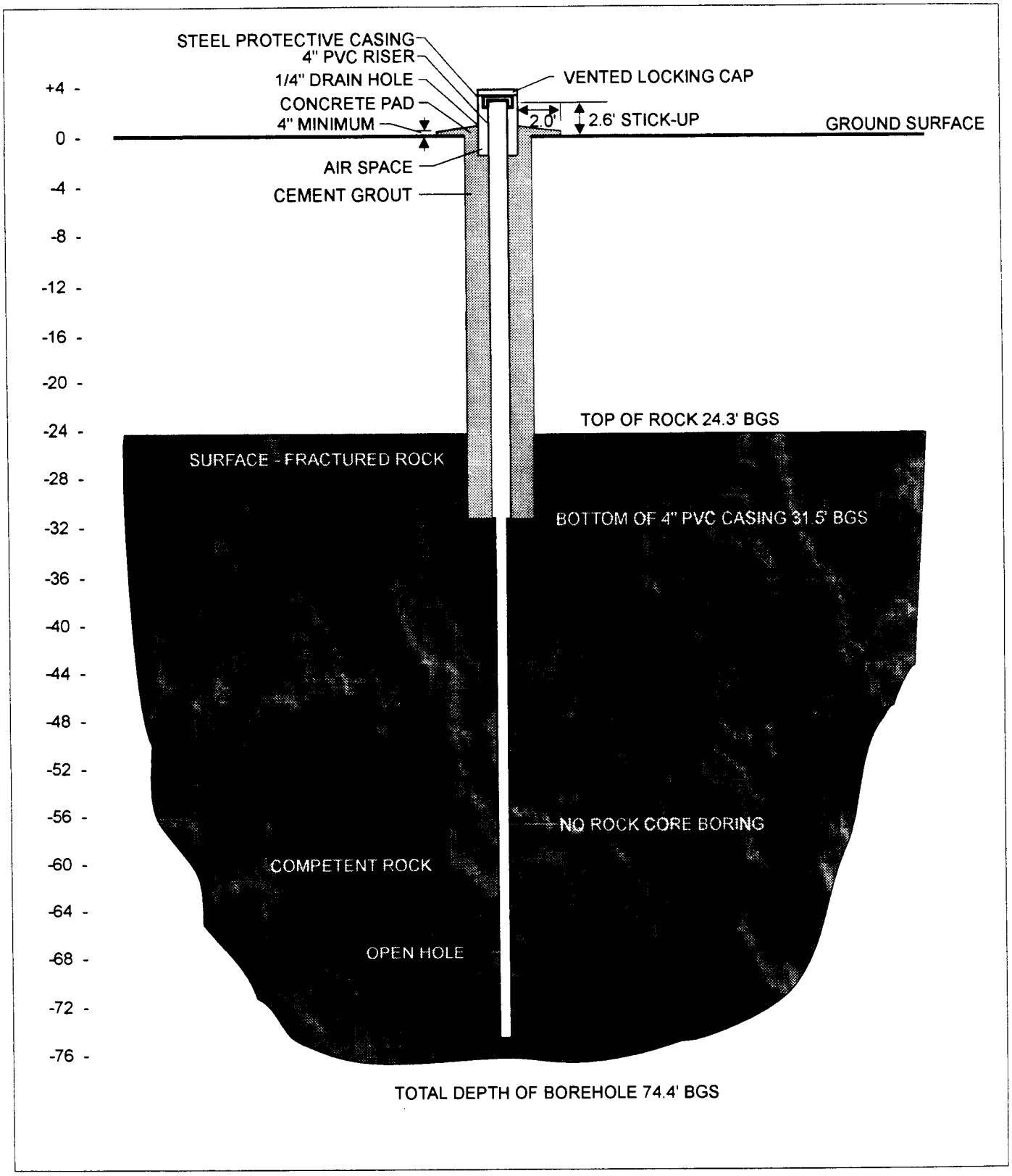


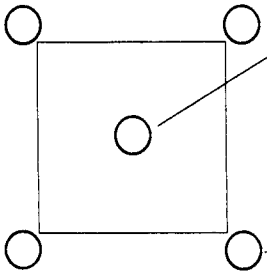
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-14
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



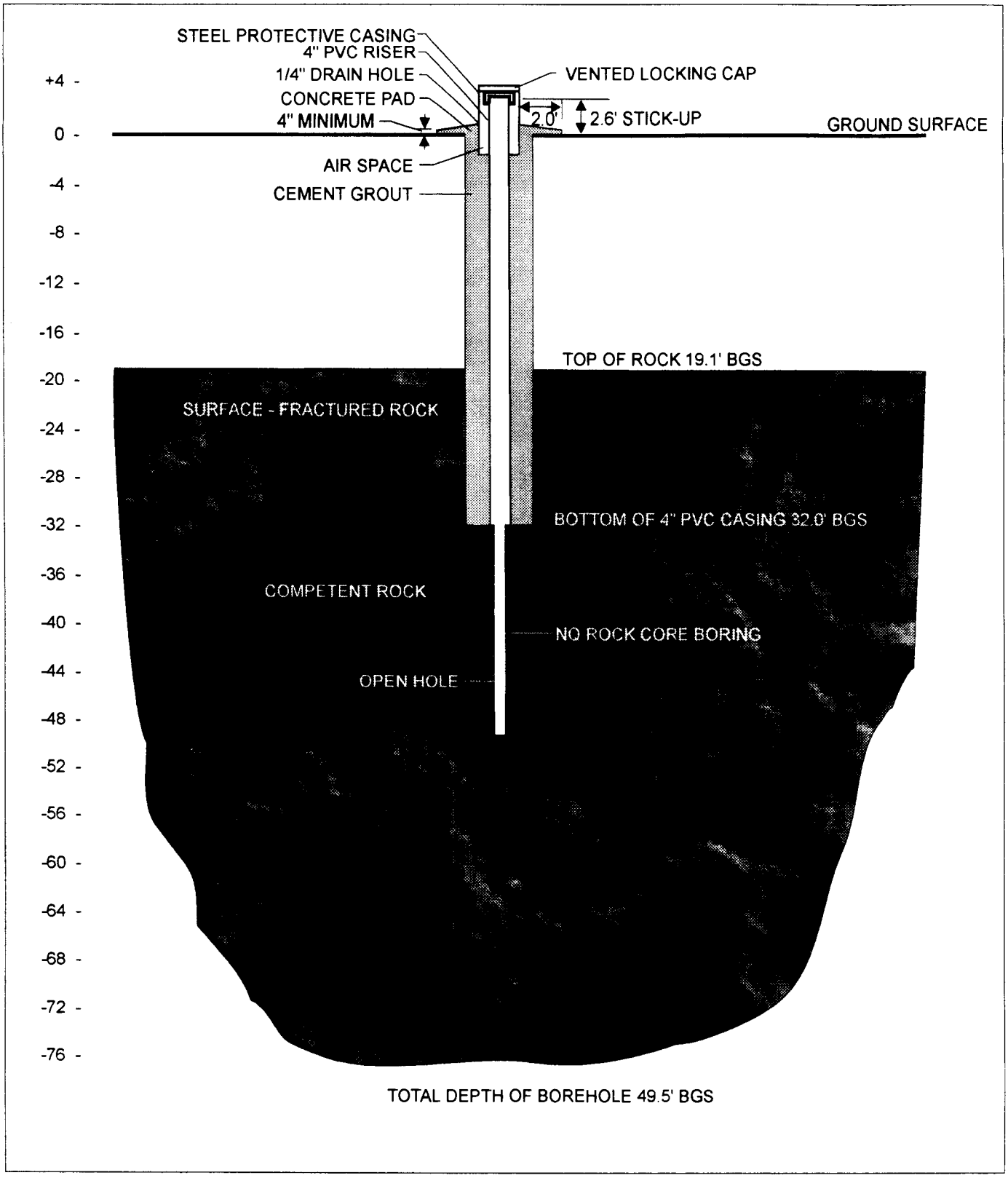


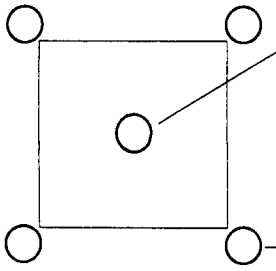
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-15
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY



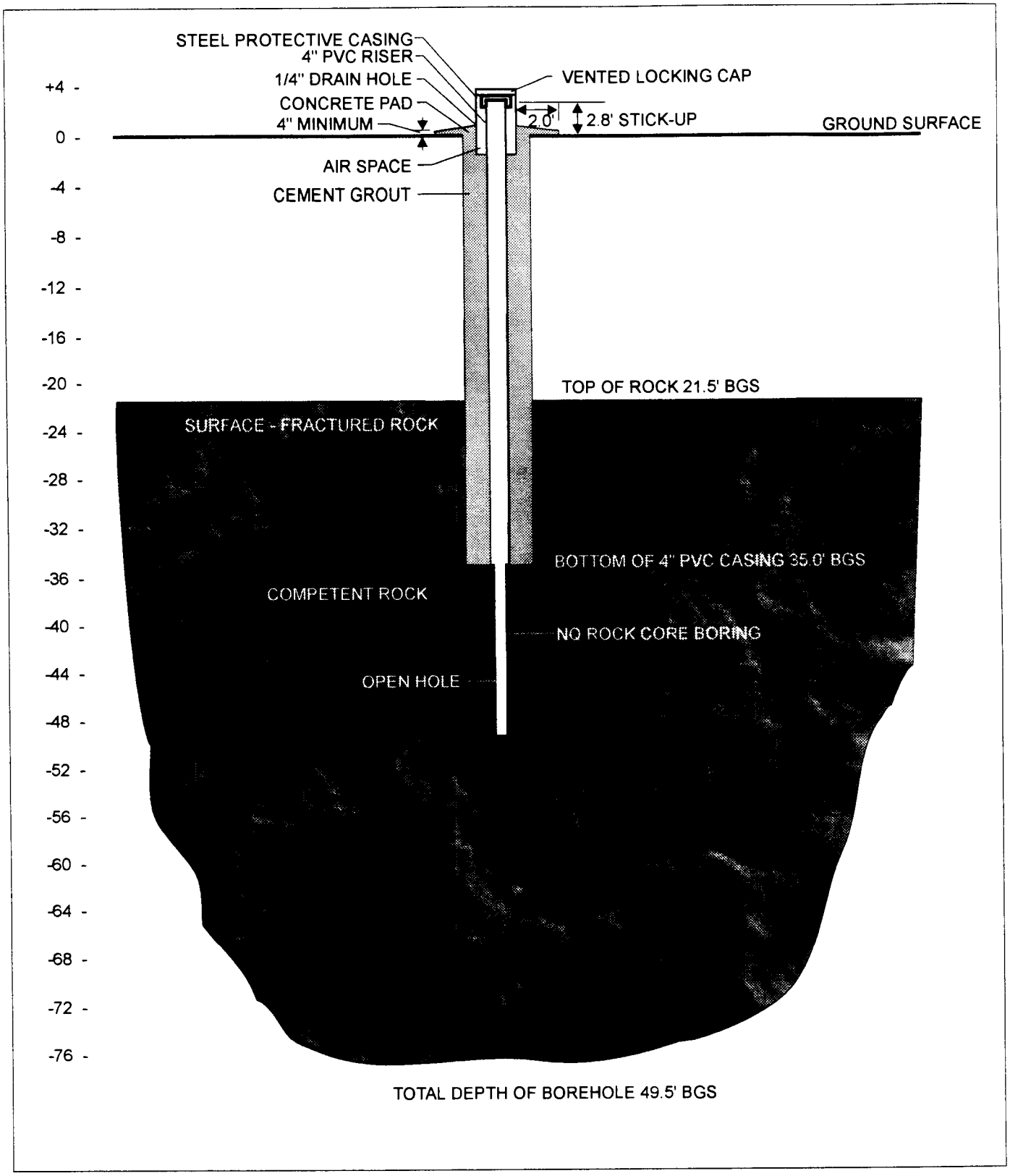


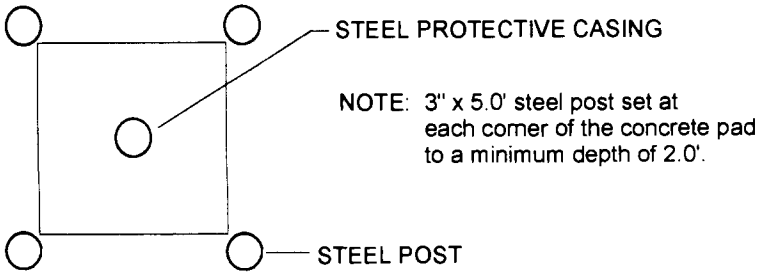
NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-19
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY





NOTE: 3" x 5.0' steel post set at each corner of the concrete pad to a minimum depth of 2.0'.

PB-Bed-MW-20
BEDROCK WELL DETAILS

Plum Brook Ordnance Works
Sandusky, Ohio

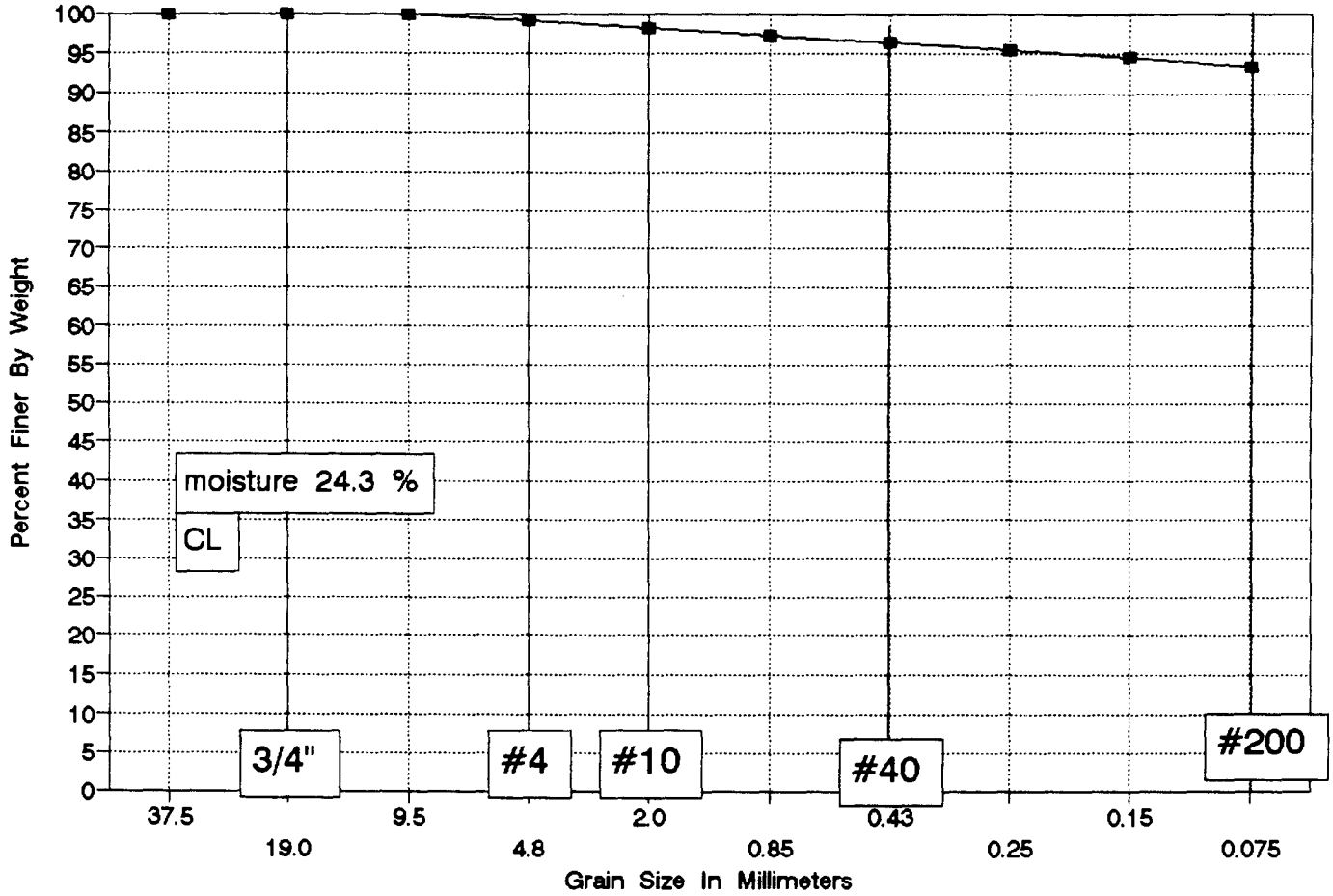
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

APPENDIX E

SIEVE ANALYSES

GRADATION CURVE

Boring PB-WA-MW1, Sample at 4-22.4 ft



Plum Brook Ordinance Works
Sandusky Ohio

Boring PB-WA-MW1
Sample at 4-22.4 feet

Wet soil & dish	390
Dry soil & dish	336
Dish	113.6

Moisture Content = 24.3

SIEVE ANALYSIS

Dry weight of total sample= 222.4

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	1.83	99.18%	99.2	4.8
# 10	3.79	98.30%	98.3	2.0
# 20	5.98	97.31%	97.3	0.85
# 40	7.8	96.49%	96.5	0.43
# 60	9.67	95.65%	95.7	0.25
# 100	11.68	94.75%	94.7	0.15
# 200	14.6	93.44%	93.4	0.075

MECHANICAL ANALYSIS (SA) HA -#20

DATE 11/3/94 BY RJH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOK ORDNANCE

LOCATION

BORING PB-WA-MW1 SAMPLE DEPTH 4-22.4'

NUMBER OF RINGS		DISH	21
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	390.0
WT. OF RINGS		WT. OF DISH & DRY SOIL	336.0
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	113.6
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		1.83		
		PAN				
		TOTAL				

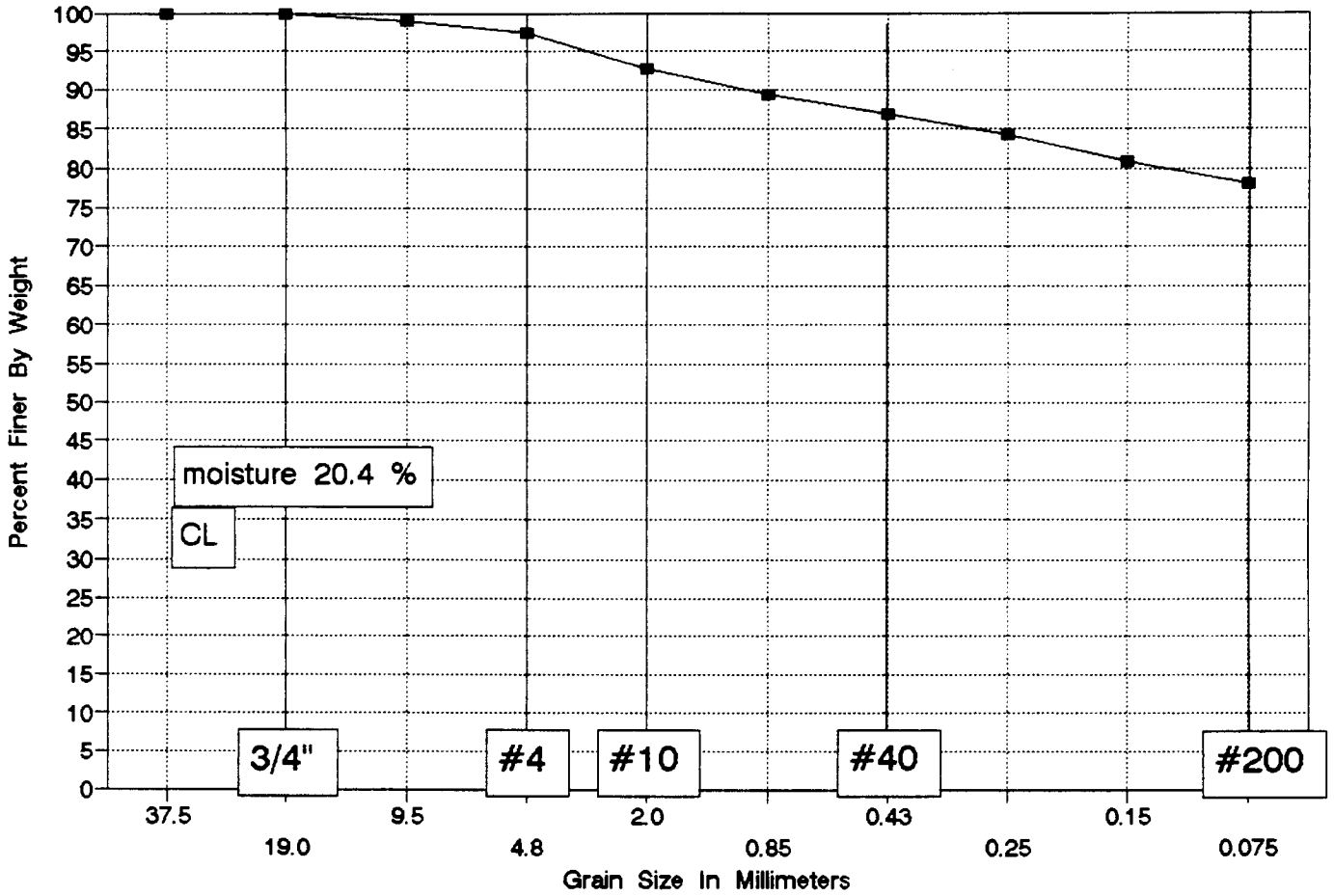
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		3.79			
		#20		5.98			
		#40		7.80			
		#60		9.67			
		#100		11.68			
		#200		14.60			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring PB-WA-MW2, Sample at 4-12 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring PB-WA-MW2
Sample at 4 to 12 feet

Wet soil & dish	396.4
Dry soil & dish	347.3
Dish	106.8

Moisture Content = 20.4

SIEVE ANALYSIS

Dry weight of total sample= 240.5

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	2.54	98.94%	98.9	9.5
# 4	5.88	97.56%	97.6	4.8
# 10	17.19	92.85%	92.9	2.0
# 20	25.9	89.23%	89.2	0.85
# 40	31.72	86.81%	86.8	0.43
# 60	37.78	84.29%	84.3	0.25
# 100	45.82	80.95%	80.9	0.15
# 200	52.76	78.06%	78.1	0.075

MECHANICAL ANALYSIS (SA) HA -#20

DATE 12/3/94 BY RJH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOK ORDINANCE

LOCATION

BORING PB-1NA-MW2 SAMPLE DEPTH 4-12'

NUMBER OF RINGS		DISH	4
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	396.4
WT. OF RINGS		WT. OF DISH & DRY SOIL	347.3
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	106.8
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"		0		
		3/8"		2.54		
		#4		5.88		
		PAN				
		TOTAL				

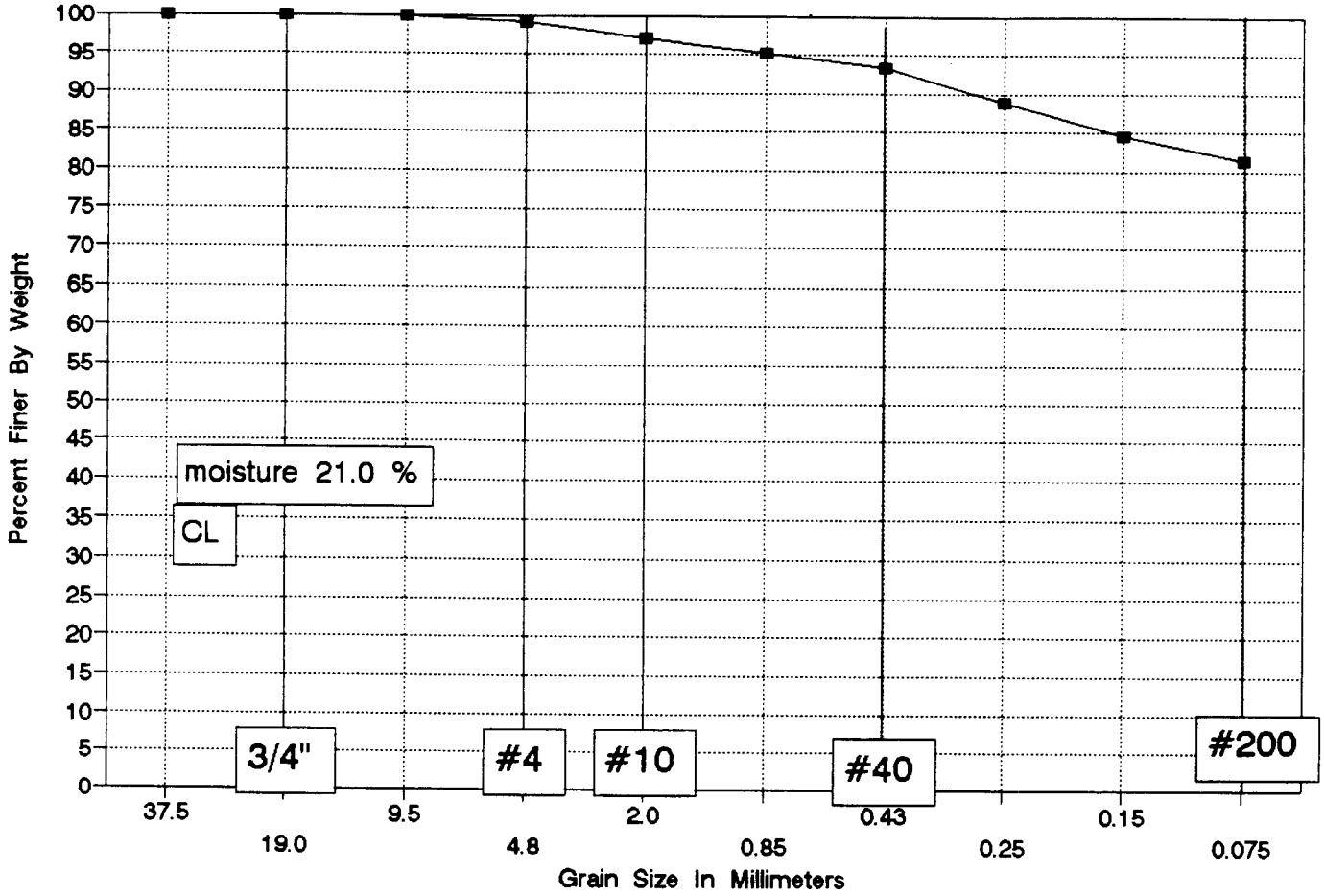
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		17.19			
		#20		25.90			
		#40		31.72			
		#60		37.78			
		#100		45.82			
		#200		52.76			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring PB-PR-MW7, at 4-22 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring PB-PR-MW7
Sample at 4-22 feet

Wet soil & dish	474.7
Dry soil & dish	411.7
Dish	111.9

Moisture Content = 21.0

SIEVE ANALYSIS

Dry weight of total sample= 299.8

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	2.58	99.14%	99.1	4.8
# 10	8.54	97.15%	97.2	2.0
# 20	14.42	95.19%	95.2	0.85
# 40	20.11	93.29%	93.3	0.43
# 60	33.48	88.83%	88.8	0.25
# 100	46.16	84.60%	84.6	0.15
# 200	55.98	81.33%	81.3	0.075

MECHANICAL ANALYSIS (SA) HA -#20

DATE _____ BY RH

JOB NUMBER 241037-035 OWNER/CLIENT PLUM BROOKS ORDINANCE

LOCATION _____

BORING PB-PR-MW7 SAMPLE _____ DEPTH 4-22'

NUMBER OF RINGS		DISH	123
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	474.7
WT. OF RINGS		WT. OF DISH & DRY SOIL	411.7
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	111.9
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		258		
		PAN				
		TOTAL				

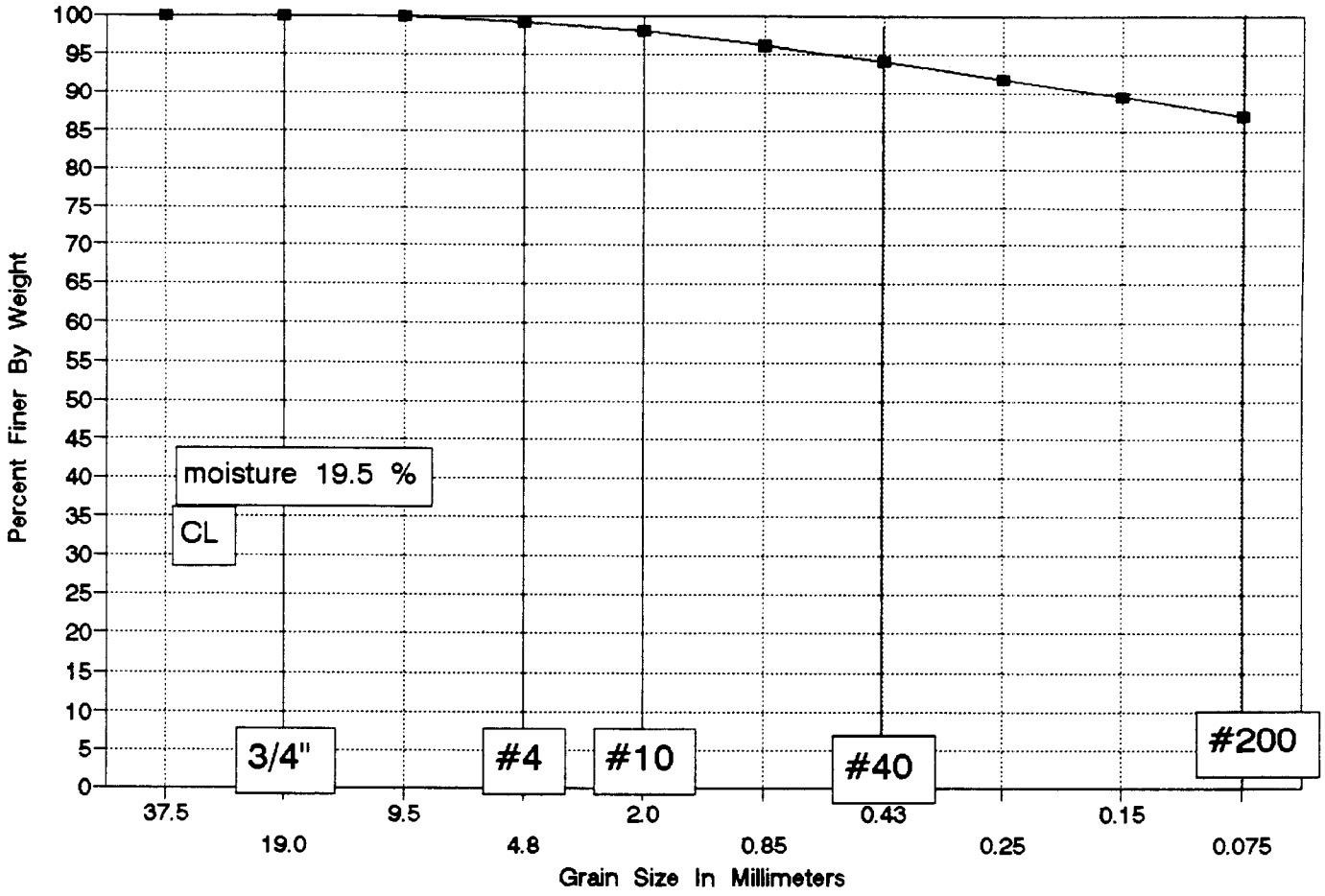
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		8.54			
		#20		14.42			
		#40		20.11			
		#60		33.48			
		#100		46.16			
		#200		55.98			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring PB-PR-S14-MW8, at 5-27.5 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring PB-PR-S14-MW8
Sample at 5-27.5 feet

Wet soil & dish	327.2
Dry soil & dish	292
Dish	111.5

Moisture Content = 19.5

SIEVE ANALYSIS

Dry weight of total sample= 180.5

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	1.41	99.22%	99.2	4.8
# 10	3.58	98.02%	98.0	2.0
# 20	6.9	96.18%	96.2	0.85
# 40	10.57	94.14%	94.1	0.43
# 60	14.71	91.85%	91.9	0.25
# 100	19.07	89.43%	89.4	0.15
# 200	23.5	86.98%	87.0	0.075

MECHANICAL ANALYSIS

SA HA -#20

DATE 11/3/94 BY RH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOK ORDINANCE

LOCATION

BORING PB-PR-S14-MW18 SAMPLE DEPTH 5'-27.5'

NUMBER OF RINGS		DISH	ST-30
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	327.2
WT. OF RINGS		WT. OF DISH & DRY SOIL	292.0
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	111.5
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"		0		
		#4		1.41		
		PAN				
		TOTAL				

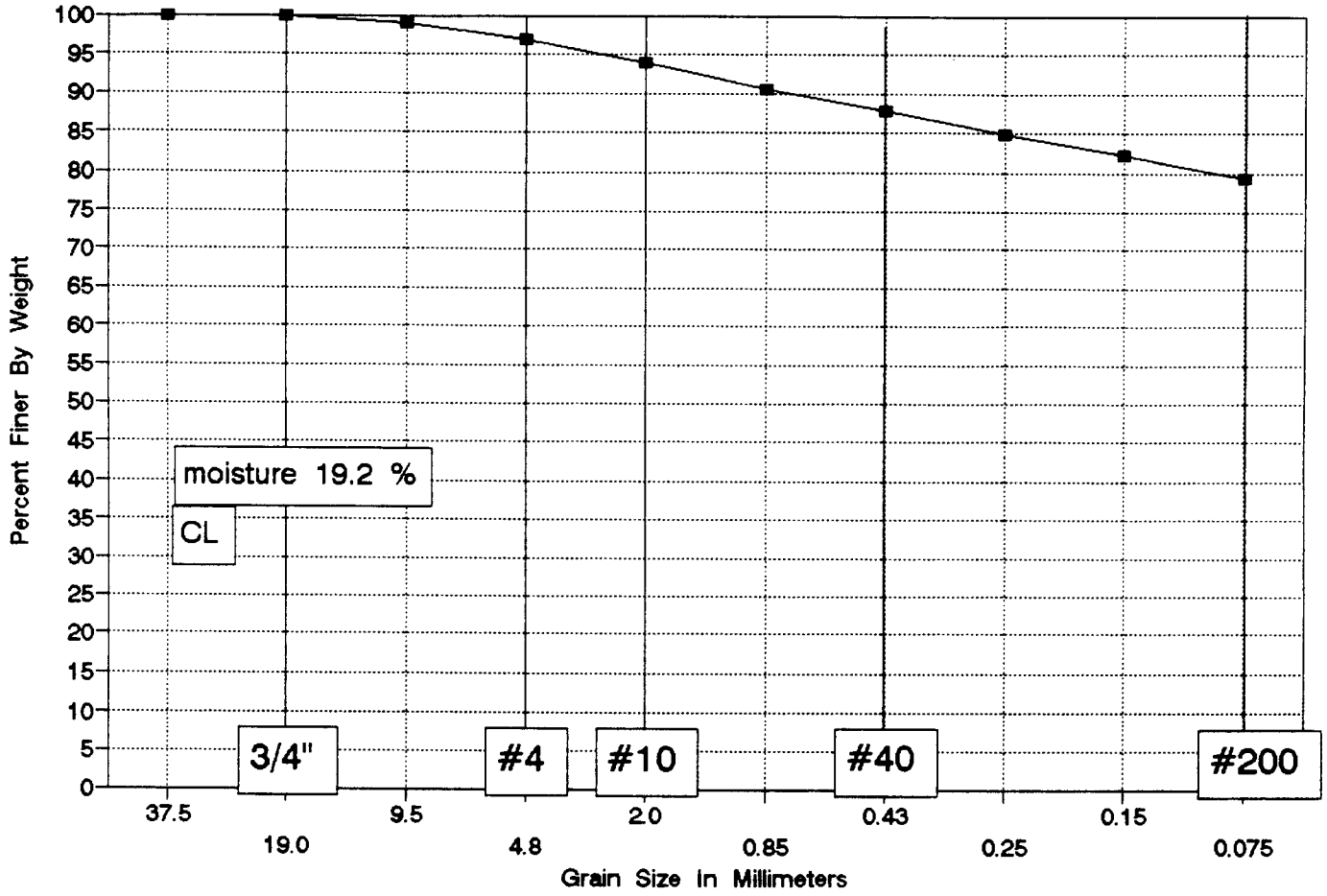
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		3.58			
		#20		6.90			
		#40		10.57			
		#60		14.71			
		#100		19.07			
		#200		23.50			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring PB-PR-MW9, Sample at 4-19 feet



Plum Brook Ordinance Works
Sandusky Ohio

Boring PB-PR-MW9
Sample at 4 to 19 feet

Wet soil & dish	486.8
Dry soil & dish	426.8
Dish	114.8

Moisture Content = 19.2

SIEVE ANALYSIS

Dry weight of total sample= 312

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	3.01	99.04%	99.0	9.5
# 4	9.39	96.99%	97.0	4.8
# 10	18.82	93.97%	94.0	2.0
# 20	29.48	90.55%	90.6	0.85
# 40	38.03	87.81%	87.8	0.43
# 60	47.29	84.84%	84.8	0.25
# 100	55.67	82.16%	82.2	0.15
# 200	65.06	79.15%	79.1	0.075

MECHANICAL ANALYSIS (SA) HA -#20

DATE 12/3/94 BY RH

JOB NUMBER _____ OWNER/CLIENT PLUM BROOKS ORDINANCE

LOCATION _____

BORING PB-PR-MW9 SAMPLE _____ DEPTH 4-19'

NUMBER OF RINGS		DISH	313
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	486.8
WT. OF RINGS		WT. OF DISH & DRY SOIL	426.8
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	114.8
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"		0		
		3/8"		3.01		
		#4		9.39		
		PAN				
		TOTAL				

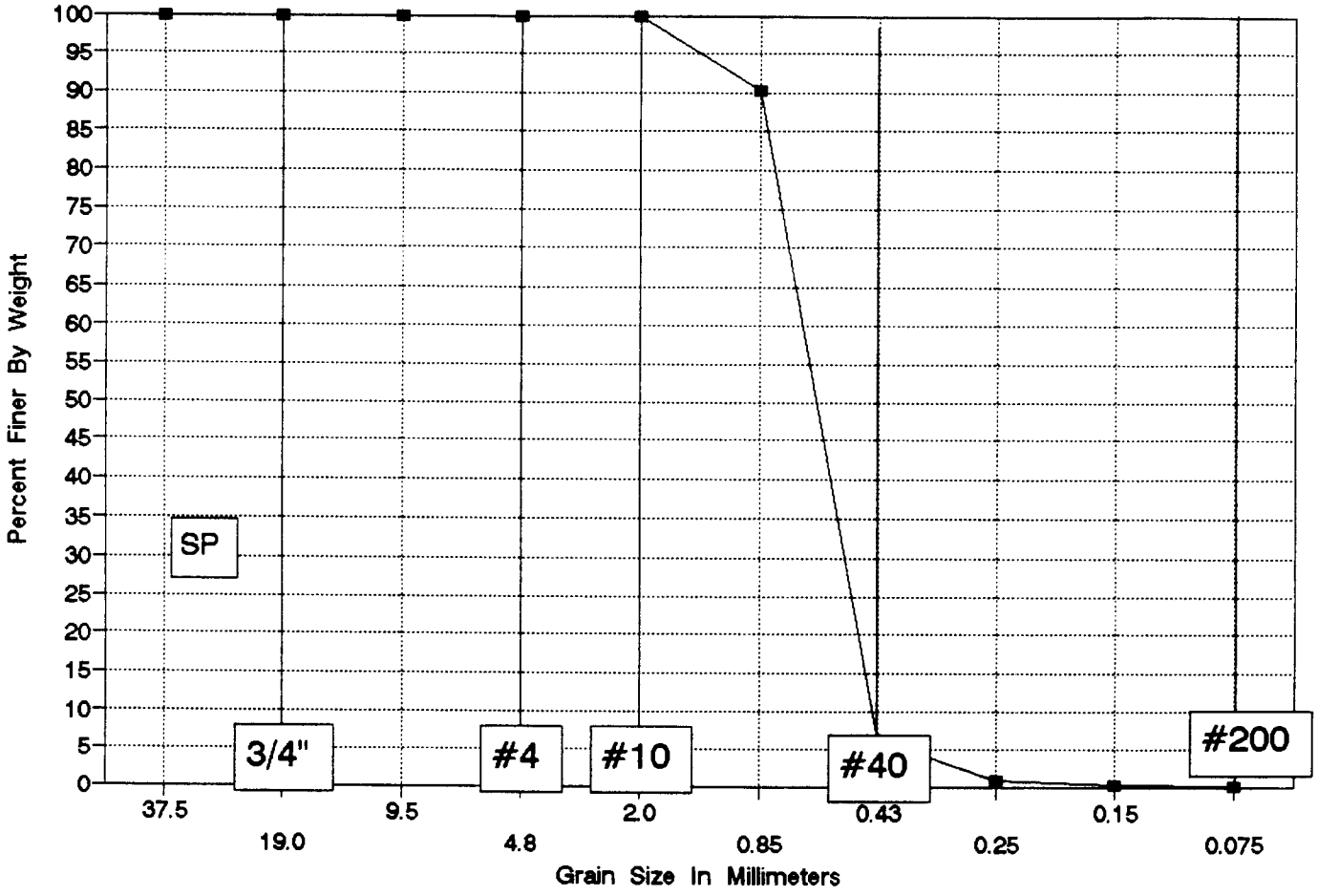
DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		18.82			
		#20		29.48			
		#40		38.03			
		#60		47.29			
		#100		55.67			
		#200		65.06			
		PAN					
		TOTAL					

CL

Dames & Moore

GRADATION CURVE

Boring PB-WA-MW1, Sand # 7



Plum Brook Ordinance Works
Sandusky Ohio

Boring PB-WA-MW1
Sand #7

Wet soil & dish	197.6
Dry soil & dish	197.6
Dish	111.9

Moisture Content = 0.0

SIEVE ANALYSIS

Dry weight of total sample= 85.7

Sieve #	weight retained	Finer	% Finer	mm
1.5 inch	0	100.00%	100.0	37.5
3/4 inch	0	100.00%	100.0	19.0
3/8 inch	0	100.00%	100.0	9.5
# 4	0	100.00%	100.0	4.8
# 10	0	100.00%	100.0	2.0
# 20	8.46	90.13%	90.1	0.85
# 40	80.48	6.09%	6.1	0.43
# 60	84.92	0.91%	0.9	0.25
# 100	85.52	0.21%	0.2	0.15
# 200	85.61	0.11%	0.1	0.075

MECHANICAL ANALYSIS (SA) HA -#20

DATE 12/3/94 BY RH

JOB NUMBER 24637-035 OWNER/CLIENT PLUM BROOKS ORDINANCE

LOCATION

BORING PB-WA-MW1 SAMPLE SAND #7 DEPTH

NUMBER OF RINGS		DISH	ST-23
WT. OF RINGS & WET SOIL		WT. OF DISH & WET SOIL	197.6
WT. OF RINGS		WT. OF DISH & DRY SOIL	~~197.2~~ 197.6
WT. OF WET SOIL		WT. OF MOISTURE	
FIELD DENSITY		WT. OF DISH	111.9
DRY DENSITY		WT. OF DRY SOIL	
		FIELD MOISTURE CONTENT	

WASH SIEVE _____ DRY SIEVE _____ WEIGHT OF OVEN DRY SOIL _____ (grams)

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUMULATIVE WEIGHT RETAINED	ACCUMULATIVE PERCENT	
					RETAINED	FINER
		3"				
		1-1/2"				
		3/4"				
		3/8"				
		#4				
		PAN				
		TOTAL				

DISH NUMBER	DISH WEIGHT	SIEVE NUMBER	WEIGHT RETAINED	ACCUM. WEIGHT RETAINED	ACCUMULATIVE PERCENT		
					PARTIAL		TOTAL
					RETAINED	FINER	FINER
		#10		0			
		#20		8.46			
		#40		80.48			
		#60		84.92			
		#100		85.52			
		#200		85.61			
		PAN					
		TOTAL					

Dames & Moore

APPENDIX F

WELL DEVELOPMENT DOCUMENTATION

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-WA-MW2

   Location: West area pond

3. Well Installation:
   Date(s) and Time(s): 10-27-94

4. Well Development:
   Date(s) and Time(s): 11-10-94, 1340 11-13-94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 14.5 ft

7. Static Water Level

   Before Development: 5.75 ft below top of casing
   24 Hours After Development: 5.73 ft below top of casing
   11/13 5.37

8. Quantity of Water
   Added During Filter Placement: 0 gallons
   Added during drilling: 0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.49 gallons
      (8.75 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 5.01 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (6.50 gals x 5 = 32.5 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 7.24 conductivity: 1400 temperature: 54 °C/°F

PB-WA-MW2

b. During Development:

11/13 pH: 6.65 conductivity: 1380 temperature: 57 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 9 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 14.55 ft (11/10) 14.68 (11/13)

b. After development: 14.68 ft

14. Physical character of removed water

a. Clarity Opaque, very cloudy

b. Color Gray

c. Particulates Heavy silt + sand

d. Odor None

15. Type and size/capacity of pump and/or bailor used: 1.1" Ø, 3' long bailer

16. Depth of well casing below ground surface (since flush-mount): N/A ft

17. Typical pumping rate (if applicable): N/A gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 9 (11/10) gal. 13 (11/13)

20. Quantity of sediment removed: 0.13 (11/10) ~~gal~~ ft.

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: IT-MW02

   Location: West Area Pond

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): 11-10-94 1450 11-13-94 1320

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 21.3 ft

7. Static Water Level

   Before Development: 13.43 ft below top of casing
   24 Hours After Development: 13.83 ft below top of casing
   1/6 13.33

8. Quantity of Water
   Added During Filter Placement: _____ gallons
   Added during drilling: _____ gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.34 gallons
      (7.87 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 4.51 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (5.85 gals x 5 = 29.25 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.90 conductivity: 3780 temperature: 55 °C/°F

ITMW02

b. During Development:

11/15 pH: 6.63 conductivity: 4120 temperature: 55 °C/°F

pH: _____ conductivity: _____ temperature: _____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: _____ °C/°F

12. Screen length: 10 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 20.90 (11/10) ft 20.93 (11/15)

b. After development: 20.93 ft

14. Physical character of removed water

a. Clarity cloudy

b. Color Red

c. Particulates very little Grayish Brown Fine Sand/Silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: _____

16. Depth of well casing below ground surface ~~(since flush-mount)~~: 18.3 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: ≈ 7 (11/10) gal. 5 (11/15)

20. Quantity of sediment removed: 0.03 (11/10) gal.

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-PR-MW7

   Location: PENTOLITE Rd. Red WATER PONDS

3. Well Installation:
   Date(s) and Time(s): 10-31-94

4. Well Development: 1645
   Date(s) and Time(s): 11/8/94 11/14/94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 25.0 ft

7. Static Water Level

   Before Development: 7.35 ft below top of casing
   36 ~~24~~ Hours After Development: 7.60 ft below top of casing
   11/14 7.58

8. Quantity of Water
   Added During Filter Placement: 0.0 gallons
   Added during drilling: 0.0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 3.00 gallons
      (17.65 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 10.11 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (13.11 gals x 5 = 65.55 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.90 conductivity: 8110 temperature: 55 °C/°F

b. During Development:

11/14 pH: 6.72 conductivity: 12030 temperature: 57 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 18.0 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 25.0 (11/8) ft 25.12 (11/14)

b. After development: 25.12 ft

14. Physical character of removed water

a. Clarity Opaque

b. Color Red

c. Particulates Reddish Brown Fine Sand/Silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: _____

16. Depth of well casing below ground surface (~~since flush-mount~~): 22.3 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 14.0 (11/8) gal. 16 (11/11)

20. Quantity of sediment removed: 0.12 ft (11/3) ~~gal.~~

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-PR-MW8

   Location: Pentolite Rd Red Water Ponds

3. Well Installation:
   Date(s) and Time(s): 11/7/94

4. Well Development: 1200 1550
   Date(s) and Time(s): 11/10/94 11/13/94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 30.3 ft

7. Static Water Level

   Before Development: 11.14 ft below top of casing
   24 Hours After Development: 13.22 ft below top of casing
   11/13 10.75

8. Quantity of Water
   Added During Filter Placement: 6.0 gallons
   Added during drilling: 0.0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 3.26 gallons
      (19.16 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 10.98 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (14.24 gals x 5 = 71.2 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.83 conductivity: 11070 temperature: 56 °C/°F

b. During Development:

11/13 pH: ~~6.64~~ 6.72 s.s. conductivity: ~~15030~~ 14340 s.s. temperature: 58 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 22.5 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: ~~30.3~~ 30.3 s.s. ft (11/10/94) 30.0 (11/13)

b. After development: 30.0 ft

14. Physical character of removed water

a. Clarity opaque

b. Color Rusty/Brick Red

c. Particulates Grayish Brown Fine Sand/Silt

d. Odor None

15. Type and size/capacity of pump and/or bailor used: _____

16. Depth of well casing below ground surface (since flush-mount): 27.5 ft

17. Typical pumping rate (if applicable): _____ gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: ≈20 gal. (11/10) 17 (11/13)

20. Quantity of sediment removed: ~0.3 ~~ft~~ ~~gal.~~ (11/10)

PA-QR-MW8

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: PB-PR-mw9

   Location: Pentylite Rd

3. Well Installation:
   Date(s) and Time(s): 11-1-94

4. Well Development:
   Date(s) and Time(s): 11-10-94 1455 11-13-94

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 21.5 ft

7. Static Water Level

   Before Development: 12.98 ft below top of casing
   24 Hours After Development: 17.19 ft below top of casing
   11/13 14.46

8. Quantity of Water
   Added During Filter Placement: 0 gallons
   Added during drilling: 0 gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.45 gallons
      (8.52 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 4.88 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (6.33 gals x 5 = 31.65 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 6.81 conductivity: 7900 temperature: 58 °C/°F

PB-PR-MW9

b. During Development:

11/13 pH: 6.80 conductivity: 8670 temperature: 57 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 15 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 21.5 ft (11/10) 21.68 (11/13)

b. After development: 21.68 ft

14. Physical character of removed water

a. Clarity Opaque

b. Color Red

c. Particulates Silt

d. Odor none

15. Type and size/capacity of pump and/or bailor used: N/A

16. Depth of well casing below ground surface (since flush-mount): N/A ft

17. Typical pumping rate (if applicable): N/A gpm

18. Estimated recharge rate: * gpm

19. Quantity of water removed: 8 (11/10) gal. 8 (11/13)

20. Quantity of sediment removed: 0.18 ft ~~gal~~ (11/10).

WELL DEVELOPMENT RECORD

1. Project Name: Plum Brook Ordnance Works

   Location: Sandusky, Ohio

2. Well Designation: FT-05

   Location: Pentalite Rd

3. Well Installation:
   Date(s) and Time(s): _____

4. Well Development:
   Date(s) and Time(s): 11-11-94 ~~11-13-94~~ 1415

5. Elevation of top of casing (if available) _____ ft msl

6. Depth from top of well casing to bottom of well: 24.15 ft

7. Static Water Level

   Before Development: 14.68 ft below top of casing
   24 Hours After Development: 16.85 (11/12) ft below top of casing
   ~~11/13~~ 15.34

8. Quantity of Water
   Added During Filter Placement: Unknown gallons
   Added during drilling: Unknown gallons

9. Quantity of Fluid in Well
   Prior to Development:

   a. Standing in Well: 1.61 gallons
      (9.47 ft x.17 gal)
   b. Contained in Annulus
      (assuming 30% porosity): 5.43 gallons

10. Total amount of water to be purged from well: Add amounts from 6 and 7 and multiply by 5 (7.04 gals x 5 = 35.18 gals to be purged).

11. Field Measurements of pH, Conductivity, and Temperature:

    a. Before Development:

       pH: 7.04 conductivity: 790 temperature: 54 °C/~~°F~~

IT-05

b. During Development:

11/15 pH: 6.66 conductivity: 744 temperature: 55 °C/°F

pH: _____ conductivity: _____ temperature: ____ °C/°F

c. After Development:

pH: _____ conductivity: _____ temperature: ____ °C/°F

12. Screen length: 10 ft

13. Depth from top of well casing to top of sediment inside well

a. Before development: 11/11 21.85 ft 11/15 21.95

b. After development: 21.95 ft

14. Physical character of removed water

a. Clarity Clear

b. Color Slight Gray

c. Particulates Fine Sand

d. Odor Slight Sulfer odor

15. Type and size/capacity of pump and/or bailor used: 1.1" Ø, 3' long disposible bailer

16. Depth of well casing below ground surface (since flush-mount): N/A ft

17. Typical pumping rate (if applicable): N/A gpm

18. Estimated recharge rate: _____ gpm

19. Quantity of water removed: 11/11 4 gal. 11/15 3 gal

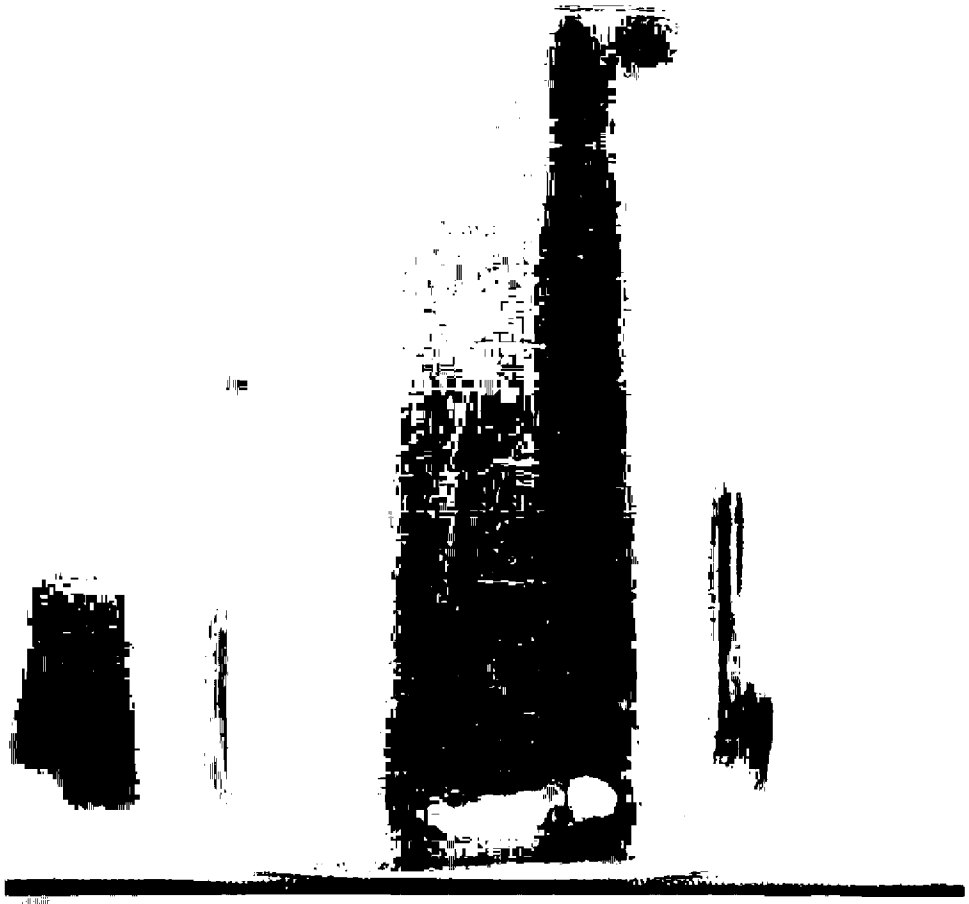
20. Quantity of sediment removed: 11/11 0.10 ft ~~gal.~~

Well ID: PB-WA-MW2 Collected 11-13-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District



Well ID: IT-MW02 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: PB-PR-MW7 Collected 11-14-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

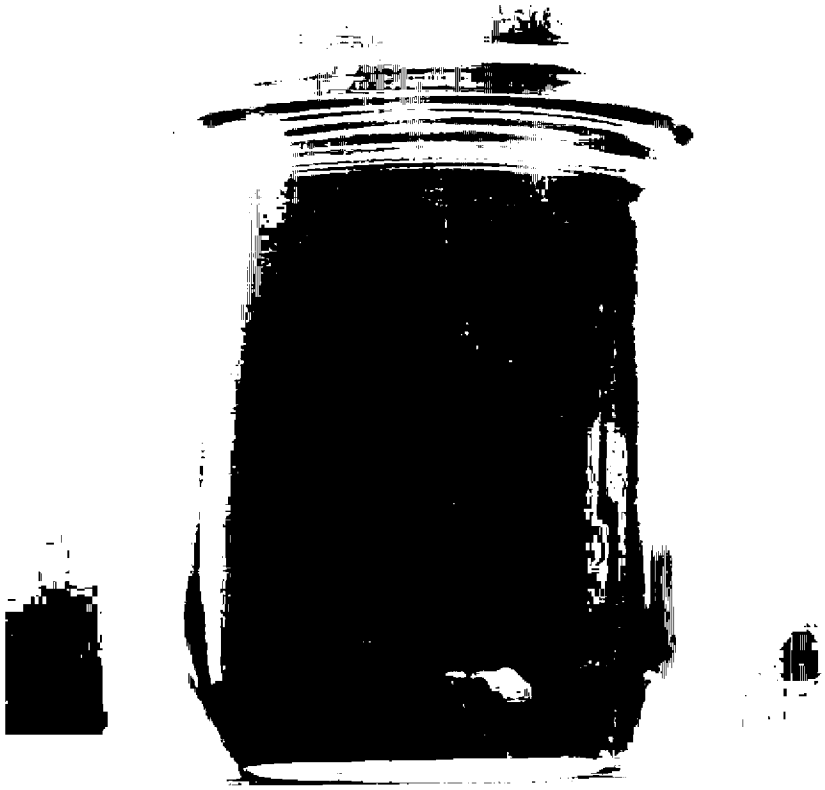
HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: PB-PR-MW8 Collected 11-13-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District



Well ID: PB-PR-MW9 Collected 11-13-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

Well ID: IT-MW05 Collected 11-15-94

DEVELOPMENT WATER SAMPLE
Photographed December 12, 1994

PLUM BROOK ORDNANCE WORKS
Sandusky, Ohio

HTW Investigation by Dames & Moore, Inc.
for U.S. Army Corps of Engineers, Nashville District

APPENDIX G

WELL SURVEY DOCUMENTATION

File: TNTA.PRN

POINT	NORTHING	EASTING	ELEVATION	NOTE
1000	32580.1577	27844.9668	638.0465	MK-MW22 CAS
1001	32580.3630	27844.3376	635.5575	MK-MW22 GND
1002	32935.1711	29414.2443	639.4729	MK-MW23 CAS
1003	32934.0916	29414.5169	636.9500	MK-MW23 GND
1004	30493.6231	27420.8660	657.1164	MK-MW24 CAS
1005	30494.7078	27420.4812	654.4446	MK-MW24 GND
1006	32095.2811	27479.5229	640.1783	PB-TNTA-MW10 CAS
1007	32093.1214	27478.6611	637.5025	PB-TNTA-MW10 GND
1008	31733.6648	26832.7054	640.4990	PB-TNTA-MW11 CAS
1009	31731.5058	26832.6482	637.8648	PB-TNTA-MW11 GND

File: [illegible].CRD

POINT	NORTHING	EASTING	ELEVATION	NOTE
2000	24937.4730	22260.6698	674.3227	MK-MW16 CAS
2001	24938.5128	22260.1230	671.3271	MK-MW16 GND
2002	26671.1286	22021.0026	664.6425	MK-MW17 CAS
2003	26670.7095	22019.8256	660.9672	MK-MW17 GND

[illegible] DITNTC.CNF

POINT	NORTHING	EASTING	ELEVATION	NOTE
3000	29408.6978	13531.0263	645.4149	PB-TNTC-MW3 CAS
3001	29408.8887	15532.7451	642.5686	PB-TNTC-MW3 GND
3002	28334.5197	14635.8790	654.4254	PB-TNTC-MW4 CAS
3003	28332.1101	14634.9910	651.8891	PB-TNTC-MW4 GND
3004	28645.6081	15969.9882	651.8103	PB-TNTC-MW5 CAS
3005	28645.9387	15972.1375	649.0699	PB-TNTC-MW5 GND
3006	28411.4613	17171.1652	659.4018	PB-TNTC-MW6 CAS
3007	28413.0296	17169.5598	656.8196	PB-TNTC-MW6 GND

File: IWA WELLS.XLS

POINT	NORTHING	EASTING	ELEVATION	NOTE
4000	30428.4220	14380.0948	639.5980	IT-MW002 CASING
4001	30428.0835	14379.8283	636.6895	IT-MW002 GND
4002	30428.3357	14379.9481	639.6292	IT-MW002 MEAS PT
4003	31783.0116	14647.2616	640.8941	MK-MW10 CAS
4004	31784.0924	14646.6469	638.0600	MK-MW10 GND
4005	31782.0442	15925.8393	637.6858	MK-MW11 CAS
4006	31782.6482	15926.8071	634.7066	MK-MW11 GND
4007	30549.5032	14060.0756	644.4319	PB-WA-MW-1 CASING
4008	30549.4006	14060.5771	642.3200	PB-WA-MW-1 GND
4009	30038.2737	14301.1938	633.6505	PB-WA-MW-2 CASING
4010	30038.9137	14301.2543	631.1569	PB-WA-MW-2 GND

File: G:PEN-WELL.CRD

POINT	NORTHING	EASTING	ELEVATION	NOTE
5000	33122.3541	23074.6346	633.3861	PB-PR-MW7 CAS
5001	33122.1380	23074.6900	631.5000	PB-PR-MW7 GND
5002	33022.0426	23365.0504	635.0205	PB-PR-MW8 CAS
5003	33022.1700	23364.7000	632.5000	PB-PR-MW8 GND
5004	33229.7381	23561.4850	633.6999	PB-PR-MW9 CAS
5005	33227.1940	23564.6760	630.7000	PB-PR-MW9 GND
5006	33482.7542	23520.4311	634.9943	IT-MW05 CAS
5007	33481.1410	23518.7250	631.9147	IT-MW05 GND

POINT	NORTHING	EASTING	ELEVATION	NOTE
6000	29006.7777	16324.7729	648.2732	PB-BED-MW13 CAS
6001	29004.7448	16324.8381	645.8093	PB-BED-MW13 GND
6002	30640.9823	14567.4105	646.0366	PB-BED-MW14 CAS
6003	30640.6739	14564.9269	643.0537	PB-BED-MW14 GND
6004	34311.2880	23307.8810	631.6394	PB-BED-MW15 CAS
6005	34311.2752	23310.1041	629.0787	PB-BED-MW15 GND
6006	31463.0050	24687.7929	636.0173	PB-BED-MW16 CAS
6007	31461.0305	24688.0338	633.6826	PB-BED-MW16 GND
6008	33666.0038	28164.0776	629.9697	PB-BED-MW17 CAS
6009	33667.9151	28164.7514	627.3369	PB-BED-MW17 GND
6010	32130.3503	29563.1857	651.5041	PB-BED-MW18 CAS
6011	32128.0488	29563.0032	648.8318	PB-BED-MW18 GND
6012	31782.9542	14256.5847	643.0705	PB-BED-MW19 CAS
6013	31780.9102	14256.3225	640.5050	PB-BED-MW19 GND
6014	20646.7145	27306.6374	676.3317	PB-BED-MW20 CAS
6015	20645.1156	27305.6314	673.5732	PB-BED-MW20 GND
6016	34874.6151	21994.7173	630.1175	REACTOR1 CAS
6017	34874.7528	21994.7061	630.2061	REACTOR1 GND
6018	34762.4651	22017.2722	630.6801	REACTOR2 CAS
6019	34762.6821	22017.2191	630.7188	REACTOR2 GND
6020	34790.0318	22161.7567	630.8760	REACTOR3 CAS
6021	34790.0394	22161.8592	630.7346	REACTOR3 GND
6022	34735.1486	22161.2091	631.1532	REACTOR4 CAS
6023	34735.1918	22161.2332	630.7567	REACTOR4 GND

File: C:WA-SOIL.CR5

POINT	NORTHING	EASTING	ELEVATION	NOTE
7000	30006.1890	14404.1956	631.8186	PB-WA-S1
7001	29954.2200	14345.3691	624.3863	PB-WA-S2
7002	29932.7040	14250.8353	626.0317	PB-WA-S3
7003	30183.0401	14061.7649	633.3041	PB-WA-S4
7004	30159.2497	14065.3231	633.0988	PB-WA-S5
7005	30147.6119	13844.2866	633.3705	PB-WA-S6
7006	30184.1411	13752.1463	635.3703	PB-WA-S7
7007	30354.5881	13748.0405	637.7745	PB-WA-S8
7008	30441.3753	14085.3392	639.3238	PB-WA-S9
7009	30331.5225	14694.5146	632.1665	PB-WA-S11
7010	30166.2900	14696.1580	627.5275	PB-WA-S12
7011	30066.0276	14455.5353	631.5901	PB-WA-S13
7012	30058.3731	14678.7106	629.1723	PB-WA-S14
7013	30531.8066	14752.4694	632.8720	PB-WA-S15
7014	30438.0133	14278.0708	638.2466	PB-WA-S16
7015	30334.9682	14416.1808	633.1152	PB-WA-S17
7016	30192.6733	14442.4040	631.5738	PB-WA-S18
7017	30442.8399	14461.8413	632.3120	PB-WA-S19
7018	30092.2223	14361.9554	631.3624	PB-WA-S20
7019	30105.3354	14387.2320	630.8781	E POND H2O ELEV
7020	30091.9365	14312.4992	634.9013	W POND H2O ELEV
7021	30411.8869	14299.0826	0.0000	GRID A,0
7022	30312.0487	14304.8151	0.0000	GRID 2
7023	30362.2829	14301.7802	0.0000	GRID 1
7024	30263.3419	14307.5367	0.0000	GRID 3
7025	30214.0439	14310.2108	0.0000	GRID 4
7026	30164.6824	14313.1814	0.0000	GRID 5
7027	30115.9103	14315.8810	0.0000	GRID 6
7028	30089.5931	14317.2533	0.0000	GRID 7
7029	30080.1290	14267.4196	0.0000	GRID B'
7030	30084.4724	14220.4927	0.0000	GRID C'
7031	30088.0436	14168.2477	0.0000	GRID D'
7032	30106.6105	14145.6197	0.0000	GRID 6'
7033	30156.6212	14143.6142	0.0000	GRID 5'
7034	30205.4939	14112.9276	0.0000	GRID E'
7035	30202.9630	14063.6400	0.0000	GRID F'
7036	30203.0170	14014.3397	0.0000	GRID G'
7037	30203.0974	13964.5085	0.0000	GRID H'
7038	30202.7904	13915.0375	0.0000	GRID I'
7039	30197.5543	13867.1776	0.0000	GRID J'
7040	30196.9283	13817.7907	0.0000	GRID K'
7041	30201.5060	13768.7801	636.6574	GRID L' BOB
7042	30280.3993	13771.3730	0.0000	GRID 3'
7043	30280.8029	13768.3270	0.0000	GRID 2'
7044	30323.9362	13765.6818	636.0894	GRID 1' BOB
7045	30380.2808	13764.6497	0.0000	GRID 0'
7046	30410.8059	13751.3223	0.0000	GRID L
7047	30413.6969	13801.2278	0.0000	GRID K
7048	30415.0329	13851.4200	0.0000	GRID J
7049	30416.6131	13902.1923	0.0000	GRID I
7050	30418.5878	13950.5357	0.0000	GRID H
7051	30417.9195	14001.1511	0.0000	GRID G
7052	30416.4089	14050.5135	0.0000	GRID F
7053	30415.9302	14101.0651	0.0000	GRID E
7054	30415.1270	14150.6100	0.0000	GRID D
7055	30414.4[illegible]	14200.1267	0.0000	GRID [illegible]

POINT	NORTHING	EASTING	ELEVATION	NOTE
7056	30412.9637	14249.8965	0.0000	GRID B
7057	30411.3433	14231.3303	635.9779	BOB (BOT OF BANK
7058	30415.9536	14232.9379	639.3188	TOB (TOP OF BANK)
7059	30387.0836	14301.1532	637.6700	TOB
7060	30374.3088	14301.9589	634.8275	BOB
7061	30368.4182	14314.1058	635.1599	BOB
7062	30358.6547	14336.7958	637.5027	BERM
7063	30226.2309	14339.8316	638.1550	BERM
7064	30227.7183	14321.0614	635.4249	BOB
7065	30074.9673	14323.4755	638.4649	BERM
7066	30085.9520	14318.9367	636.1066	BOB
7067	30067.9813	14230.8525	637.9243	BERM
7068	30075.3576	14224.2036	635.9106	BOB
7069	30078.5948	14142.1937	638.5194	BERM
7070	30085.1195	14144.8041	636.3330	BOB
7071	30129.2379	14126.9881	637.7410	BERM
7072	30132.4814	14132.5218	635.9668	BOB
7073	30190.0450	14110.7680	638.1967	BERM
7074	30199.0133	14115.1351	635.3406	BOB
7075	30193.9837	14068.9819	636.1824	BREECH
7076	30189.3128	13957.6800	638.1029	BERM
7077	30194.4934	13956.8308	635.9451	BOB
7078	30195.9626	13763.0785	638.0533	BERM
7079	30255.0272	13748.0461	637.4130	EDGE LOW AREA
7080	30266.2094	13754.2036	636.0354	BOB
7081	30323.5849	13754.0661	637.2612	EDGE LOW AREA
7082	30360.1172	13798.4222	637.7170	TOB
7083	30356.4426	13802.7049	635.9964	BOB
7084	30384.3376	13851.3515	635.9836	BOB
7085	30388.2027	13847.7164	638.6041	TOB
7086	30416.7064	13937.8832	637.8301	TOB
7087	30409.4718	13943.9074	635.4179	BOB
7088	30434.4388	14035.9950	635.9225	BOB
7089	30442.5649	14040.6405	636.8063	BOB
7090	30428.0000	14047.0726	639.2780	TOB
7091	30421.8045	14046.8447	635.6744	BOB
7092	30412.0179	14130.6031	635.3740	BOB
7093	30418.6284	14129.3554	638.0894	TOB

File: C:PEN-SOIL.CR5

POINT	NORTHING	EASTING	ELEVATION	NOTE
8000	33227.1240	22964.6760	633.5100	P-BH1
8001	33022.1240	22964.7000	633.0200	P-BH2
8002	32922.1240	22964.7120	633.0800	P-BH3
8003	33122.1380	23074.6900	631.4900	P-MW4
8004	32922.1670	23074.7120	631.2100	P-BH5
8005	33227.1470	23164.6770	631.3200	P-BH6
8006	33022.1470	23164.7000	631.1100	P-BH7
8007	33517.1580	23264.6430	633.6700	P-BH8
8008	33322.1580	23264.6650	631.1200	P-BH9
8009	33122.1590	23264.6880	631.1000	P-BH10
8010	32922.1610	23284.7120	632.2900	P-MW11
8011	33422.1700	23364.6540	630.4200	P-BH12
8012	33227.1700	23364.6760	632.8100	P-BH13
8013	33022.1700	23364.7000	632.4800	P-MW14
8014	33322.1830	23464.6670	633.0200	P-BH15
8015	33122.1820	23464.6880	634.5400	P-BH16
8016	32922.1820	23464.7120	631.1900	P-BH17
8017	33422.1920	23564.6540	629.8800	P-BH18
8018	33227.1940	23564.6760	630.7300	P-MW19
8019	33122.1940	23564.6880	631.6100	P-BH20
8020	33110.0910	23177.0110	630.5700	PB-PR-S21
8021	33162.1750	23394.6850	634.6300	P-BH21A
8022	33275.8650	23282.9030	630.3200	PB-PR-S22
8023	33369.6920	23353.9460	629.8300	PB-PR-S23
8024	33373.7880	23447.8330	629.9700	PB-PR-S24

APPENDIX H

GROUNDWATER SAMPLING RECORDS

Volume Calculation

Casing: (.16)(10.49) = 1.68

Sand: (1.91)(0.3)(10.49) = 6.01

PV = 6.01 + 1.68 = 7.69

5xPV = 38.45

Vol	PH	Cond	Temp
0	7.58	—	53°F
4	7.18	—	53°F
8	7.47	—	53°F

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME~~

DATE: 12-12-94 TIME: _____

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-WA-MW2 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 4.06

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 14.55

SCREENED INTERVAL (ft. below TOC): 5.55

VOLUME OF WATER TO BE EVACUATED (gallons)*: 38.45

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 12.9 pH: 6.5

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosives, METALS (FILTERED + UNFILTERED), NITRATES

NO. OF CONTAINERS AND I.D. 5; PB-WA-DM-MW2-U
MW2-F

FIELD BLANK I.D.NO.: see Below TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: See Below

COMMENTS: Duplicate of DM-MW2 → PB-WA-DM-MW22-U+F
MW22-U+F-S

Equip Blank PB-E-WA-DM MW2-U+F
MW2-U+F-S

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing: (.16)(8.48) = 1.36

Sand: (1.91)(.3)(8.48) = 4.86

PV = 1.36 + 4.86 = 6.22

5 x PV = 31.1

$PH_1 = 6.37$ $Cond_1 = 5920$

$T_1 = 53°F$ Vol = 0

$PH_2 = 6.50$ $Cond_2 = 6030$

$T_2 = 53°F$ Vol = 2g

$PH_3 = 6.56$ $Cond_3 = 6030$

$T_3 = 53°F$ Vol = 4g

$PH_4 = 6.56$ $Cond_4 = 5850$

$T_4 = 53°F$ Vol = 5g

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-13-94 TIME: _____

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: IT-MW02 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 12.31

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 20.79 (21.3)

SCREENED INTERVAL (ft. below TOC): (10.79) (11.3)

VOLUME OF WATER TO BE EVACUATED (gallons)*: 31.1

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☒ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 51°F pH: 6.0

CONDUCTIVITY (µmhos/cm): >1996 PID (ppm) _____

LABORATORY ANALYSES: Explosives, Metals (Filtered, Unfiltered), Nitrates

NO. OF CONTAINERS AND I.D. 5; PB-W4-IT-MW2-U
MW2-F

FIELD BLANK I.D.NO.: _____ TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: _____

COMMENTS: Well dries after approx 5 gal removed

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

casing = (.16)(3.42) = 0.55

sand = (1.91)(0.3)(3.42) = 1.96

PV = 2.51

5xPV = 12.55 gal

PH1 = 5.94 Cond1 = 1070

T1 = 53°F Vol = 0 g

PH2 = 6.11 Cond2 = 1093

T2 = 53°F Vol = 1 gal

PH3 = 6.22 Cond3 = 1090

T3 = 53°F Vol = 2 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-9-94 TIME: 15:56

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: MK-MW11 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 12.47

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 15.89

SCREENED INTERVAL (ft. below TOC):

VOLUME OF WATER TO BE EVACUATED (gallons)*: 12.55

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐ Positive Displacement Pump ☐ Bailer ☒ Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐ Stainless Steel Bailer ☐ Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☒ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: mostly clear

FIELD TESTS:

SAMPLE TEMP. (°C): 54°F pH: 6.71

CONDUCTIVITY (µmhos/cm): 1080 PID (ppm)

LABORATORY ANALYSES: Explosives, metals (Filtered & unfiltered), Nitrate.

NO. OF CONTAINERS AND I.D. 5

FIELD BLANK I.D. NO.: N/A TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Well dries after 2 gal removed. Water is slightly cloudy and brown

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-9-94 TIME: 1050

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-PR-DM-MW7 WELL SIZE (I.D., inches) 2"

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): _____

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 35

SCREENED INTERVAL (ft. below TOC): 19.3 - 35.0

VOLUME OF WATER TO BE EVACUATED (gallons)*: _____

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 52°F pH: 6.75

CONDUCTIVITY (µmhos/cm): 1800 PID (ppm) _____

LABORATORY ANALYSES: Explosives, Metals (unfiltered and filtered), nitrates

NO. OF CONTAINERS AND I.D. 5 PB-PR-DM-MW7-U PB-PR-DM-MW7-F

FIELD BLANK I.D.NO.: _____ TRIP BLANK I.D. NO. N/A

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Extra bottles for MS/MSD

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing: (.167)(19.53) = 3.12

Sand: (1.917)(.3)(19.53) = 11.19

PV = 14.31

5xPV = 71.55 gal

PH1 = 7.15 Cond1 = 28500

T1 = 53°F Vol = 0

PH2 = 6.90 Cond2 = 28500

T2 = 53°F Vol = 3g

PH3 = 6.86 Cond3 = 29100

T3 = 53°F Vol = 6g

PH4 = 6.81 Cond4 = 29100

T4 = 53°F Vol = 16g

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-8-94 TIME: 12:00

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: PB-PR-MW-8 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 10.47

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 30.0

SCREENED INTERVAL (ft. below TOC): 7.5 - 30.0

VOLUME OF WATER TO BE EVACUATED (gallons)*: 71.55

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 53°F pH: 6.82

CONDUCTIVITY (µmhos/cm): 26,400 PID (ppm)

LABORATORY ANALYSES: Explosives, metals (unfiltered and filtered), nitrates

NO. OF CONTAINERS AND I.D. 5 PB-PR-PM-MW8-U
PB-PR-PM-MW8-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO. N/A

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Well dries after bailed removed. Red Water

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing: (0.16)(10.92) = 1.75

Sand: (1.91)(0.3)(10.92) = 6.26

PV = 1.75 + 6.26 = 8.01

5 x PV = 40 gal

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~

DATE: 12-8-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: PB-PR-MW9 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 10.78

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 21.70

SCREENED INTERVAL (ft. below TOC): 6.7 - 21.7

VOLUME OF WATER TO BE EVACUATED (gallons)*: 40

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 53°F pH: 6.82

CONDUCTIVITY (µmhos/cm): 11,520 PID (ppm)

LABORATORY ANALYSES: Explosives, Metals (Filtered + Unfiltered), Nitrates

NO. OF CONTAINERS AND I.D. 5; PB-PR-DM-MW9-U
MW9-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: Well dries after approx 9 gal removed.

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

Volume Calculation

Casing: (.16)(7.05) = 1.13

Sand: (1.91)(0.3)(7.05) = 4.04

PV = 1.13 + 4.04 = 5.17

5xPV = 25.85

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-8-94 TIME:

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐

WELL NO.: FT-MW05 WELL SIZE (I.D., inches) 2

TOP OF CASING (TOC) ELEVATION (ft., msl):

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 14.80

STATIC WATER LEVEL ELEVATION (ft., msl):

DEPTH TO BOTTOM OF WELL (ft. below TOC): 21.85 (24.15)

SCREENED INTERVAL (ft. below TOC): 11.85 - 21.85

VOLUME OF WATER TO BE EVACUATED (gallons)*: 25.8

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☒

Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC):

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.:

FIELD TESTS:

SAMPLE TEMP. (°C): 52°F pH: 6.61

CONDUCTIVITY (µmhos/cm): 931 PID (ppm)

LABORATORY ANALYSES: Explosives, METALS (FILTERED + Unfiltered), NITRATES

NO. OF CONTAINERS AND I.D. 5; PB-PR-~~FT~~T-MW5-U
MW5-F

FIELD BLANK I.D.NO.: TRIP BLANK I.D. NO.

DUPLICATE SAMPLE I.D. NO.:

COMMENTS: Well dries after approx 3gal removed.

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works Invest. Area: SAMPLED BY: Dames & Moore

~~SAMPLE NO. & NAME:~~

DATE: 12-14-94 TIME: _____

WELL TYPE: Monitoring ☒ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-BED-MW14 WELL SIZE (I.D., inches) 4" (3" Cleanout)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 24.28

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 55.0

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 29.0 – 55.0

VOLUME OF WATER TO BE EVACUATED (gallons)*: 65.0

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 47 °F pH: 6.0

CONDUCTIVITY (µmhos/cm): 1580 PID (ppm) _____

LABORATORY ANALYSES: Explosives, BNA's, Metals (Filtered + Unfiltered), Nitrates, VOAs

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW14-U, PB-BED-MW14-F

FIELD BLANK I.D.NO.: _____ TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: _____

COMMENTS: _____

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-13-94 TIME: _____

WELL TYPE: Monitoring ☑ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-BED-MW15 WELL SIZE (I.D., inches) 4" (3" telescope)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 28.10

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 97.0

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 31.5 → 97.0

VOLUME OF WATER TO BE EVACUATED (gallons)*: 97.7 gal

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): 66.86

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 50 °F pH: 7.5

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosive, BNAs, METALS (FILTERED + UNFILTERED), NITRATES, VOAs

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW15-U
PB-BED-MW15-F

FIELD BLANK I.D. NO.: _____ TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: _____

COMMENTS: ≈25 removed, well dries

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-14-94 TIME: _____

WELL TYPE: Monitoring ☑ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-BED-MW19 WELL SIZE (I.D., inches) 4"/3" (telescope)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 22.0

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 52.2

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 32.0 → 52.2

VOLUME OF WATER TO BE EVACUATED (gallons)*: 71

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC BAILER

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 50°F pH: 7.0

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosives, BNAs, METALS (FILTERED + UNFILTERED), NITRATES, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW19-U
PB-BED-MW19-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: 60 gal removed; Reading Stabilized

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-14-94 TIME: _____

WELL TYPE: Monitoring ☑ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-BED-MW20 WELL SIZE (I.D., inches) 4" (3" Bladder pump)

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 14.98

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): 52.3

~~SCREENED~~ 3" INTERVAL (ft. below TOC): 35.0 - 52.3

VOLUME OF WATER TO BE EVACUATED (gallons)*: 97.0

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other Disposable PVC Bailer

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): _____

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 51°F pH: 6.0

CONDUCTIVITY (µmhos/cm): >1990 PID (ppm) _____

LABORATORY ANALYSES: Explosives, BNAs, Metals (Filtered + Unfiltered), Nitrates, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-BED-MW20-U
PB-BED-MW20-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: _____

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-15-94 TIME: _____

WELL TYPE: Monitoring ☑ Potable ☐ Supply ☐

Other ☐ _____

WELL NO.: PB-Reactor 2- WELL SIZE (I.D., inches) 8"

TOP OF CASING (TOC) ELEVATION (ft., msl): _____

DEPTH TO STATIC WATER LEVEL (ft. below TOC): 15.97

STATIC WATER LEVEL ELEVATION (ft., msl): _____

DEPTH TO BOTTOM OF WELL (ft. below TOC): ≈40ft

SCREENED INTERVAL (ft. below TOC): _____

VOLUME OF WATER TO BE EVACUATED (gallons)*: _____

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐

Positive Displacement Pump ☐ Bailer ☑

Other _____

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐

Stainless Steel Bailer ☐

Other DISPOSABLE PVC BAILER

SAMPLE NO.: _____ SAMPLE DEPTH (ft. below TOC): 36.95

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: _____

FIELD TESTS:

SAMPLE TEMP. (°C): 52°F pH: 6.5

CONDUCTIVITY (µmhos/cm): 700 PID (ppm) _____

LABORATORY ANALYSES: EXPLOSIVES, BNA's, METALS (FILTERED + UNFILTERED), NITRATES, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-REACTOR 2-U
PB-REACTOR 2-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. _____

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: Removed 62 gals ⇒ Dry 12-7-94 12-8-94

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

GROUND-WATER SAMPLING RECORD

CLIENT: CEORN JOB NO: 24637-035-009

LOCATION: Plum Brook Ordnance Works SAMPLED BY: Dames & Moore

~~SWMU NO. & NAME:~~ Invest. Area:

DATE: 12-14-94 TIME:

WELL TYPE: Monitoring ☐ Potable ☐ S.S. Supply ☐

Other ☒ Not A well; Drill Water

WELL NO.: DRILL WATER WELL SIZE (I.D., inches) N/A

TOP OF CASING (TOC) ELEVATION (ft., msl): N/A

DEPTH TO STATIC WATER LEVEL (ft. below TOC): N/A

STATIC WATER LEVEL ELEVATION (ft., msl): N/A

DEPTH TO BOTTOM OF WELL (ft. below TOC): N/A

SCREENED INTERVAL (ft. below TOC): N/A

VOLUME OF WATER TO BE EVACUATED (gallons)*: N/A

EVACUATION METHOD: Submersible Pump ☐ Centrifugal Pump ☐
N/A
Positive Displacement Pump ☐ Bailer ☐
Other

SAMPLING METHOD: Submersible Pump ☐ Positive Displ. Pump ☐
Stainless Steel Bailer ☐
Other FROM HOSE

SAMPLE NO.: SAMPLE DEPTH (ft. below TOC): N/A

SAMPLE TREATMENT: Field Filtered ☐ Preservative Added ☐

SAMPLE APPEARANCE, ODOR, ETC.: Clear, odorless

FIELD TESTS:

SAMPLE TEMP. (°C): 57 °F pH: 6.0

CONDUCTIVITY (µmhos/cm): 350 PID (ppm)

LABORATORY ANALYSES: ~~Explosives~~, BNA S, METALS (FILTERED + UNFILTERED), NITRATES, VOCs

NO. OF CONTAINERS AND I.D. 10; PB-DRILL WATER-U
PB-DRILL WATER-F

FIELD BLANK I.D.NO.: N/A TRIP BLANK I.D. NO. N/A

DUPLICATE SAMPLE I.D. NO.: N/A

COMMENTS: WATER TAKEN Directly FROM HOSE in GUARD SHACK

*2-inch casing has 0.16 gallons/ft.
4-inch casing has 0.65 gallons/ft.
6-inch casing has 1.47 gallons/ft.

APPENDIX I

WEST POND SEDIMENT BORING LOGS

HTRW DRILLING LOG

HOLE NUMBER: Core 1

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR: N/A
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: —
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" PVC Sediment Sampler	8. HOLE LOCATION: C+40, 0+25
	9. SURFACE ELEVATION
	10. DATE STARTED: 10-26-94 / 11. DATE COMPLETED: 10-26-94
12. OVERBURDEN THICKNESS: —	15. DEPTH GROUNDWATER ENCOUNTERED: —
13. DEPTH DRILLED INTO ROCK: —	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —
14. TOTAL DEPTH OF HOLE: 24"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---	1	N/A

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
None	None	None	Explosives	—	—	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Collapsed	—	—	—	

LOCATION SKETCH/COMMENTS

SCALE:

Grid established C+40' 0+25'

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: CORE #1

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: T. Fontes / T. Berry / C. Allen	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SHELBY TUBE - 3-inch	8. HOLE LOCATION: CORE #1 Grid Loc: C+25' 1+25
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/26/94
	11. DATE COMPLETED: 10/26/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 8" Pore water
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: Core 1

PROJECT: Plum Brook Ordnance Works

INSPECTOR: J. Endres

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		▽ Pond surface				
	0.5'	Pond water				
	1.0'	Sediments - Black, organic silty clay w/roots				No Sample
	1.5					
	2.0					
	2.5	Brown silty clay with some sand				No Sample
	3.0	Sample terminated at 2.67' below pond level @ 14:45 on 10-26-94				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #2

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Smereck / Lynn Rose	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: PVC SEDIMENT SAMPLER 2-INCH	8. HOLE LOCATION: CORE #2 GRID LOC: B/6
	9. SURFACE ELEVATION: 1.08' Pond Water
	10. DATE STARTED: 10/22/04 — 11. DATE COMPLETED: 10/22/04
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:

GRID LOC B/6

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE/LOCATION: CORE #2

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		Pond surface				
	0.5	Pond Water				
		Sediments - [illegible]				PB-WA-SED-0.2/1.7
	3.5	Gray silt [illegible] occasional [illegible] and fine sand				PB-WA-SED-1.7/2.5
		Sample terminated @ 3.5' below pond [illegible] 10/27/05				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #3

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J. Endres / T. Berry	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch PVC SEDIMENT SAMPLER	8. HOLE LOCATION: GRID LOC: A+25/4
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/27/94 — 11. DATE COMPLETED: 10/27/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 0.8' Pond Water
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

GRID LOC: A+25/4

PROJECT: Plum Brook Ordnance Works — HOLE NO.:

HTRW DRILLING LOG

HOLE NUMBER CORE # 3

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Pond Surface				
	0.5	Pond Water				
	1.0	Sediments - Black organic Silty Clay w/ roots				PB-WA-SED2-.2/1 16 30
	1.5					
	2.0	Mottled brown tan silty clay w/ fine sand				PB-WA-SED2-1/2 16 30
	2.5					
	3.0	Sample terminated @ 2.8' below pond surface on 10/27/04				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE # 4

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch PVC sediment sampler	8. HOLE LOCATION: GRID LOC C/3
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/22/04 — 11. DATE COMPLETED: 10/22/04
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 1.17' Pond water
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

GRID LOC: C/3

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE/LOCATION CORE # 4

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	Pond Surface				
	1.5	Pond Water				
	1.0					
	1.5	Sediments - Black and gray organic silty clay w/roots and fine sand				PB-WA-SED3-0.2/1.0 10/27/04 1800
	2.0					
	2.5	Grayish brown silty clay w/occasional brown mottling and fine sand				PB-WA-SED3-1/2 10/27/04 1800
	3.0					
		Sample Terminated @ 3.17' below pond surface on 10/27/04				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #5

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J. ENDRES / T. BERRY	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch PVC SEDIMENT SAMPLER	8. HOLE LOCATION: GRID LOC: F/1+25'
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/28/94 — 11. DATE COMPLETED: 10/28/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 1.5' Pond Water
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

GRID LOC: F/1+25'

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NO. CORE #5

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	POND SURFACE				
	.5 1.0	POND WATER				
	1.5	SEDIMENTS - Black organic silty clay w/roots				PB-WA-SED4-0.2/0.5 10/28/[illegible] 0845
	2.0 2.5	Brown silty clay w/gray mottling and trace fine sand				PB-WA-SED4-0.5/1.5 10/28/[illegible] 0845
	3.0	Sample terminated 2.0' below sediment surface on 10/28/[illegible]				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #6

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J Andres / T Berry	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch PVC sediment sampler	8. HOLE LOCATION: GRID LOC: H/2+25'
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/28/04 — 11. DATE COMPLETED: 10/28/04
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 0.83' Pond Water
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

GRID LOC: H/2+25'

PROJECT: Plum Brook Ordnance Works — HOLE ID.:

HTRW DRILLING LOG

HOLE NUMBER CORE #6

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	▼ POND SURFACE				
	0.5	POND WATER				
	0	SEDIMENTS - Black organic silty clay w/ roots				No Sample
	5 7.0	Brown & gray silty clay w/ fine sand				No Sample
	7.5 10	Sample Terminated @ 2.22' below pond surface or 10/28/04				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE # 7

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: J ENDRESIT BERRY	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-INCH PVC SEDIMENT SAMPLER	8. HOLE LOCATION: GRID LOC: K/2
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/28/04 — 11. DATE COMPLETED: 10/28/04
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 1.25' POND WATER
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

GRID LOC: K/2

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER CORE #7

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
	0	POND SURFACE				
	0.5	POND WATER				
	1.5	Dark brown - black [illegible] organic silty clay w/ roots				PB-WA-SED5-0.5/0.5 10/28/94 1100
	2.0	Brown orange silty clay w/ occasional brown or orange mottling				PB-WA-SED5-0.5/1.5 10/28/94 1100
	2.5	Brown or orange silty fine sand				
	3.0	Sand with [illegible] to 2.25 below pond surface.				

PROJECT Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #8

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: T. ENDRES / T. BERRY	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-INCH PVC SEDIMENT SAMPLER	8. HOLE LOCATION: GRID LOC: B/1+25'
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 10/28/04 — 11. DATE COMPLETED: 10/28/04
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 1.5' Pond Water
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	~~OTHER (SPECIFY)~~ Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

GRID LOC: B/1+25

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER CORE #8

PROJECT Plum Brook Ordnance Works | INSPECTOR | SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		POND SURFACE				
	.5 1.0	POND WATER				
	1.5 2.0 2.5	SEDIMENTS - Black organic silty clay w/roots				PB-WA-SED6-0.2/1.3 10/28/94 1230
	3.0	Brownish Gray silty clay w/ trace fine sand				PB-WA-SED6-3.0/3.2 10/28/94 1230
		Sample terminated 3.2' below pond surface on 10/28/94				

PROJECT Plum Brook Ordnance Works | HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #9

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
SHEET 1 OF 2 SHEETS	
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" PVC Sediment Sampler	8. HOLE LOCATION: CORE #9 GRID LOC: E 2+25'
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/28/94
	11. DATE COMPLETED: 10/28/94
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 16" PONDWATER
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
			Explosives			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT	HOLE NO.
Plum Brook Ordnance Works	

HTRW DRILLING LOG

HOLE NUMBER: CORE #9

PROJECT: Plum Brook Ordnance Works

INSPECTOR:

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		▼ POND SURFACE				
		POND WATER				
	0.5					
	1.0					
	1.5	SEDIMENTS - Black organic silty clay w/ roots				
	2.0	Gray silty clay w/ brown mottling				
	2.5					
	3.0					
	3.5	Sample terminated @ 3.33' below pond level on 10/28/94.				

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER: CORE #K

SHEET 1 OF 2 SHEETS

1. COMPANY NAME: Dames & Moore	2. DRILLING SUBCONTRACTOR:
3. PROJECT: Plum Brook Ordnance Works	4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT:	8. HOLE LOCATION: CORE #10 GRID LOC: I+25 1+25
	9. SURFACE ELEVATION:
	10. DATE STARTED: 10/28/04 — 11. DATE COMPLETED: 10/28/04
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: 12" POND WATER
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: N/A	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
None	---		

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY) Explosives	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS — SCALE:

PROJECT: Plum Brook Ordnance Works

HOLE NO.

HTRW DRILLING LOG

HOLE NUMBER CORE #10

PROJECT Plum Brook Ordnance Works

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)
		POND SURFACE				
	0.5	POND WATER				
	1.0	SEDIMENTS: Black organic silty clay w/ roots				
	1.5					
	2.0	Gray silty clay w/ brown mottling and fine sand				
	2.5					
	3.0	Sample term @ 3.0' below pond level on 10/28/04				

PROJECT Plum Brook Ordnance Works

HOLE NO.

APPENDIX J

ANALYTICAL LABORATORY REPORTS

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092
(770) 734-4200 • FAX (770) 734-4201

As a part of the contracted work associated with the Plum Brook site evaluation, ASI was required to report explosives residue analysis to the method detection limit (MDL), using the CRREL modification (Special Report 92-25) of EPA method 8330.

The method detection limit study attempts to answer the question, "What is the lowest level of analyte in a sample which will result in a signal which is different than zero?" The study is based upon repetitive analysis of a interference free sample which is spiked with a known amount of the target analyte. A minimum of seven aliquotes of the spiked sample are taken through the entire sample preparation and instrument analysis protocol. The standard deviation of the results is determined, then multiplied by the one-tailed t-statistic at the 99% confidence level for the number of degrees of freedom in the study (one less than the number of repetitions used to calculate the standard deviation). For seven repetitions this is a multiplier of 3.14. The resulting value is finally compared to the spike level in the sample. If the sample spike level is within 2 to 5 times the calculated MDL then the procedure is considered successful. If not the spike level in the sample is adjusted and the study repeated.

The MDL is not a measure of the of the lowest level of analyte in the sample which can be reported with accuracy. The MDL is only a measure of the ability of the test procedure to generate a positive response within the retention time window of the target analyte in the absence of any other interferences from the sample. It is actually a determination of the precision of obtaining a response from very low levels of target analyte and has no bearing on quantitative accuracy.

When applied to methods such as 8330, use of the MDL as a reporting limit can generate some results in which there is very low confidence. The minimum level of target analyte which can be detected and <u>accurately</u> quantitated is generally some multiple of the MDL. There is no uniform procedure by which this level is determined and depending on the procedure it may from 5 to 20 times higher than the MDL. The value is frequently called the Practical Quantitation Level (PQL), although many other terms are used to present the same idea.

Real samples contribute noise to the the analytical procedure and the instrument response which is independent of the procedure and instrument. The MDL is a performance characteristic which does not take into account any contribution to analytical inaccuracy by sample noise. The use of methods, such as 8330, which generate analyte identifications through retention time matches on analytical and confirmation columns are very prone to mis-

identification of target analytes through random non-target analyte signals appearing in the appropriate retention time window. As reporting levels are lowered there is increased probability that noise signals will coincidentially appear in the target analyte retention time window on both columns. If signals are found in samples which meet the method criteria for a confirmed hit, then to be in compliance with the method, a "hit" must be reported.

These samples associated with the Plum Brook contract exhibited considerable low level noise which was not found in blanks and other quality controls. Due to the inherent low level sample interference, there is less confidence in values reported for analytes close to the MDL. ASI is suggesting that a MDL multiplier of 20 be used to generate PQL's for these samples. This results in a PQL of 5 ppb for the water samples. Results reported between the MDL and the PQL should properly be flagged with a "J" as they are estimated quantitations on tentatively identified target analytes. Results reported as "BDL" at the MDL are confident in that the identification criteria for the target analyte were not met.

Roy-Keith Smith, PhD
AMM/QAM

LABORATORY REPORTS

PENTOLITE ROAD RED WATER PONDS SOIL BORINGS

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S1-0.0/2.0, 10/31/94, 11:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.7	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.9	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	150	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.7	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	23	2.1

BDL - Below Detection Limit

Report No. 56823-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S1-2.0/5.0, 10/31/94, 11:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	4.1	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.3	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.4	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	260	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	31	2.3

BDL - Below Detection Limit

Report No. 56823-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S2-0.0/3.0, 10/28/94, 15:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.5	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.9	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	110	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.7	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	22	2.2

BDL - Below Detection Limit

Report No. 56824-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S2-3.0/5.0, 10/28/94, 16:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.8	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	6.5	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.4	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.5	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	280	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	36	2.3

BDL - Below Detection Limit

Report No. 56824-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S2-5.0/10.0, 10/28/94, 16:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	6.0	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.4	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.5	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	400	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	19	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	49	2.5

BDL - Below Detection Limit

Report No. 56824-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.4	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dlier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S3-0.0/2.0, 10/30/94, 17:33, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.0	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.4	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	88	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.5	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	23	2.1

BDL - Below Detection Limit

Report No. 56823-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S3-2.0/5.0, 10/30/94, 17:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	3.9	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.2	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.0	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	310	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	38	2.4

BDL - Below Detection Limit

Report No. 56823-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dion

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S4-0.0/3.0, 10/30/94, 15:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.5	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.3	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	210	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.3	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	34	2.3

BDL - Below Detection Limit

Report No. 56824-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.7	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.1	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.8	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S4-3.0/5.0, 10/30/94, 15:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	8.0	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.9	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.3	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	560	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	46	2.5

BDL - Below Detection Limit

Report No. 56824-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	12	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	5.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.5	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	3.2	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S4-5.0/10.0, 10/30/94, 15:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.3	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	470	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.5

BDL - Below Detection Limit

Report No. 56824-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	6.8	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.8	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.1	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S5-0.0/3.0, 10/28/94, 13:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	15	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.8	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.5	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.2	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	200	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.8	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.2

BDL - Below Detection Limit

Report No. 56824-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S5-3.0/5.0, 10/28/94, 14:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	9.3	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.8	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	270	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	19	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.5

BDL - Below Detection Limit

Report No. 56824-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.7	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56824-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S5-5.0/10.0, 10/28/94, 14:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	27	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.2	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	490	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	27	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.5

BDL - Below Detection Limit

Report No. 56824-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.4	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S6-0.0/3.0, 10/29/94, 14:35, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	3.9	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	150	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.9	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	35	2.2

BDL - Below Detection Limit

Report No. 56811-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.7	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.1	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.4	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.9	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S6-3.0/5.0, 10/29/94, 14:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	6.3	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.5	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	280	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	12	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	41	2.4

BDL - Below Detection Limit

Report No. 56811-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	13	0.25
Nitrobenzene (NB)	1.1	0.26
2,4-Dinitrotoluene (2,4-DNT)	8.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	3.6	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	3.4	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S6-5.0/10.0, 10/29/94, 15:05, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	9.4	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.9	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	490	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	45	2.4

BDL - Below Detection Limit

Report No. 56811-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	18	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	7.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.5	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.0	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	3.8	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S7-0.0/3.0, 10/28/94, 17:20, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	3.7	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.4	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	230	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.6	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	25	2.3

BDL - Below Detection Limit

Report No. 56811-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S7-3.0/5.0, 10/28/94, 17:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.8	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	650	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	48	2.5

BDL - Below Detection Limit

Report No. 56811-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	6.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	3.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.4	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.1	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Deier

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LABORATORY REPORT

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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S7-5.0/10.0, 10/28/94, 17:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	8.3	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.2	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	10	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	500	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.5

BDL - Below Detection Limit

Report No. 56811-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.3	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.5	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S8-0.0/0.5, 12/15/94, 11:10, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.9	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.6	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	90	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.0	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	31	2.3

BDL - Below Detection Limit

Report No. 58168-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S8-0.0/2.0, 10/31/94, 12:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL UJ	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.0	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	3.9	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	86	4.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.4	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL UJ	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.1

BDL - Below Detection Limit

Report No. 56822-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL UJ	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL UJ	0.25
Nitrobenzene (NB)	BDL UJ	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL UJ	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL UJ	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL UJ	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL UJ	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL UJ	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL UJ	0.25
2-Nitrotoluene (2-NT)	BDL UJ	0.25
3-Nitrotoluene (3-NT)	BDL UJ	0.25
4-Nitrotoluene (4-NT)	BDL UJ	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL UJ	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL UJ	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	3	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S8-2.0/5.0, 10/31/94, 12:23, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.0
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.0
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.0	1.0
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	3.9	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	230	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.4	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.0
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	23	2.1

BDL - Below Detection Limit

Report No. 56822-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL UJ	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL UJ	0.25
Nitrobenzene (NB)	BDL UJ	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL UJ	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL UJ	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL UJ	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL UJ	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL UJ	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL UJ	0.25
2-Nitrotoluene (2-NT)	BDL UJ	0.25
3-Nitrotoluene (3-NT)	BDL UJ	0.25
4-Nitrotoluene (4-NT)	BDL UJ	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL UJ	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL UJ	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	4	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S9-0.0/3.0, 10/29/94, 16:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	4.6	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.8	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	130	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.3	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.2

BDL - Below Detection Limit

Report No. 56811-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.1	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.8	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.6	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S9-3.0/5.0, 10/29/94, 16:20, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	6.0	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.5	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	320	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	47	2.5

BDL - Below Detection Limit

Report No. 56811-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	6.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	3.8	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.5	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S9-5.0/10.0, 10/29/94, 16:35, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.7	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	11	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.3	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	10	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	415	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	48	2.4

BDL - Below Detection Limit

Report No. 56811-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	4.9	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.0	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.2	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S10-0.0/3.0, 10/29/94, 10:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	22	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	820	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	38	2.4

BDL - Below Detection Limit

Report No. 56811-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	15	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-11

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S10-3.0/5.0, 10/29/94, 11:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	9.6	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	14	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1040	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	35	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	65	2.4

BDL - Below Detection Limit

Report No. 56811-11

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.8	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.6	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56811-12

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S10-5.0/10.0, 10/29/94, 11:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	12	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	18	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.4	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	490	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	25	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	56	2.5

BDL - Below Detection Limit

Report No. 56811-12

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	5.2	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	2.2	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.5	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	21	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S11-0.0/3.0, 10/29/94, 08:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.9	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	150	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.4	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.2

BDL - Below Detection Limit

Report No. 56813-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S11-3.0/5.0, 10/29/94, 09:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.3	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	8.0	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	13	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.9	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	800	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	52	2.4

BDL - Below Detection Limit

Report No. 56813-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S11-5.0/10.0, 10/29/94, 09:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	16	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	720	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	30	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	58	2.5

BDL - Below Detection Limit

Report No. 56813-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S12-0.0/3.0, 10/30/94, 09:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	6.7	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.7	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	12	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	810	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.3	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.4

BDL - Below Detection Limit

Report No. 56813-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S12-3.0/5.0, 10/30/94, 09:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	11	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	12	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.9	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	520	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	49	2.4

BDL - Below Detection Limit

Report No. 56813-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.7	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.2	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.1	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S12-5.0/10.0, 10/30/94, 10:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	9.3	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	14	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.2	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	410	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	47	2.4

BDL - Below Detection Limit

Report No. 56813-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.8	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.5	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S13-0.0/0.5, 12/11/94, 12:30, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	10	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.9	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	390	5.0
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.0
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.5

BDL - Below Detection Limit

Report No. 58168-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	20	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S13-0.0/3.0, 10/31/94, 08:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	4.4	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.8	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.8	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	330	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.7	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.3

BDL - Below Detection Limit

Report No. 56813-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S13-3.0/5.0, 10/31/94, 09:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	3.6	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	11	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	530	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	53	2.2

BDL - Below Detection Limit

Report No. 56813-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S13-5.0/10.0, 10/31/94, 09:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	15	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	12	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	580	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	22	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	58	2.5

BDL - Below Detection Limit

Report No. 56813-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.5	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	9.4	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	5.2	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.5	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.5	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.7	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	3.2	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deer

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56813-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S13-3.0/10.0, 10/31/94, 10:30, received 11/1/94

RESULTS

	Result	Detection Limit
Extractable Organic Carbon (TOC) (mg/kg) (EPA 9060)	1990	13
Total Potassium (K) (mg/kg) (EPA 6010A)	1500	27
pH (laboratory) (EPA 9045)	8.00	-
Extractable Sulfate (SO_4) (mg/kg) (EPA 9038)	3330	667
Extractable Alkalinity (as $CaCO_3$) (mg/kg) (EPA 310.1M)	830	13
Extractable Nitrate Nitrogen (N) (mg/kg) (EPA 353.2M)	150	1
Total Kjeldahl Nitrogen (N) (mg/kg) (EPA 351.3M)	2130	7
Extractable Phosphorus (P) (mg/kg) (EPA 365.1M)	31	5
Cation Exchange Capacity (meq/100g) (EPA 9081) (Na Acetate)	5.2	0.0004
Moisture (%) (ASTM D2216)	24.5	0.1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S14-0.0/0.5, 12/11/94, 12:20, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.3	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.9	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	190	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.7	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.4

BDL - Below Detection Limit

Report No. 58168-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Klein

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LABORATORY REPORT

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6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 57081-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S14-0.0/3.0, 11/7/94, 10:30, received 11/10/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	3.4	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.1	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	170	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.6	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.1

BDL - Below Detection Limit

Report No. 57081-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
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January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 57081-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S14-3.0/5.0, 11/7/94, 10:40, received 11/10/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	6.6	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	225	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.4	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	47	2.2

BDL - Below Detection Limit

Report No. 57081-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	12000	2.5
1,3,5-Trinitrobenzene (1,3,5-TNB)	58	2.5
Nitrobenzene (NB)	BDL	2.6
2,4-Dinitrotoluene (2,4-DNT)	BDL	2.5
2,6-Dinitrotoluene (2,6-DNT)	BDL	2.6
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	2.5
3,4-Dinitrotoluene (3,4-DNT)	4.5	2.5
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	9.5	2.5
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	2.5
2-Nitrotoluene (2-NT)	BDL	2.5
3-Nitrotoluene (3-NT)	BDL	2.5
4-Nitrotoluene (4-NT)	BDL	2.5
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	2.5
1,3-Dinitrobenzene (1,3-DNB)	6.4	2.5

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 57081-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S14-5.0/10.0, 11/7/94, 10:55, received 11/10/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	4.3	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.0	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	260	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	21	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	85	2.5

BDL - Below Detection Limit

Report No. 57081-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	340	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	18	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	19	0.25
2,6-Dinitrotoluene (2,6-DNT)	2.9	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	1.7	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	2.0	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	0.9	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	6.7	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S15-0.0/3.0, 10/30/94, 11:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	4.6	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.9	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.8	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	320	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.3	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	29	2.2

BDL - Below Detection Limit

Report No. 56816-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S15-3.0/5.0, 10/30/94, 11:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	6.3	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.0	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.9	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	340	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	11	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.2

BDL - Below Detection Limit

Report No. 56816-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S15-5.0/10.0, 10/30/94, 11:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	11	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.2	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	780	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	59	2.5

BDL - Below Detection Limit

Report No. 56816-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	23	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	14	0.25
2,6-Dinitrotoluene (2,6-DNT)	2.0	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.9	0.25
3,4-Dinitrotoluene (3,4-DNT)	1.1	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	6.6	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S16-0.0/3.0, 10/30/94, 16:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	4.6	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	250	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.2	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	22	2.2

BDL - Below Detection Limit

Report No. 56816-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S16-3.0/5.0, 10/30/94, 16:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.6	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	19	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.0	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	210	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.2

BDL - Below Detection Limit

Report No. 56816-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	11	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S16-5.0/10.0, 10/30/94, 17:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	9.5	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.8	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	480	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	60	2.4

BDL - Below Detection Limit

Report No. 56816-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	14	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	8.9	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.0	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.6	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.8	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	4.3	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
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January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S17-0.0/0.5, 12/15/94, 11:25, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	5.8	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.0	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	185	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.1	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.5

BDL - Below Detection Limit

Report No. 58168-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S17-0.0/2.0, 10/31/94, 12:47, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	3.3	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.0	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	165	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.8	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	26	2.2

BDL - Below Detection Limit

Report No. 56822-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL UJ	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL UJ	0.25
Nitrobenzene (NB)	BDL UJ	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL UJ	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL UJ	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL UJ	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL UJ	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL UJ	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL UJ	0.25
2-Nitrotoluene (2-NT)	BDL UJ	0.25
3-Nitrotoluene (3-NT)	BDL UJ	0.25
4-Nitrotoluene (4-NT)	BDL UJ	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL UJ	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL UJ	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olier

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LABORATORY REPORT

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6 Piedmont Center, Suite #500
3525 Piedmont Road
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January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-11

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S17-2.0/5.0, 10/31/94, 12:57, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.1	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	7.1	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	18	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	11	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1500	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	28	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.3

BDL - Below Detection Limit

Report No. 56822-11

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL UJ	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL UJ	0.25
Nitrobenzene (NB)	BDL UJ	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL UJ	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL UJ	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL UJ	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL UJ	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL UJ	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL UJ	0.25
2-Nitrotoluene (2-NT)	BDL UJ	0.25
3-Nitrotoluene (3-NT)	BDL UJ	0.25
4-Nitrotoluene (4-NT)	BDL UJ	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL UJ	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL UJ	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
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Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S18-0.0/2.0, 10/30/94, 16:20, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	3.6	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.1	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.7	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.0	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	160	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	28	2.2

BDL - Below Detection Limit

Report No. 56823-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S18-2.0/5.0, 10/30/94, 16:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	6.4	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.6	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	390	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.4

BDL - Below Detection Limit

Report No. 56823-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S19-0.0/0.5, 12/11/94, 16:45, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	6.1	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.0	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	300	5.0
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.1	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.0
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.5

BDL - Below Detection Limit

Report No. 58168-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	20	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S19-0.0/3.0, 10/30/94, 13:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	4.6	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.5	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	370	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.9	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	37	2.2

BDL - Below Detection Limit

Report No. 56816-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olier

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LABORATORY REPORT

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3525 Piedmont Road
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January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S19-3.0/5.0, 10/30/94, 14:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.0	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.5	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	380	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.4

BDL - Below Detection Limit

Report No. 56816-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S19-5.0/10.0, 10/30/94, 14:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.8	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	7.9	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.8	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	570	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	48	2.4

BDL - Below Detection Limit

Report No. 56816-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.0	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.4	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
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Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S20-0.0/2.0, 10/30/94, 17:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	3.8	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.4	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	340	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	35	2.2

BDL - Below Detection Limit

Report No. 56823-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S20-2.0/5.0, 10/30/94, 17:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.7	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	10	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	140	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	14	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	38	2.3

BDL - Below Detection Limit

Report No. 56823-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S21-0.0/0.5, 10/30/94, 17:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.8	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	460	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.8	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	20	2.2

BDL - Below Detection Limit

Report No. 56823-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S22-0.0/0.5, 10/30/94, 17:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.0	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.2	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	130	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.4	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	19	2.2

BDL - Below Detection Limit

Report No. 56823-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.4	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-11

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S23-0.0/0.5, 10/30/94, 16:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	7.1	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.7	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	180	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	6.0	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	26	2.3

BDL - Below Detection Limit

Report No. 56823-11

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.0	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.4	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-12

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S24-0.0/0.5, 10/30/94, 16:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	5.6	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	14	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	180	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	4.7	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	17	2.2

BDL - Below Detection Limit

Report No. 56823-12

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.1	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S25-5.0/10.0, 10/29/94, 09:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	9.8	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	13	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1100	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	40	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	52	2.4

BDL - Below Detection Limit

Report No. 56816-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dia

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-11

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S26-5.0/10.0, 10/29/94, 11:50, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.7	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	13	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.7	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	10	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	420	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	29	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.4

BDL - Below Detection Limit

Report No. 56816-11

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	3.9	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.1	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.1	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56816-12

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S27-5.0/10.0, 10/30/94, 10:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	12	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	11	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	530	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	26	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	59	2.5

BDL - Below Detection Limit

Report No. 56816-12

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.8	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.8	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.9	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 57081-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S28-5.0/10.0, 11/7/94, 10:55, received 11/10/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	5.6	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.6	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.5	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	570	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.4

BDL - Below Detection Limit

Report No. 57081-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	280	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	8.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	10	0.25
2,6-Dinitrotoluene (2,6-DNT)	1.8	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	1.1	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.8	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	3.9	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-12

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S29-2.0/5.0, 10/31/94, 16:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	6.2	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	13	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	10	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	380	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	44	2.4

BDL - Below Detection Limit

Report No. 56822-12

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL UJ	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL UJ	0.25
Nitrobenzene (NB)	BDL UJ	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL UJ	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL UJ	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL UJ	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL UJ	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL UJ	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL UJ	0.25
2-Nitrotoluene (2-NT)	BDL UJ	0.25
3-Nitrotoluene (3-NT)	BDL UJ	0.25
4-Nitrotoluene (4-NT)	BDL UJ	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL UJ	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL UJ	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	15	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 9, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56823-13

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-S30-0.0/0.5, 10/30/94, 16:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	8.3	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.5	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	150	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	5.9	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.1

BDL - Below Detection Limit

Report No. 56823-13

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.9	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.4	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deis

LABORATORY REPORTS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S1-0.0/0.5, 10/27/94, 10:30, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	6.0	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	23	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	366	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	73	2.4

BDL - Below Detection Limit

Report No. 56720-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Olin

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S2-0.0/0.5, 10/27/94, 10:55, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	5.7	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.8	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.6	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.0	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	329	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	52	2.5

BDL - Below Detection Limit

Report No. 56720-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	21	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56720-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S3-0.0/0.5, 10/27/94, 14:20, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	7.2
Total Arsenic (As) (mg/kg) (EPA 7060)	6.5	4.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	11.3	2.9
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	3.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	841	5.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.36
Total Nickel (Ni) (mg/kg) (EPA 6010A)	29	2.9
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	7.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	78	2.9

BDL - Below Detection Limit

Report No. 56720-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	31	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S4-0.0/0.5, 10/29/94, 11:15, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.4	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	350	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	49	2.4

BDL - Below Detection Limit

Report No. 56822-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Weir

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S5-0.0/2.0, 10/17/94, 15:09, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	4.7	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	35	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1012	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	35	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	91	2.5

BDL - Below Detection Limit

Report No. 56448-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S5-2.0/5.0, 10/17/94, 15:52, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.1	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	11.7	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	305	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	26	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.4

BDL - Below Detection Limit

Report No. 56448-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	3.0	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	1.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.4	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.7	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S6-0.0/2.0, 10/17/94, 17:28, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.3	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	268	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	21	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	66	2.4

BDL - Below Detection Limit

Report No. 56448-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.3	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S6-2.0/5.0, 10/17/94, 17:44, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.4
Total Arsenic (As) (mg/kg) (EPA 7060)	5.6	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12.7	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.8	2.6
Total Lead (Pb) (mg/kg) (EPA 6010A)	11.5	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	282	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	22	2.6
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	56	2.6

BDL - Below Detection Limit

Report No. 56448-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	4.2	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	3.0	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.6	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.4	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	22	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

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December 21, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S7-0.0/2.0, 10/18/94, 14:51, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	4.4	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.6	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	300	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.2

BDL - Below Detection Limit

Report No. 56491-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dlier

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LABORATORY REPORT

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6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 21, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S7-2.0/5.0, 10/18/94, 15:08, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	5.1	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	14	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	20	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1011	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	31	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	60	2.3

BDL - Below Detection Limit

Report No. 56491-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.4	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S8-0.0/2.0, 10/18/94, 15:30, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	4.5	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	702	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	57	2.4

BDL - Below Detection Limit

Report No. 56491-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

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6 Piedmont Center, Suite #500
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December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S8-2.0/5.0, 10/18/94, 15:44, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	5.3	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.4	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.4	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.4	2.6
Total Manganese (Mn) (mg/kg) (EPA 6010A)	621	4.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.26
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	34	2.1

BDL - Below Detection Limit

Report No. 56491-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	5	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S9-0.0/2.0, 10/18/94, 16:48, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	6.2	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	30	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.6	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.8	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	163	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10.3	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.3

BDL - Below Detection Limit

Report No. 56491-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S9-2.0/5.0, 10/18/94, 17:07, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.5
Total Arsenic (As) (mg/kg) (EPA 7060)	3.9	3.9
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	23	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.6
Total Lead (Pb) (mg/kg) (EPA 6010A)	7.9	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	156	5.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.4	2.6
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	34	2.6

BDL - Below Detection Limit

Report No. 56491-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	23	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 56722-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S10-3.0/5.0, 10/27/94, 15:30, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.5
Total Arsenic (As) (mg/kg) (EPA 7060)	5.8	3.9
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	26	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.4	2.6
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.0	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	455	5.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.6
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	60	2.6

BDL - Below Detection Limit

Report No. 56722-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.4	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	5.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	5.1	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.7	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	2.3	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	23	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 56722-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S10-5.0/10.0, 10/27/94, 16:35, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	25	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.9	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	392	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	25	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	68	2.5

BDL - Below Detection Limit

Report No. 56722-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.1	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.3	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.5	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	21	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S11-0.0/2.0, 10/25/94, 11:43, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	5.1	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.8	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	466	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	27	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	76	2.3

BDL - Below Detection Limit

Report No. 56640-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S11-2.0/5.0, 10/25/94, 12:04, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	4.3	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10.6	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.4	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	267	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	19	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.2

BDL - Below Detection Limit

Report No. 56640-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S12-0.0/2.0, 10/25/94, 10:00, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.6	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	216	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	41	2.3

BDL - Below Detection Limit

Report No. 56640-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S12-2.0/5.0, 10/25/94, 10:20, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	7.2	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	29	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.5	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	373	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	29	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	58	2.4

BDL - Below Detection Limit

Report No. 56640-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S13-0.0/0.5, 12/13/94, 08:30, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	6.4	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.2	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	17	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	200	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	57	2.5

BDL - Below Detection Limit

Report No. 58168-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S13-0.0/3.0, 10/18/94, 13:45, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.4	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	184	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	55	2.3

BDL - Below Detection Limit

Report No. 56494-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

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3525 Piedmont Road
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December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S13-3.0/5.0, 10/18/94, 14:00, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11.0	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.8	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	11.1	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	220	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	22	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.4

BDL - Below Detection Limit

Report No. 56494-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.6	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S13-5.0/10.0, 10/18/94, 14:45, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	23	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	12	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	18	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	434	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	35	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	59	2.4

BDL - Below Detection Limit

Report No. 56494-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S14-0.0/2.0, 10/25/94, 09:05, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	5.6	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.3	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	398	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	45	2.2

BDL - Below Detection Limit

Report No. 56640-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	7	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S14-2.0/5.0, 10/25/94, 09:30, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	5.5	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.9	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.4	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.4	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	198	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	19	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	46	2.2

BDL - Below Detection Limit

Report No. 56640-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.4	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	0.5	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S15-0.0/2.0, 10/24/94, 16:45, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	6.1	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	17	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	433	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	21	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.2

BDL - Below Detection Limit

Report No. 56640-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S15-2.0/5.0, 10/24/94, 16:59, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	4.8	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.1	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	413	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.2

BDL - Below Detection Limit

Report No. 56640-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	8	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Oliver

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S16-0.0/2.0, 10/18/94, 17:46, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	4.4	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	21	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.8	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.4	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	165	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10.1	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	32	2.4

BDL - Below Detection Limit

Report No. 56491-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	15	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Olin

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S16-2.0/4.0, 10/18/94, 18:12, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.2
Total Arsenic (As) (mg/kg) (EPA 7060)	6.9	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.3	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.9	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	185	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.5	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.2
Total Zinc (Zn) (mg/kg) (EPA 6010A)	33	2.5

BDL - Below Detection Limit

Report No. 56491-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	19	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 11, 1995

P.O. No. ATL-4429

Attention: Ms. Deborah L. Raede

Report No. 58168-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S17-0.0/0.5, 12/13/94, 08:15, received 12/16/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.4	6.4
Total Arsenic (As) (mg/kg) (EPA 7060)	8.5	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.7	2.6
Total Lead (Pb) (mg/kg) (EPA 6010A)	22	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	270	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.6
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	69	2.6

BDL - Below Detection Limit

Report No. 58168-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	22	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S17-0.0/3.0, 10/19/94, 10:45, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.5	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	23	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1023	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	31	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	80	2.3

BDL - Below Detection Limit

Report No. 56494-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	0.3	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S17-3.0/5.0, 10/19/94, 11:15, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	8.5	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	8.2	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	398	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	22	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.3

BDL - Below Detection Limit

Report No. 56494-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Weir

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S17-5.0/10.0, 10/19/94, 11:45, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	5.4	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11.2	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	11.3	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	11.4	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	274	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	50	2.4

BDL - Below Detection Limit

Report No. 56494-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	2.1	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	4.2	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	3.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.5	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.9	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
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December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-7

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S18-0.0/3.0, 10/18/94, 16:15, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	3.9	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	20	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	16	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	1000	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	34	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	87	2.5

BDL - Below Detection Limit

Report No. 56494-7

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	21	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

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December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-8

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S18-3.0/5.0, 10/18/94, 16:30, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11.0	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	9.3	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	325	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.4

BDL - Below Detection Limit

Report No. 56494-8

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.9	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S18-5.0/10.0, 10/18/94, 17:00, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.7
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.0
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.9	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.3
Total Manganese (Mn) (mg/kg) (EPA 6010A)	333	5.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.33
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	57	2.7

BDL - Below Detection Limit

Report No. 56494-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.9	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	25	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
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December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-9

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S19-0.0/2.0, 10/24/94, 15:35, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	5.7	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.2	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	20	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	442	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	27	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	79	2.3

BDL - Below Detection Limit

Report No. 56640-9

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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Atlanta, GA 30305

December 27, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56640-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S19-2.0/5.0, 10/24/94, 15:55, received 10/26/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	7.7	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	11	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	494	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	31	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	66	2.3

BDL - Below Detection Limit

Report No. 56640-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	13	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
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January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S20-0.0/0.5, 10/29/94, 11:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	4.6	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.9	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	190	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	45	2.4

BDL - Below Detection Limit

Report No. 56822-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.7	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	17	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Blair

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LABORATORY REPORT

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Atlanta, GA 30305

December 16, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56448-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S21-0.0/2.0, 10/17/94, 15:09, received 10/19/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	5.2	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.0	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	695	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	29	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	72	2.4

BDL - Below Detection Limit

Report No. 56448-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56491-5

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S22-2.0/5.0, 10/18/94, 15:44, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.3
Total Arsenic (As) (mg/kg) (EPA 7060)	5.0	3.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	1.6	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	12	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	14	2.1
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.5	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	3300	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	52	2.1
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	37	2.1

BDL - Below Detection Limit

Report No. 56491-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	6	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56822-6

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S23-0.0/0.5, 10/29/94, 11:45, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	5.0	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	18	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.1	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	290	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.4

BDL - Below Detection Limit

Report No. 56822-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.5	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 20, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56494-10

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S24-5.0/10.0, 10/19/94, 11:45, received 10/20/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11.2	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.3	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	11.0	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	198	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.3

BDL - Below Detection Limit

Report No. 56494-10

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	3.0	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	3.1	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	3.8	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.3	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	0.3	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	1.5	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

LABORATORY REPORTS

BACKGROUND SOIL BORINGS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S1-0.5/3.0, 10/30/94, 10:39, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	6.8	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.6	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	8.5	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	270	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	41	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	1.4	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
Hexacosane	10	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	720
2-Chlorophenol	BDL	360
2,4-Dichlorophenol	BDL	360
2,4-Dimethylphenol	BDL	360
4,6-Dinitro-2-methylphenol	BDL	1790
2,4-Dinitrophenol	BDL	1790
2-Methylphenol	BDL	360
3-Methylphenol	BDL	360
4-Methylphenol	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2-Nitrophenol	BDL	360
4-Nitrophenol	BDL	1790
Pentachlorophenol	BDL	1790
Phenol	BDL	360
2,4,5-Trichlorophenol	BDL	360
2,4,6-Trichlorophenol	BDL	360
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	360
Acenaphthylene	BDL	360
Anthracene	BDL	360
Benzoic Acid	BDL	1790
Benzo(a)anthracene	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(ghi)perylene	BDL	360
Benzo(a)pyrene	BDL	360
Benzyl Alcohol	BDL	720
Bis(2-chloroethoxy)methane	BDL	360
Bis(2-chloroethyl)ether	BDL	360
Bis(2-chloroisopropyl)ether	BDL	360
Bis(2-ethylhexyl)phthalate	BDL	360
4-Bromophenyl phenyl ether	BDL	360
Benzyl butyl phthalate	BDL	360
4-Chloroaniline	BDL	720
2-Chloronaphthalene	BDL	360
4-Chlorophenyl phenyl ether	BDL	360
Chrysene	BDL	360
Dibenzo(a,h)anthracene	BDL	360
Dibenzofuran	BDL	360
Di-n-butylphthalate	BDL	360
1,3-Dichlorobenzene	BDL	360
1,4-Dichlorobenzene	BDL	360
1,2-Dichlorobenzene	BDL	360
3,3'-Dichlorobenzidine	BDL	720
Diethylphthalate	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	360
2,4-Dinitrotoluene	BDL	360
2,6-Dinitrotoluene	BDL	360
Di-n-octylphthalate	BDL	360
Fluoranthene	BDL	360
Fluorene	BDL	360
Hexachlorobenzene	BDL	360
Hexachlorobutadiene	BDL	360
Hexachlorocyclopentadiene	BDL	360
Hexachloroethane	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Isophorone	BDL	360
2-Methylnaphthalene	BDL	360
Naphthalene	BDL	360
2-Nitroaniline	BDL	1790
3-Nitroaniline	BDL	1790
4-Nitroaniline	BDL	720
Nitrobenzene	BDL	360
N-Nitrosodiphenylamine	BDL	360
N-Nitrosodi-n-propylamine	BDL	360
Phenanthrene	BDL	360
Pyrene	BDL	360
1,2,4-Trichlorobenzene	BDL	360

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
n-Nonacosane (C29)	340	-
n-Hentriacontane (C31)	330	-
Diacetone alcohol (Aldol-condensation product)	250	-
n-Heptacosane (C27)	240	-
unknown natural product, BP=204	240	-
n-Pentacosane (C25)	150	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S1-3.0/5.0, 10/30/94, 11:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	10	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	5.2	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.5	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	400	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	39	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	12	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	2.2	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
Unknown	13	-
Decanal	11	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	750
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1880
2,4-Dinitrophenol	BDL	1880
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1880
Pentachlorophenol	BDL	1880
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1880
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	750
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	410	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	750
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	750
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1880
3-Nitroaniline	BDL	1880
4-Nitroaniline	BDL	750
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
Diacetone alcohol (Aldol-condensation product)	260	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	150	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S2-0.5/3.0, 10/30/94, 11:40, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.3	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	8.4	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	2.3	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	340	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	51	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	10	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	1.2	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11
Tentatively identified compounds (EPA 8240)	None found	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	370
2,4-Dichlorophenol	BDL	370
2,4-Dimethylphenol	BDL	370
4,6-Dinitro-2-methylphenol	BDL	1830
2,4-Dinitrophenol	BDL	1830
2-Methylphenol	BDL	370
3-Methylphenol	BDL	370
4-Methylphenol	BDL	370
2-Nitrophenol	BDL	370
4-Nitrophenol	BDL	1830

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Pentachlorophenol	BDL	1830
Phenol	BDL	370
2,4,5-Trichlorophenol	BDL	370
2,4,6-Trichlorophenol	BDL	370
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	370
Acenaphthylene	BDL	370
Anthracene	BDL	370
Benzoic Acid	BDL	1830
Benzo(a)anthracene	BDL	370
Benzo(b)fluoranthene	BDL	370
Benzo(k)fluoranthene	BDL	370
Benzo(ghi)perylene	BDL	370
Benzo(a)pyrene	BDL	370
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	370
Bis(2-chloroethyl)ether	BDL	370
Bis(2-chloroisopropyl)ether	BDL	370
Bis(2-ethylhexyl)phthalate	BDL	370
4-Bromophenyl phenyl ether	BDL	370
Benzyl butyl phthalate	BDL	370
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	370
4-Chlorophenyl phenyl ether	BDL	370
Chrysene	BDL	370
Dibenzo(a,h)anthracene	BDL	370
Dibenzofuran	BDL	370
Di-n-butylphthalate	BDL	370
1,3-Dichlorobenzene	BDL	370
1,4-Dichlorobenzene	BDL	370
1,2-Dichlorobenzene	BDL	370
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	370
2,4-Dinitrotoluene	BDL	370
2,6-Dinitrotoluene	BDL	370
Di-n-octylphthalate	BDL	370
Fluoranthene	BDL	370
Fluorene	BDL	370
Hexachlorobenzene	BDL	370
Hexachlorobutadiene	BDL	370
Hexachlorocyclopentadiene	BDL	370
Hexachloroethane	BDL	370
Indeno(1,2,3-cd)pyrene	BDL	370
Isophorone	BDL	370
2-Methylnaphthalene	BDL	370
Naphthalene	BDL	370
2-Nitroaniline	BDL	1830
3-Nitroaniline	BDL	1830
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	370
N-Nitrosodiphenylamine	BDL	370
N-Nitrosodi-n-propylamine	BDL	370
Phenanthrene	BDL	370
Pyrene	BDL	370
1,2,4-Trichlorobenzene	BDL	370

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
Ethylene glycol phenyl ether	510	-
Diacetone alcohol (Aldol-condensation product)	340	-
unknown fatty aldehyde	300	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	160	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	160	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56810-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S2-3.0/5.0, 10/30/94, 12:05, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.8
Total Arsenic (As) (mg/kg) (EPA 7060)	12	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	4.0	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	9.9	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	314	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	17	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	45	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	14	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.3	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	4.5	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
2,2,3,4,6,6-hexamethyl Heptane	26	-
3,7-dimethyl Nonane	20	-
2,2-dimethyl Heptane	15	-
Unknown	9	-
4,5-dimethyl Nonane	7	-
2,2,4-trimethyl Heptane	7	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	770
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4,6-Dinitro-2-methylphenol	BDL	1920
2,4-Dinitrophenol	BDL	1920
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1920
Pentachlorophenol	BDL	1920
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1920
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	770
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	770
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	770
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56810-4

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1920
3-Nitroaniline	BDL	1920
4-Nitroaniline	BDL	770
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
Ethylene glycol phenyl ether	700	-
Diacetone alcohol (Aldol-condensation product)	510	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	200	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl propyl isobutyrate	190	-
unknown C6 alcohol	150	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Oliver

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S3-0.5/3.0, 11/1/94, 08:15, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.4
Total Arsenic (As) (mg/kg) (EPA 7060)	3.5	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	5.3	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	152	4.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.0	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	43	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	8	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.7	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	720
2-Chlorophenol	BDL	360
2,4-Dichlorophenol	BDL	360
2,4-Dimethylphenol	BDL	360
4,6-Dinitro-2-methylphenol	BDL	1790
2,4-Dinitrophenol	BDL	1790
2-Methylphenol	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
3-Methylphenol	BDL	360
4-Methylphenol	BDL	360
2-Nitrophenol	BDL	360
4-Nitrophenol	BDL	1790
Pentachlorophenol	BDL	1790
Phenol	BDL	360
2,4,5-Trichlorophenol	BDL	360
2,4,6-Trichlorophenol	BDL	360
Base/Neutral Extractable Organics (EPA 8270)	**(ug/kg)**	**(ug/kg)**
Acenaphthene	BDL	360
Acenaphthylene	BDL	360
Anthracene	BDL	360
Benzoic Acid	BDL	1790
Benzo(a)anthracene	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(ghi)perylene	BDL	360
Benzo(a)pyrene	BDL	360
Benzyl Alcohol	BDL	720
Bis(2-chloroethoxy)methane	BDL	360
Bis(2-chloroethyl)ether	BDL	360
Bis(2-chloroisopropyl)ether	BDL	360
Bis(2-ethylhexyl)phthalate	BDL	360
4-Bromophenyl phenyl ether	BDL	360
Benzyl butyl phthalate	BDL	360
4-Chloroaniline	BDL	720
2-Chloronaphthalene	BDL	360
4-Chlorophenyl phenyl ether	BDL	360
Chrysene	BDL	360
Dibenzo(a,h)anthracene	BDL	360
Dibenzofuran	BDL	360
Di-n-butylphthalate	BDL	360
1,3-Dichlorobenzene	BDL	360
1,4-Dichlorobenzene	BDL	360
1,2-Dichlorobenzene	BDL	360
3,3'-Dichlorobenzidine	BDL	720
Diethylphthalate	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	360
2,4-Dinitrotoluene	BDL	360
2,6-Dinitrotoluene	BDL	360
Di-n-octylphthalate	BDL	360
Fluoranthene	BDL	360
Fluorene	BDL	360
Hexachlorobenzene	BDL	360
Hexachlorobutadiene	BDL	360
Hexachlorocyclopentadiene	BDL	360
Hexachloroethane	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Isophorone	BDL	360
2-Methylnaphthalene	BDL	360
Naphthalene	BDL	360
2-Nitroaniline	BDL	1790
3-Nitroaniline	BDL	1790
4-Nitroaniline	BDL	720
Nitrobenzene	BDL	360
N-Nitrosodiphenylamine	BDL	360
N-Nitrosodi-n-propylamine	BDL	360
Phenanthrene	BDL	360
Pyrene	BDL	360
1,2,4-Trichlorobenzene	BDL	360

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
unknown natural product, BP=204	870
unknown natural product, BP=189	520

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S3-3.0/4.0, 11/1/94, 09:00, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.5
Total Arsenic (As) (mg/kg) (EPA 7060)	15	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	35	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	24	2.7
Total Manganese (Mn) (mg/kg) (EPA 6010A)	154	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.27
Total Nickel (Ni) (mg/kg) (EPA 6010A)	33	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	187	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	9	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.9	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)
1-chloro-Tetradecane	77
2-methyl-Heptane	64
3-methyl-Heptane	43
Heptane	36
Unknown	30
4-methyl-Octane	24
3-methyl-Hexane	13
1-ethyl-4-methyl-,trans-Cyclohexane	13
Unknown	13
3-methyl-Octane	12

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	360
2,4-Dichlorophenol	BDL	360
2,4-Dimethylphenol	BDL	360
4,6-Dinitro-2-methylphenol	BDL	1810
2,4-Dinitrophenol	BDL	1810
2-Methylphenol	BDL	360
3-Methylphenol	BDL	360
4-Methylphenol	BDL	360
2-Nitrophenol	BDL	360
4-Nitrophenol	BDL	1810
Pentachlorophenol	BDL	1810
Phenol	BDL	360
2,4,5-Trichlorophenol	BDL	360
2,4,6-Trichlorophenol	BDL	360
Base/Neutral Extractable Organics (EPA 8270)	**(ug/kg)**	**(ug/kg)**
Acenaphthene	BDL	360
Acenaphthylene	BDL	360
Anthracene	BDL	360
Benzoic Acid	BDL	1810
Benzo(a)anthracene	BDL	360
Benzo(b)fluoranthene	BDL	360
Benzo(k)fluoranthene	BDL	360
Benzo(ghi)perylene	BDL	360
Benzo(a)pyrene	BDL	360
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	360
Bis(2-chloroethyl)ether	BDL	360
Bis(2-chloroisopropyl)ether	BDL	360
Bis(2-ethylhexyl)phthalate	BDL	360
4-Bromophenyl phenyl ether	BDL	360
Benzyl butyl phthalate	BDL	360
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	360
4-Chlorophenyl phenyl ether	BDL	360
Chrysene	BDL	360
Dibenzo(a,h)anthracene	BDL	360
Dibenzofuran	BDL	360
Di-n-butylphthalate	BDL	360

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
1,3-Dichlorobenzene	BDL	360
1,4-Dichlorobenzene	BDL	360
1,2-Dichlorobenzene	BDL	360
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	360
Dimethylphthalate	BDL	360
2,4-Dinitrotoluene	BDL	360
2,6-Dinitrotoluene	BDL	360
Di-n-octylphthalate	BDL	360
Fluoranthene	BDL	360
Fluorene	BDL	360
Hexachlorobenzene	BDL	360
Hexachlorobutadiene	BDL	360
Hexachlorocyclopentadiene	BDL	360
Hexachloroethane	BDL	360
Indeno(1,2,3-cd)pyrene	BDL	360
Isophorone	BDL	360
2-Methylnaphthalene	BDL	360
Naphthalene	BDL	360
2-Nitroaniline	BDL	1810
3-Nitroaniline	BDL	1810
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	360
N-Nitrosodiphenylamine	BDL	360
N-Nitrosodi-n-propylamine	BDL	360
Phenanthrene	BDL	360
Pyrene	BDL	360
1,2,4-Trichlorobenzene	BDL	360

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
n-Undecane (C11)	850
n-Decane (C10)	850
n-Nonane (C9)	700
n-Dodecane (C12)	690
n-Tridecane (C13)	650
n-Pentadecane (C15)	570
Ethylene glycol phenyl ether	560
n-Tetradecane (C14)	500

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-2

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
Methyl Carbitol + unknown C10 cycloparaffin..	460
n-Hexadecane (C16).....	420
unknown C11 isoparaffinic hydrocarbon.....	350
unknown natural product, BP=69, MW=316.....	320
unknown C13 isoparaffinic hydrocarbon.....	310
Dodecanoic acid.....	300
unknown C10 cycloparaffinic hydrocarbons.....	300
unknown C15 isoparaffinic hydrocarbon.....	300
unknown C10 isoparaffinic hydrocarbon.....	290
unknown C13 isoparaffinic hydrocarbon.....	250
unknown C18 isoparaffinic hydrocarbon.....	240
n-Heptadecane (C17).....	240

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S4-0.5/3.0, 10/30/94, 10:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.6	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	17	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	34	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	27	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	24	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	11	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	13	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	17	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	3.5	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	3.5	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)	
2-ethyl-1,3-dimethyl-Benzene	17 NJ	-
1-methyl-Naphthalene	7 NJ	-
Unknown	7 ~~NJ~~ J	-
Unknown	7 ~~NJ~~ 806 2.645 J	-
1-ethyl-2,4-dimethyl-Benzene	6 NJ	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	800
2-Chlorophenol	BDL	400
2,4-Dichlorophenol	BDL	400
2,4-Dimethylphenol	BDL	400
4,6-Dinitro-2-methylphenol	BDL	1990

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2,4-Dinitrophenol	BDL	1990
2-Methylphenol	BDL	400
3-Methylphenol	BDL	400
4-Methylphenol	BDL	400
2-Nitrophenol	BDL	400
4-Nitrophenol	BDL	1990
Pentachlorophenol	BDL	1990
Phenol	BDL	400
2,4,5-Trichlorophenol	BDL	400
2,4,6-Trichlorophenol	BDL	400
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	400
Acenaphthylene	BDL	400
Anthracene	BDL	400
Benzoic Acid	BDL	1990
Benzo(a)anthracene	BDL	400
Benzo(b)fluoranthene	BDL	400
Benzo(k)fluoranthene	BDL	400
Benzo(ghi)perylene	BDL	400
Benzo(a)pyrene	BDL	400
Benzyl Alcohol	BDL	800
Bis(2-chloroethoxy)methane	BDL	400
Bis(2-chloroethyl)ether	BDL	400
Bis(2-chloroisopropyl)ether	BDL	400
Bis(2-ethylhexyl)phthalate	1070	400
4-Bromophenyl phenyl ether	BDL	400
Benzyl butyl phthalate	BDL	400
4-Chloroaniline	BDL	800
2-Chloronaphthalene	BDL	400
4-Chlorophenyl phenyl ether	BDL	400
Chrysene	BDL	400
Dibenzo(a,h)anthracene	BDL	400
Dibenzofuran	BDL	400
Di-n-butylphthalate	BDL	400
1,3-Dichlorobenzene	BDL	400
1,4-Dichlorobenzene	BDL	400
1,2-Dichlorobenzene	BDL	400
3,3'-Dichlorobenzidine	BDL	800
Diethylphthalate	BDL	400

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	400
2,4-Dinitrotoluene	BDL	400
2,6-Dinitrotoluene	BDL	400
Di-n-octylphthalate	BDL	400
Fluoranthene	BDL	400
Fluorene	BDL	400
Hexachlorobenzene	BDL	400
Hexachlorobutadiene	BDL	400
Hexachlorocyclopentadiene	BDL	400
Hexachloroethane	BDL	400
Indeno(1,2,3-cd)pyrene	BDL	400
Isophorone	BDL	400
2-Methylnaphthalene	BDL	400
Naphthalene	BDL	400
2-Nitroaniline	BDL	1990
3-Nitroaniline	BDL	1990
4-Nitroaniline	BDL	800
Nitrobenzene	BDL	400
N-Nitrosodiphenylamine	BDL	400
N-Nitrosodi-n-propylamine	BDL	400
Phenanthrene	BDL	400
Pyrene	BDL	400
1,2,4-Trichlorobenzene	BDL	400

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl isobutyrate	6870 NJ	-
unknown natural product, BP=204	3000 N	-
unknown natural product, BP=189	1130 N	-
Ethylene glycol phenyl ether	940 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	520 NJ	-
Diacetone alcohol (Aldol-condensation product)	390 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	340 NJ	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
Unknown	205 ~~N~~ J BP=245	-
unknown natural product, BP=245	205 N	-
n-Pentacosane (C25)	190 NJ	-
n-Hexacosane (C26)	190 NJ	-
n-Heptacosane (C27)	190 NJ	-
unknown oxygenate (Di-sec-butoxymethane?)	170 N	-
n-Pentadecane (C15)	160 NJ	-
Butyl Carbitol	160 NJ	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S5-0.5/3.0, 10/30/94, 12:00, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.7	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	17	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	10	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	220	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	28	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	54	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	1.2 J	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)
Unknown	9~~1~~ J BD 2.645

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	370
2,4-Dichlorophenol	BDL	370
2,4-Dimethylphenol	BDL	370
4,6-Dinitro-2-methylphenol	BDL	1830

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2,4-Dinitrophenol	BDL	1830
2-Methylphenol	BDL	370
3-Methylphenol	BDL	370
4-Methylphenol	BDL	370
2-Nitrophenol	BDL	370
4-Nitrophenol	BDL	1830
Pentachlorophenol	BDL	1830
Phenol	BDL	370
2,4,5-Trichlorophenol	BDL	370
2,4,6-Trichlorophenol	BDL	370
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	370
Acenaphthylene	BDL	370
Anthracene	BDL	370
Benzoic Acid	BDL	1830
Benzo(a)anthracene	BDL	370
Benzo(b)fluoranthene	BDL	370
Benzo(k)fluoranthene	BDL	370
Benzo(ghi)perylene	BDL	370
Benzo(a)pyrene	BDL	370
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	370
Bis(2-chloroethyl)ether	BDL	370
Bis(2-chloroisopropyl)ether	BDL	370
Bis(2-ethylhexyl)phthalate	980	370
4-Bromophenyl phenyl ether	BDL	370
Benzyl butyl phthalate	BDL	370
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	370
4-Chlorophenyl phenyl ether	BDL	370
Chrysene	BDL	370
Dibenzo(a,h)anthracene	BDL	370
Dibenzofuran	BDL	370
Di-n-butylphthalate	BDL	370
1,3-Dichlorobenzene	BDL	370
1,4-Dichlorobenzene	BDL	370
1,2-Dichlorobenzene	BDL	370
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	370
2,4-Dinitrotoluene	BDL	370
2,6-Dinitrotoluene	BDL	370
Di-n-octylphthalate	BDL	370
Fluoranthene	BDL	370
Fluorene	BDL	370
Hexachlorobenzene	BDL	370
Hexachlorobutadiene	BDL	370
Hexachlorocyclopentadiene	BDL	370
Hexachloroethane	BDL	370
Indeno(1,2,3-cd)pyrene	BDL	370
Isophorone	BDL	370
2-Methylnaphthalene	BDL	370
Naphthalene	BDL	370
2-Nitroaniline	BDL	1830
3-Nitroaniline	BDL	1830
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	370
N-Nitrosodiphenylamine	BDL	370
N-Nitrosodi-n-propylamine	BDL	370
Phenanthrene	BDL	370
Pyrene	BDL	370
1,2,4-Trichlorobenzene	BDL	370

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl isobutyrate	1220 NJ	-
unknown natural product, BP=204	440 N	-
Ethylene glycol phenyl ether	370 NJ	-
n-Nonacontane (C29)	270 NJ	-
Unknown	270 ~~NJ~~ 2.0.95 J	-
n-Hentriacontane (C31)	240 NJ	-
n-Heneicosane (C21)	190 NJ	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-3

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
n-Docosane (C22)	190 NJ	-
n-Tricosane (C23)	190 NJ	-
unknown natural product, BP=189	180 N	-
n-Heptadecane (C17)	180 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	170 NJ	-
n-Eicosane (C20)	170 NJ	-
n-Nonadecane (C19)	170 NJ	-
Diacetone alcohol (Aldol-condensation product)	160 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	160 NJ	-
n-Tetracosane (C24)	140 NJ	-
unknown fatty aldehyde	140 N	

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S5-3.0/5.0, 10/30/94, 12:10, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	5.9	5.9
Total Arsenic (As) (mg/kg) (EPA 7060)	6.1	3.5
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	29	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	6.7	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	330	4.7
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	33	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.7
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	64	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	15	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12
Tentatively identified compounds (EPA 8240)	None found	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	780
2-Chlorophenol	BDL	390
2,4-Dichlorophenol	BDL	390
2,4-Dimethylphenol	BDL	390
4,6-Dinitro-2-methylphenol	BDL	1940
2,4-Dinitrophenol	BDL	1940
2-Methylphenol	BDL	390
3-Methylphenol	BDL	390
4-Methylphenol	BDL	390
2-Nitrophenol	BDL	390
4-Nitrophenol	BDL	1940
Pentachlorophenol	BDL	1940

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Phenol	BDL	390
2,4,5-Trichlorophenol	BDL	390
2,4,6-Trichlorophenol	BDL	390
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	390
Acenaphthylene	BDL	390
Anthracene	BDL	390
Benzoic Acid	BDL	1940
Benzo(a)anthracene	BDL	390
Benzo(b)fluoranthene	BDL	390
Benzo(k)fluoranthene	BDL	390
Benzo(ghi)perylene	BDL	390
Benzo(a)pyrene	BDL	390
Benzyl Alcohol	BDL	780
Bis(2-chloroethoxy)methane	BDL	390
Bis(2-chloroethyl)ether	BDL	390
Bis(2-chloroisopropyl)ether	BDL	390
Bis(2-ethylhexyl)phthalate	BDL	390
4-Bromophenyl phenyl ether	BDL	390
Benzyl butyl phthalate	BDL	390
4-Chloroaniline	BDL	780
2-Chloronaphthalene	BDL	390
4-Chlorophenyl phenyl ether	BDL	390
Chrysene	BDL	390
Dibenzo(a,h)anthracene	BDL	390
Dibenzofuran	BDL	390
Di-n-butylphthalate	BDL	390
1,3-Dichlorobenzene	BDL	390
1,4-Dichlorobenzene	BDL	390
1,2-Dichlorobenzene	BDL	390
3,3'-Dichlorobenzidine	BDL	780
Diethylphthalate	BDL	390

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	390
2,4-Dinitrotoluene	BDL	390
2,6-Dinitrotoluene	BDL	390
Di-n-octylphthalate	BDL	390
Fluoranthene	BDL	390
Fluorene	BDL	390
Hexachlorobenzene	BDL	390
Hexachlorobutadiene	BDL	390
Hexachlorocyclopentadiene	BDL	390
Hexachloroethane	BDL	390
Indeno(1,2,3-cd)pyrene	BDL	390
Isophorone	BDL	390
2-Methylnaphthalene	BDL	390
Naphthalene	BDL	390
2-Nitroaniline	BDL	1940
3-Nitroaniline	BDL	1940
4-Nitroaniline	BDL	780
Nitrobenzene	BDL	390
N-Nitrosodiphenylamine	BDL	390
N-Nitrosodi-n-propylamine	BDL	390
Phenanthrene	BDL	390
Pyrene	BDL	390
1,2,4-Trichlorobenzene	BDL	390

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl		-
isobutyrate	1400 NJ	-
Ethylene glycol phenyl ether	800 NJ	-
n-Hexadecane (C16)	500 NJ	-
unknown C18 isoparaffinic hydrocarbon	450 N	-
n-Docosane (C22)	420 NJ	-
n-Heptadecane (C17)	410 NJ	-
n-Pentadecane (C15)	380 NJ	-
Diacetone alcohol (Aldol-condensation product)	370 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	370 NJ	-
n-Nonadecane (C19)	350 NJ	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-4

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
n-Tricosane (C23)	340 NJ	-
n-Eicosane (C20)	320 NJ	-
n-Pentacosane (C25)	310 NJ	-
n-Tetracosane (C24)	290 NJ	-
n-Heneicosane (C21)	270 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl isobutyrate	260 NJ	-
n-Hexacosane (C26)	250 NJ	-
n-Heptacosane (C27)	240 NJ	-
unknown C17 isoparaffinic hydrocarbon	240 N	-
n-Octadecane (C18)	220 NJ	-

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S6-0.5/3.0, 11/1/94, 09:30, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.4	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	23	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	6.0	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	14	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	78	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	15	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	56	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	13	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	760
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1900
2,4-Dinitrophenol	BDL	1900
2-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection (ug/kg)
3-Methylphenol	BDL	380
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1900
Pentachlorophenol	BDL	1900
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1900
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	760
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	760
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	760
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1900
3-Nitroaniline	BDL	1900
4-Nitroaniline	BDL	760
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	160
n-Octacosane (C28)	150
n-Nonacosane (C29)	150

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56894-4

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S6-3.0/4.5, 11/1/94, 09:45, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	8.3	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.1	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	7.5	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	11	2.9
Total Manganese (Mn) (mg/kg) (EPA 6010A)	21	4.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.29
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	34	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	13	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	760
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1900
2,4-Dinitrophenol	BDL	1900
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Methylphenol	BDL	380
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1900
Pentachlorophenol	BDL	1900
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1900
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	760
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	760
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	760
Diethylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56894-4

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1900
3-Nitroaniline	BDL	1900
4-Nitroaniline	BDL	760
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	160
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methyl] phenol (Santowhite antioxidant)	160
n-Nonacosane (C29)	160

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56907-1

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S7-0.5/3.0, 11/1/94, 10:20, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	7.5	5.7
Total Arsenic (As) (mg/kg) (EPA 7060)	14	3.4
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	34	2.3
Total Lead (Pb) (mg/kg) (EPA 6010A)	22	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	63	4.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	24	2.3
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.7
Total Zinc (Zn) (mg/kg) (EPA 6010A)	32	2.3

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	12	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	23
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	23
Carbon disulfide	BDL	23
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	750
2-Chlorophenol	BDL	380
2,4-Dichlorophenol	BDL	380
2,4-Dimethylphenol	BDL	380
4,6-Dinitro-2-methylphenol	BDL	1880
2,4-Dinitrophenol	BDL	1880
2-Methylphenol	BDL	380
3-Methylphenol	BDL	380
4-Methylphenol	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2-Nitrophenol	BDL	380
4-Nitrophenol	BDL	1880
Pentachlorophenol	BDL	1880
Phenol	BDL	380
2,4,5-Trichlorophenol	BDL	380
2,4,6-Trichlorophenol	BDL	380
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	380
Acenaphthylene	BDL	380
Anthracene	BDL	380
Benzoic Acid	BDL	1880
Benzo(a)anthracene	BDL	380
Benzo(b)fluoranthene	BDL	380
Benzo(k)fluoranthene	BDL	380
Benzo(ghi)perylene	BDL	380
Benzo(a)pyrene	BDL	380
Benzyl Alcohol	BDL	750
Bis(2-chloroethoxy)methane	BDL	380
Bis(2-chloroethyl)ether	BDL	380
Bis(2-chloroisopropyl)ether	BDL	380
Bis(2-ethylhexyl)phthalate	BDL	380
4-Bromophenyl phenyl ether	BDL	380
Benzyl butyl phthalate	BDL	380
4-Chloroaniline	BDL	750
2-Chloronaphthalene	BDL	380
4-Chlorophenyl phenyl ether	BDL	380
Chrysene	BDL	380
Dibenzo(a,h)anthracene	BDL	380
Dibenzofuran	BDL	380
Di-n-butylphthalate	BDL	380
1,3-Dichlorobenzene	BDL	380
1,4-Dichlorobenzene	BDL	380
1,2-Dichlorobenzene	BDL	380
3,3'-Dichlorobenzidine	BDL	750
Diethylphthalate	BDL	380
Dimethylphthalate	BDL	380
2,4-Dinitrotoluene	BDL	380
2,6-Dinitrotoluene	BDL	380
Di-n-octylphthalate	BDL	380

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Fluoranthene	BDL	380
Fluorene	BDL	380
Hexachlorobenzene	BDL	380
Hexachlorobutadiene	BDL	380
Hexachlorocyclopentadiene	BDL	380
Hexachloroethane	BDL	380
Indeno(1,2,3-cd)pyrene	BDL	380
Isophorone	BDL	380
2-Methylnaphthalene	BDL	380
Naphthalene	BDL	380
2-Nitroaniline	BDL	1880
3-Nitroaniline	BDL	1880
4-Nitroaniline	BDL	750
Nitrobenzene	BDL	380
N-Nitrosodiphenylamine	BDL	380
N-Nitrosodi-n-propylamine	BDL	380
Phenanthrene	BDL	380
Pyrene	BDL	380
1,2,4-Trichlorobenzene	BDL	380

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
unknown natural product, BP=204	2800
unknown natural product, BP=189	1080
n-Nonacosane (C29)	420
n-Triacontane (C30)	380
Ethylene glycol phenyl ether	350
unknown fatty aldehyde	350
unknown fatty aldehyde	260
unknown natural product, BP=191	250
unknown C18 isoparaffinic hydrocarbon	210

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
unknown fatty acid	190
n-Heptacosane (C27)	190
n-Octacosane (C28)	170
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	170
Methyl Carbitol	160
n-Nonadecane (C19)	160
n-Docosane (C22)	160
n-Heptadecane (C17)	160

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise L. Dier

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56812-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S8-0.5/3.0, 10/30/94, 10:30, received 11/1/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	6.4	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	19	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL UJ	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	27	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	23	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	8.7	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	9.4	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	10	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	16	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	4.6	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	1.3	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240)	Estimated Conc. (ug/kg)
2,2,3,4,6,6-hexamethyl-Heptane	26NJ
4-ethyl-2,2,6,6-tetramethyl-Heptane	14NJ
3,7-dimethyl-Nonane	11NJ

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	790
2-Chlorophenol	BDL	390
2,4-Dichlorophenol	BDL	390
2,4-Dimethylphenol	BDL	390
4,6-Dinitro-2-methylphenol	BDL	1960
2,4-Dinitrophenol	BDL	1960

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
2-Methylphenol	BDL	390
3-Methylphenol	BDL	390
4-Methylphenol	BDL	390
2-Nitrophenol	BDL	390
4-Nitrophenol	BDL	1960
Pentachlorophenol	BDL	1960
Phenol	BDL	390
2,4,5-Trichlorophenol	BDL	390
2,4,6-Trichlorophenol	BDL	390
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	390
Acenaphthylene	BDL	390
Anthracene	BDL	390
Benzoic Acid	BDL	1960
Benzo(a)anthracene	BDL	390
Benzo(b)fluoranthene	BDL	390
Benzo(k)fluoranthene	BDL	390
Benzo(ghi)perylene	BDL	390
Benzo(a)pyrene	BDL	390
Benzyl Alcohol	BDL	790
Bis(2-chloroethoxy)methane	BDL	390
Bis(2-chloroethyl)ether	BDL	390
Bis(2-chloroisopropyl)ether	BDL	390
Bis(2-ethylhexyl)phthalate	BDL	390
4-Bromophenyl phenyl ether	BDL	390
Benzyl butyl phthalate	BDL	390
4-Chloroaniline	BDL	790
2-Chloronaphthalene	BDL	390
4-Chlorophenyl phenyl ether	BDL	390
Chrysene	BDL	390
Dibenzo(a,h)anthracene	BDL	390
Dibenzofuran	BDL	390
Di-n-butylphthalate	BDL	390
1,3-Dichlorobenzene	BDL	390
1,4-Dichlorobenzene	BDL	390
1,2-Dichlorobenzene	BDL	390
3,3'-Dichlorobenzidine	BDL	790
Diethylphthalate	BDL	390

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	390
2,4-Dinitrotoluene	BDL	390
2,6-Dinitrotoluene	BDL	390
Di-n-octylphthalate	BDL	390
Fluoranthene	BDL	390
Fluorene	BDL	390
Hexachlorobenzene	BDL	390
Hexachlorobutadiene	BDL	390
Hexachlorocyclopentadiene	BDL	390
Hexachloroethane	BDL	390
Indeno(1,2,3-cd)pyrene	BDL	390
Isophorone	BDL	390
2-Methylnaphthalene	BDL	390
Naphthalene	BDL	390
2-Nitroaniline	BDL	1960
3-Nitroaniline	BDL	1960
4-Nitroaniline	BDL	790
Nitrobenzene	BDL	390
N-Nitrosodiphenylamine	BDL	390
N-Nitrosodi-n-propylamine	BDL	390
Phenanthrene	BDL	390
Pyrene	BDL	390
1,2,4-Trichlorobenzene	BDL	390

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	
1-(1,1-Dimethylethyl)-2-methyl-1,3-propanediyl		-
isobutyrate	4500 NJ	-
unknown natural product, BP=204	1670 N	-
unknown natural product, BP=189	950 N	-
Ethylene glycol phenyl ether	950 NJ	-
natural oleic acid derivative, BP=218	890 NJ	-
Diacetone alcohol (Aldol-condensation product)	540 NJ	-
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	430 NJ	-
n-Pentadecane (C15)	360 NJ	-
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propyl		
isobutyrate	310 NJ	-
unknown natural product, BP=218	300 N	-
unknown natural product, BP=95	290 N	-
unknown natural alcohol	270 N	-

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56812-2

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)	Detection Limit (ug/kg)
n-Docosane (C22)	270 NJ	-
n-Hentriacontane (C31)	270 NJ	-
unknown C18 isoparaffinic hydrocarbon	260 N	-
n-Heptadecane (C17)	240 NJ	-
n-Tetradecane (C14)	240 NJ	-
n-Tridecane (C13)	230 NJ	-
n-Dodecane (C12)	230 NJ	-
n-Nonacontane (C29)	210 NJ	-

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56907-2

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S9-0.5/3.0, 11/1/94, 11:45, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	5.6
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.3
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.1
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.1
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.2	1.1
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	6.6	2.8
Total Manganese (Mn) (mg/kg) (EPA 6010A)	133	4.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.28
Total Nickel (Ni) (mg/kg) (EPA 6010A)	7.6	2.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.1
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	5.6
Total Zinc (Zn) (mg/kg) (EPA 6010A)	24	2.2

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	10	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	22
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	22
Carbon disulfide	BDL	22
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection Limit (ug/kg)
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	11
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	11
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	11
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	11
1,2-Dibromoethane	BDL	11

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	730
2-Chlorophenol	BDL	370
2,4-Dichlorophenol	BDL	370
2,4-Dimethylphenol	BDL	370
4,6-Dinitro-2-methylphenol	BDL	1830
2,4-Dinitrophenol	BDL	1830
2-Methylphenol	BDL	370
3-Methylphenol	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
4-Methylphenol	BDL	370
2-Nitrophenol	BDL	370
4-Nitrophenol	BDL	1830
Pentachlorophenol	BDL	1830
Phenol	BDL	370
2,4,5-Trichlorophenol	BDL	370
2,4,6-Trichlorophenol	BDL	370
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	370
Acenaphthylene	BDL	370
Anthracene	BDL	370
Benzoic Acid	BDL	1830
Benzo(a)anthracene	BDL	370
Benzo(b)fluoranthene	BDL	370
Benzo(k)fluoranthene	BDL	370
Benzo(ghi)perylene	BDL	370
Benzo(a)pyrene	BDL	370
Benzyl Alcohol	BDL	730
Bis(2-chloroethoxy)methane	BDL	370
Bis(2-chloroethyl)ether	BDL	370
Bis(2-chloroisopropyl)ether	BDL	370
Bis(2-ethylhexyl)phthalate	BDL	370
4-Bromophenyl phenyl ether	BDL	370
Benzyl butyl phthalate	BDL	370
4-Chloroaniline	BDL	730
2-Chloronaphthalene	BDL	370
4-Chlorophenyl phenyl ether	BDL	370
Chrysene	BDL	370
Dibenzo(a,h)anthracene	BDL	370
Dibenzofuran	BDL	370
Di-n-butylphthalate	BDL	370
1,3-Dichlorobenzene	BDL	370
1,4-Dichlorobenzene	BDL	370
1,2-Dichlorobenzene	BDL	370
3,3'-Dichlorobenzidine	BDL	730
Diethylphthalate	BDL	370

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-2

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	370
2,4-Dinitrotoluene	BDL	370
2,6-Dinitrotoluene	BDL	370
Di-n-octylphthalate	BDL	370
Fluoranthene	BDL	370
Fluorene	BDL	370
Hexachlorobenzene	BDL	370
Hexachlorobutadiene	BDL	370
Hexachlorocyclopentadiene	BDL	370
Hexachloroethane	BDL	370
Indeno(1,2,3-cd)pyrene	BDL	370
Isophorone	BDL	370
2-Methylnaphthalene	BDL	370
Naphthalene	BDL	370
2-Nitroaniline	BDL	1830
3-Nitroaniline	BDL	1830
4-Nitroaniline	BDL	730
Nitrobenzene	BDL	370
N-Nitrosodiphenylamine	BDL	370
N-Nitrosodi-n-propylamine	BDL	370
Phenanthrene	BDL	370
Pyrene	BDL	370
1,2,4-Trichlorobenzene	BDL	370

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
Ethylene glycol phenyl ether	660
Methyl Carbitol	510
unknown fatty amide	320
Butyl Carbitol	180

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56907-3

Sample: Soil, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BG-S9-3.0/5.0, 11/1/94, 12:15, received 11/3/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	15	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	17	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	695	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	30	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	61	2.4

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

Volatile Organics (EPA 8240)	(ug/kg)	(ug/kg)
Acetone	BDL	24
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	24
Carbon disulfide	BDL	24
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/kg)	Detection (ug/kg)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	12
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	12
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	2.2	1
Vinyl acetate	BDL	12
Vinyl chloride	BDL	0.5
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	12
1,2-Dibromoethane	BDL	12

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)	(ug/kg)	(ug/kg)
4-Chloro-3-methylphenol	BDL	810
2-Chlorophenol	BDL	400
2,4-Dichlorophenol	BDL	400
2,4-Dimethylphenol	BDL	400
4,6-Dinitro-2-methylphenol	BDL	2010
2,4-Dinitrophenol	BDL	2010
2-Methylphenol	BDL	400
3-Methylphenol	BDL	400
4-Methylphenol	BDL	400

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/kg)	Detection (ug/kg)
2-Nitrophenol	BDL	400
4-Nitrophenol	BDL	2010
Pentachlorophenol	BDL	2010
Phenol	BDL	400
2,4,5-Trichlorophenol	BDL	400
2,4,6-Trichlorophenol	BDL	400
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	400
Acenaphthylene	BDL	400
Anthracene	BDL	400
Benzoic Acid	BDL	2010
Benzo(a)anthracene	BDL	400
Benzo(b)fluoranthene	BDL	400
Benzo(k)fluoranthene	BDL	400
Benzo(ghi)perylene	BDL	400
Benzo(a)pyrene	BDL	400
Benzyl Alcohol	BDL	810
Bis(2-chloroethoxy)methane	BDL	400
Bis(2-chloroethyl)ether	BDL	400
Bis(2-chloroisopropyl)ether	BDL	400
Bis(2-ethylhexyl)phthalate	BDL	400
4-Bromophenyl phenyl ether	BDL	400
Benzyl butyl phthalate	BDL	400
4-Chloroaniline	BDL	810
2-Chloronaphthalene	BDL	400
4-Chlorophenyl phenyl ether	BDL	400
Chrysene	BDL	400
Dibenzo(a,h)anthracene	BDL	400
Dibenzofuran	BDL	400
Di-n-butylphthalate	BDL	400
1,3-Dichlorobenzene	BDL	400
1,4-Dichlorobenzene	BDL	400
1,2-Dichlorobenzene	BDL	400
3,3'-Dichlorobenzidine	BDL	810
Diethylphthalate	BDL	400

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Report No. 56907-3

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/kg)	Detection Limit (ug/kg)
Dimethylphthalate	BDL	400
2,4-Dinitrotoluene	BDL	400
2,6-Dinitrotoluene	BDL	400
Di-n-octylphthalate	BDL	400
Fluoranthene	BDL	400
Fluorene	BDL	400
Hexachlorobenzene	BDL	400
Hexachlorobutadiene	BDL	400
Hexachlorocyclopentadiene	BDL	400
Hexachloroethane	BDL	400
Indeno(1,2,3-cd)pyrene	BDL	400
Isophorone	BDL	400
2-Methylnaphthalene	BDL	400
Naphthalene	BDL	400
2-Nitroaniline	BDL	2010
3-Nitroaniline	BDL	2010
4-Nitroaniline	BDL	810
Nitrobenzene	BDL	400
N-Nitrosodiphenylamine	BDL	400
N-Nitrosodi-n-propylamine	BDL	400
Phenanthrene	BDL	400
Pyrene	BDL	400
1,2,4-Trichlorobenzene	BDL	400

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/kg)
3-Hydroxy-2,4,4-trimethylpentyl isobutyrate	370
Ethylene glycol phenyl ether	350
2,2-Dimethyl-1-(2-hydroxy-1-methylethyl) propylisobutyrate	210

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

LABORATORY REPORTS

WEST POND SEDIMENT SAMPLES

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56781-1

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED1-0.2/1.7, 10/27/94, 11:30, received 10/29/94

RESULTS

	Result	Detection Limit
Extractable Organic Carbon (TOC) (mg/kg) (EPA 9060)	46	14
Total Potassium (K) (mg/kg) (EPA 6010A)	1500	27
pH (laboratory) (EPA 9045)	7.73	-
Extractable Sulfate (SO_4) (mg/kg) (EPA 9038)	BDL	169
Extractable Alkalinity (as $CaCO_3$) (mg/kg) (EPA 310.1M)	680	27
Extractable Nitrate Nitrogen (N) (mg/kg) (EPA 353.2M)	3.4	1
Total Kjeldahl Nitrogen (N) (mg/kg) (EPA 351.3M)	3240	7
Extractable Phosphorus (P) (mg/kg) (EPA 365.1M)	3.1	0.3
Cation Exchange Capacity (meq/100g) (EPA 9081) (Na Acetate)	5.4	0.004
Moisture (%) (ASTM D2216)	87.2	0.1

BDL - Below Detection Limit

Report No. 56781-1

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	3.4
Total Manganese (Mn) (mg/kg) (EPA 6010A)	180	5.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.34
Total Nickel (Ni) (mg/kg) (EPA 6010A)	12	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	46	2.7

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	(mg/kg)	(mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	26	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56781-2

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED1-1.7/2.5, 10/27/94, 11:30, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.4
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.6
Total Lead (Pb) (mg/kg) (EPA 6010A)	15	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	220	5.1
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.6
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.1
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.4
Total Zinc (Zn) (mg/kg) (EPA 6010A)	74	2.6

BDL - Below Detection Limit

Report No. 56781-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	22	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 56722-4

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED2-0.2/1, 10/27/94, 16:30, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	7.9
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.6
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.6
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.6
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	3.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	17	4.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	190	6.3
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.40
Total Nickel (Ni) (mg/kg) (EPA 6010A)	19	3.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	6.3
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.6
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	7.9
Total Zinc (Zn) (mg/kg) (EPA 6010A)	94	3.2

BDL - Below Detection Limit

Report No. 56722-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	37	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 56722-5

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED2-1/2, 10/27/94, 16:30, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	11.3	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.2	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	159	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	70	2.4

BDL - Below Detection Limit

Report No. 56722-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56781-4

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED3-0.2/1.0, 10/27/94, 18:00, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.5
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.9
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	16	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.6
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	3.2
Total Manganese (Mn) (mg/kg) (EPA 6010A)	180	5.2
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.32
Total Nickel (Ni) (mg/kg) (EPA 6010A)	16	2.6
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.2
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.5
Total Zinc (Zn) (mg/kg) (EPA 6010A)	57	2.6

BDL - Below Detection Limit

Report No. 56781-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	23	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deer

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56781-5

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED3-1.0/2.0, 10/27/94, 18:00, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	5.2	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	22	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	12	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	220	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	23	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	73	2.4

BDL - Below Detection Limit

Report No. 56781-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.5	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.7	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56753-1

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED4-0.2/0.5, 10/28/94, 08:45, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	9.9	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.9	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	19	3.4
Total Manganese (Mn) (mg/kg) (EPA 6010A)	149	5.4
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.34
Total Nickel (Ni) (mg/kg) (EPA 6010A)	8.8	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.4
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	36	2.7

BDL - Below Detection Limit

Report No. 56753-1

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	26	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dlier

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LABORATORY REPORT

Dames & Moore - Atlanta
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3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56753-2

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED4-0.5/1.5, 10/28/94, 08:45, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.0
Total Arsenic (As) (mg/kg) (EPA 7060)	4.0	3.6
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	13	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	3.9	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	10.7	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	262	4.8
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	18	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.8
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	50	2.4

BDL - Below Detection Limit

Report No. 56753-2

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.8	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	16	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

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3525 Piedmont Road
Atlanta, GA 30305

December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56753-3

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED5-0.2/0.5, 10/28/94, 11:00, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	7.0
Total Arsenic (As) (mg/kg) (EPA 7060)	4.2	4.2
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	11.5	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.8
Total Lead (Pb) (mg/kg) (EPA 6010A)	21	3.5
Total Manganese (Mn) (mg/kg) (EPA 6010A)	169	5.6
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.35
Total Nickel (Ni) (mg/kg) (EPA 6010A)	10.7	2.8
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.6
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	7.0
Total Zinc (Zn) (mg/kg) (EPA 6010A)	44	2.8

BDL - Below Detection Limit

Report No. 56753-3

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	29	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56753-4

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED5-0.5/1.5, 10/28/94, 11:00, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.1
Total Arsenic (As) (mg/kg) (EPA 7060)	7.2	3.7
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.2
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.2
Total Chromium (Cr) (mg/kg) (EPA 6010A)	17	1.2
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.4
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	3.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	329	4.9
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.30
Total Nickel (Ni) (mg/kg) (EPA 6010A)	20	2.4
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	4.9
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.2
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	62	2.4

BDL - Below Detection Limit

Report No. 56753-4

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.6	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.7	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	18	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56753-5

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED6-0.2/1.3, 10/28/94, 12:30, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.8
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.1
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.4
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.4
Total Chromium (Cr) (mg/kg) (EPA 6010A)	14	1.4
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.7
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	3.4
Total Manganese (Mn) (mg/kg) (EPA 6010A)	164	5.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.34
Total Nickel (Ni) (mg/kg) (EPA 6010A)	14	2.7
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.4
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.8
Total Zinc (Zn) (mg/kg) (EPA 6010A)	59	2.7

BDL - Below Detection Limit

Report No. 56753-5

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.] (EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.4	0.25
2,6-Dinitrotoluene (2,6-DNT)	0.4	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%) (EPA 160.3)	27	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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December 29, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56753-6

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED6-1.3/1.7, 10/28/94, 12:30, received 10/29/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	6.3
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	3.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.3
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.3
Total Chromium (Cr) (mg/kg) (EPA 6010A)	19	1.3
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	2.5
Total Lead (Pb) (mg/kg) (EPA 6010A)	13	3.1
Total Manganese (Mn) (mg/kg) (EPA 6010A)	250	5.0
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.31
Total Nickel (Ni) (mg/kg) (EPA 6010A)	21	2.5
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	5.0
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.3
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	6.3
Total Zinc (Zn) (mg/kg) (EPA 6010A)	73	2.5

BDL - Below Detection Limit

Report No. 56753-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	0.7	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.3	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	0.7	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	20	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

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December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 56722-6

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED7-0.2/1, 10/27/94, 16:30, received 10/28/94

RESULTS

PPL Metals + Mn (Soil/Sediment)	Result	Detection Limit
Total Antimony (Sb) (mg/kg) (EPA 6010A)	BDL	8.1
Total Arsenic (As) (mg/kg) (EPA 7060)	BDL	4.8
Total Beryllium (Be) (mg/kg) (EPA 6010A)	BDL	1.6
Total Cadmium (Cd) (mg/kg) (EPA 6010A)	BDL	1.6
Total Chromium (Cr) (mg/kg) (EPA 6010A)	10	1.6
Total Copper (Cu) (mg/kg) (EPA 6010A)	BDL	3.2
Total Lead (Pb) (mg/kg) (EPA 6010A)	16	4.0
Total Manganese (Mn) (mg/kg) (EPA 6010A)	160	6.5
Total Mercury (Hg) (mg/kg) (EPA 7471)	BDL	0.40
Total Nickel (Ni) (mg/kg) (EPA 6010A)	13	3.2
Total Selenium (Se) (mg/kg) (EPA 7740)	BDL	6.5
Total Silver (Ag) (mg/kg) (EPA 6010A)	BDL	1.6
Total Thallium (Tl) (mg/kg) (EPA 7841)	BDL	8.1
Total Zinc (Zn) (mg/kg) (EPA 6010A)	63	3.2

BDL - Below Detection Limit

Report No. 56722-6

RESULTS

Nitroaromatics and Nitramines by HPLC [soil/sed.](EPA 8330)

	Result (mg/kg)	Detection Limit (mg/kg)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.25
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.25
Nitrobenzene (NB)	BDL	0.26
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.25
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.26
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.25
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.25
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	0.25
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.25
2-Nitrotoluene (2-NT)	BDL	0.25
3-Nitrotoluene (3-NT)	BDL	0.25
4-Nitrotoluene (4-NT)	BDL	0.25
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.25
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.25

	Result	Detection Limit
Percent Moisture (%)(EPA 160.3)	38	1

BDL - Below Detection Limit
Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Dein

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110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 12, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56781-3

Sample: Sediment, composite, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SED8-0.2/1.7, 10/27/94, 11:30, received 10/29/94

RESULTS

	Result	Detection Limit
Extractable Organic Carbon (TOC) (mg/kg) (EPA 9060)	44	20
Percent Moisture (%) (EPA 160.3)	50	1

Note: Results reported on dry-weight basis

Respectfully submitted,

By: Denise S. Deier

LABORATORY REPORTS

GROUNDWATER SAMPLES

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57992-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-DM-MW2-U, 12/12/94, 10:07, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	15	1.0
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	14	10
Total Copper (Cu) (ug/l) (EPA 6010A)	38	20
Total Lead (Pb) (ug/l) (EPA 7421)	10	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	1600	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	63	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	88	20

BDL - Below Detection Limit

Report No. 57992-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	34	~~6.4~~ 0.64 BCD 2.13 95
1,3,5-Trinitrobenzene (1,3,5-TNB)	550	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	320	0.10
2,6-Dinitrotoluene (2,6-DNT)	12	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	1.1
3,4-Dinitrotoluene (3,4-DNT)	75	2.1
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	4.2	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	5.7	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	4.1	0.94
1,3-Dinitrobenzene (1,3-DNB)	470	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57992-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-DM-MW2-F, 12/12/94, 10:07, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	20	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	1000	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	60	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58027-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-IT-MW2-U, 12/13/94, 08:42, received 12/14/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	12	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	10
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	140	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	2300	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	120	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	25
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	34	20

BDL - Below Detection Limit

Report No. 58027-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.4	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	390	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	340	0.10
2,6-Dinitrotoluene (2,6-DNT)	24	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	14	0.55
3,4-Dinitrotoluene (3,4-DNT)	0.5	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	5.1	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.6	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	2.8	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	1.7	0.94
1,3-Dinitrobenzene (1,3-DNB)	340	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58027-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-IT-MW2-F, 12/13/94, 08:42, received 12/14/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
PPL Metals + Mn (Groundwater)		
Dissolved Antimony (Sb) (ug/l) (EPA 7041).....	BDL	20
Dissolved Arsenic (As) (ug/l) (EPA 7060).....	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A).....	130	20
Dissolved Lead (Pb) (ug/l) (EPA 7421).....	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)....	2500	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A).....	130	20
Dissolved Selenium (Se) (ug/l) (EPA 7740).....	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 16, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57934-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-MK-MW11-U, 12/9/94, 15:56, received 12/10/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	160	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	30	20

BDL - Below Detection Limit

Report No. 57934-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.1	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Robert D. [illegible]

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 16, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57934-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-MK-MW11-F, 12/9/94, 15:56, received 12/10/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	180	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Robert D. [illegible]

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 21, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56646-1

Sample: Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-S16-P, 10/24/94, 16:24, received 10/26/94

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous](EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	6.4
1,3,5-Trinitrobenzene (1,3,5-TNB)	20000	450
Nitrobenzene (NB)	BDL	6.5
2,4-Dinitrotoluene (2,4-DNT)	9200	100
2,6-Dinitrotoluene (2,6-DNT)	850	10
4-Amino-2-nitrotoluene (4-Am-2-NT)	190	5.5
3,4-Dinitrotoluene (3,4-DNT)	1500	21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	370	15.7
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	63	1.6
2-Nitrotoluene (2-NT)	BDL	4.1
3-Nitrotoluene (3-NT)	BDL	14
4-Nitrotoluene (4-NT)	110	6.2
2-Amino-4-nitrotoluene (2-AM-4-NT)	22	9.4
1,3-Dinitrobenzene (1,3-DNB)	7200	150

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Klein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 57898-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-DM-MW7-U, 12/8/94, 10:50, received 12/9/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	80	2.0
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	50
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	50
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	5
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	2
Total Chromium (Cr) (ug/l) (EPA 6010A)	36	10
Total Copper (Cu) (ug/l) (EPA 6010A)	1400	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	12000	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	2000	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	0.9	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	94	20

BDL - Below Detection Limit

Report No. 57898-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	30	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	5700	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	980	0.10
2,6-Dinitrotoluene (2,6-DNT)	17	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	66	0.55
3,4-Dinitrotoluene (3,4-DNT)	11	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	1.9	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	3000	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 57898-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-DM-MW7-F, 12/8/94, 10:50, received 12/9/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	50
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	50
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	5
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	2
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	21	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	1100	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	10000	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	1800	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	0.7	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	44	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Olier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 16, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57902-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-DM-MW8-U, 12/8/94, 12:00, received 12/9/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	650	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	5
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	5
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	5
Total Chromium (Cr) (ug/l) (EPA 6010A)	52	10
Total Copper (Cu) (ug/l) (EPA 6010A)	1600	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	8000	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	2500	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	10
Total Zinc (Zn) (ug/l) (EPA 6010A)	52	20

BDL - Below Detection Limit

Report No. 57902-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	64	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	1300	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	440	0.10
2,6-Dinitrotoluene (2,6-DNT)	33	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	37	0.55
3,4-Dinitrotoluene (3,4-DNT)	41	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	10	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	11	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	2.2	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	790	0.15

BDL - Below Detection Limit

Respectfully submitted,

By:

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 16, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57902-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-DM-MW8-F, 12/8/94, 12:00, received 12/9/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	5
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	5
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	38	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	1400	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	7000	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	2100	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	10
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	50	20

BDL - Below Detection Limit

Respectfully submitted,

By: Billy P. Dyer

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

Attention: Ms. Deborah L. Raede

Report No. 57899-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-DM-MW9-U, 12/8/94, 14:40, received 12/9/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	50	2.0

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

Attention: Ms. Deborah L. Raede

Report No. 57899-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-DW-MW9-F, 12/8/94, 14:40, received 12/9/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	50
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	5
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	2
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	760	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	1800	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	1600	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	100
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	1.0
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	70	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L. Deer

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

Attention: Ms. Deborah L. Raede

Report No. 57899-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-IT-MW5-U, 12/8/94, 15:18, received 12/9/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.1	0.1

Report No. 57899-3

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	50
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	2
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	100	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	27	20

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 14, 1995

Attention: Ms. Deborah L. Raede

Report No. 57899-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-PR-IT-MW5-F, 12/8/94, 15:18, received 12/9/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041).....	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060).....	BDL	50
Dissolved Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	2
Dissolved Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421).....	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)....	100	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740).....	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58098-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW14-U, 12/14/94, 08:36, received 12/15/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	3.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	0.5	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	28	20

BDL - Below Detection Limit

Report No. 58098-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	2.8	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	11	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	1.6	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	3	1

BDL - Below Detection Limit

Report No. 58098-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	14	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively Identified Compounds (EPA 8240)	Estimated Concentration (ug/l)	
2-methyl-Butane	100	-
Unknown	44	-
Cyclohexane	28	-
methyl-Cyclopentane	21	-
3-methyl-Pentane	14	-
2,3-dimethyl-Butane	11	-
1,2,4-trimethyl-Benzene	10	-
ethyl-Cyclohexane	9	-
unknown	9	-

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10

BDL - Below Detection Limit

Report No. 58098-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58098-1

RESULTS

Tentatively Identified Compounds (EPA 8240)	Estimated Concentration (ug/l)	
unknown glycerol triester.....	19	-
unknown glycerol triester.....	14	-
unknown C9 aromatic hydrocarbon.....	12	-
		-
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	8	-
6-Aminohexanoic acid.....	6	-
unknown C9 aromatic hydrocarbon.....	5	-
unknown C9 aromatic hydrocarbon.....	4	-
unknown benzenepropanamine.....	4	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58098-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW14-F, 12/14/94, 08:36, received 12/15/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	BDL	10
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58046-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW15-U, 12/13/94, 16:04, received 12/14-15/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.5	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	40	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL UJ	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	0.6	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	22	20

BDL - Below Detection Limit

 Report No. 58046-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	1.2	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	2.1	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.7	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.6	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	2.7	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	660 J	200
Benzene	830 J	10
Bromodichloromethane	BDL UJ	10
Bromoform	BDL UJ	10
Bromomethane	BDL UJ	20
2-Butanone	BDL UJ	200
Carbon disulfide	1500 J	200
Carbon tetrachloride	BDL UJ	10
Chlorobenzene	BDL UJ	10
Chlorodibromomethane	BDL UJ	10
Chloroethane	BDL UJ	20
2-Chloroethylvinyl ether	BDL UJ	20
Chloroform	BDL UJ	10
Chloromethane	BDL UJ	20
1,1-Dichloroethane	BDL UJ	10
1,2-Dichloroethane	BDL UJ	10
1,1-Dichloroethene	BDL UJ	10
trans-1,2-Dichloroethene	BDL UJ	10
1,2-Dichloropropane	BDL UJ	10
cis-1,3-Dichloropropene	BDL UJ	10
trans-1,3-Dichloropropene	BDL UJ	10
Ethylbenzene	180 J	10
2-Hexanone	BDL UJ	100
Methylene chloride	BDL UJ	10
4-Methyl-2-pentanone	BDL UJ	100
Styrene	BDL UJ	10
1,1,2,2-Tetrachloroethane	BDL UJ	10
Tetrachloroethene	BDL UJ	10
Toluene	540 J	10

BDL - Below Detection Limit

 Report No. 58046-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
1,1,1-Trichloroethane	BDL UJ	10
Trichloroethene	BDL UJ	10
Vinyl acetate	BDL UJ	100
Vinyl chloride	BDL UJ	4
Xylenes	1300J	10
cis-1,2-Dichloroethene	BDL UJ	10
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively Identified Compounds (EPA 8240)	Estimated Conc. (ug/l)
Butane	1500 NJ
Pentane	780 NJ
Cyclohexane	700 NJ
Unknown	670 ~~NJ~~ BRO J 2-6-95
Unknown	580 ~~NJ~~ J
Unknown	580 ~~NJ~~ J
1,2,4-trimethyl-Benzene	300 NJ
Decane	260 NJ
Undecane	240 NJ
Unknown	230 ~~NJ~~ BRO J 2-6-95

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	60
2-Chlorophenol	BDL	30
2,4-Dichlorophenol	BDL	30
2,4-Dimethylphenol	BDL	30
4,6-Dinitro-2-methylphenol	BDL	150
2,4-Dinitrophenol	BDL	150
2-Methylphenol	BDL	30
3-Methylphenol	BDL	30
4-Methylphenol	BDL	30
2-Nitrophenol	BDL	30
4-Nitrophenol	BDL	150
Pentachlorophenol	BDL	15
Phenol	BDL	30
2,4,5-Trichlorophenol	BDL	30
2,4,6-Trichlorophenol	BDL	30

Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	6
Acenaphthylene	BDL	6
Anthracene	BDL	30

BDL - Below Detection Limit

Report No. 58046-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Benzo(b)fluoranthene	BDL	6
Benzo(k)fluoranthene	BDL	12
Benzo(ghi)perylene	BDL	6
Benzo(a)pyrene	BDL	9
Benzyl Alcohol	BDL	60
Bis(2-chloroethoxy)methane	BDL	30
Bis(2-chloroethyl)ether	BDL	30
Bis(2-chloroisopropyl)ether	BDL	30
Bis(2-ethylhexyl)phthalate	BDL	9
4-Bromophenyl phenyl ether	BDL	30
Benzyl butyl phthalate	BDL	6
4-Chloroaniline	BDL	60
2-Chloronaphthalene	BDL	30
4-Chlorophenyl phenyl ether	BDL	30
Chrysene	BDL	30
Dibenzo(a,h)anthracene	BDL	9
Dibenzofuran	BDL	30
Di-n-butylphthalate	BDL	6
1,3-Dichlorobenzene	BDL	30
1,4-Dichlorobenzene	BDL	30
1,2-Dichlorobenzene	BDL	30
3,3'-Dichlorobenzidine	BDL	60
Diethylphthalate	BDL	6
Dimethylphthalate	BDL	6
2,4-Dinitrotoluene	BDL	30
2,6-Dinitrotoluene	BDL	30
Di-n-octylphthalate	BDL	9
Fluoranthene	BDL	6
Fluorene	BDL	6
Hexachlorobenzene	BDL	6
Hexachlorobutadiene	BDL	30
Hexachlorocyclopentadiene	BDL	30
Hexachloroethane	BDL	30
Indeno(1,2,3-cd)pyrene	BDL	30
Isophorone	BDL	30
2-Methylnaphthalene	70 J	30
Naphthalene	60 J	30
2-Nitroaniline	BDL	150
3-Nitroaniline	BDL	150
4-Nitroaniline	BDL	60
Nitrobenzene	BDL	30
N-Nitrosodiphenylamine	BDL	30
N-Nitrosodi-n-propylamine	BDL	30
Phenanthrene	BDL	30
Pyrene	BDL	30
1,2,4-Trichlorobenzene	BDL	30
Benzoic Acid	BDL	150
Benzo(a)anthracene	BDL	6

BDL - Below Detection Limit

Report No. 58046-1

RESULTS

Tentatively Identified Compounds (EPA 8240)	Estimated Conc. (ug/l)
Molecular Sulfur	11000 NJ
unknown ester (Erythritol tetraester?)	5200 N
unknown glycerol triester	820 N
unknown glycerol triester	680 N
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	340 NJ
n-Tridecane (C13)	330NJ
n-Dodecane (C12)	280 NJ
n-Tetradecane (C14)	260 NJ
n-Undecane (C11)	250 NJ
unknown C9 aromatic hydrocarbon	250 N
unknown	250 ~~N~~ J 2.6.96
unknown C18 isoparaffinic hydrocarbon	240 N
n-Pentadecane (C15)	230 NJ
6-Aminohexanoic acid	230 NJ
unknown C9 aromatic hydrocarbon	220 N
n-Heptadecane (C17)	200 NJ
n-Decane (C10)	200 NJ
unknown C18 isoparaffinic hydrocarbon	200 N
n-Hexadecane (C16)	190 NJ
n-Octadecane (C18)	160 NJ

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58046-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW15-F, 12/13/94, 16:04, received 12/14-15/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	18	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL UJ	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL ~~R~~ UJ BCQ 1.24AS	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL UJ	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58093-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW19-U, 12/14/94, 09:15, received 12/15/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	22	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	0.6	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	24	20

BDL - Below Detection Limit

Report No. 58093-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.8	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.2	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	1.2	0.41
3-Nitrotoluene (3-NT)	8.1	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	59	20
Benzene	5	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	26	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	3	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	5	1

BDL - Below Detection Limit

Report No. 58093-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	26	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively Identified Compounds (EPA 8240)	Estimated Conc. (ug/l)
2-methyl-Butane	100
Cyclohexane	31
Unknown	27
Unknown	17
Unknown	15
1,2,4-trimethyl-Benzene	14
2,3-dimethyl-Butane	10

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2

BDL - Below Detection Limit

Report No. 58093-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58093-1

RESULTS

Tentatively Identified Compounds (EPA 8240)	Estimated Conc. (ug/l)
Molecular Sulfur	9500
unknown fatty acid ester	100
unknown glycerol triester	64
unknown glycerol triester	58
Hexathiepane	44
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	18
6-Aminohexanoic acid	15
unknown glycerol triester	9
n-Triacontane (C30)	8
unknown C9 aromatic hydrocarbon	8
Tetrahydro-2,5-dimethyl thiophene	8
unknown Ethylthiacyclohexane	8
unknwon glycerol triester	7
unknown C10 aromatic hydrocarbon	6
n-Hexacosane (C26)	5
unknown Ethylthiacyclohexane	5
unknown oxygenate	5
unknown C9 aromatic hydrocarbon	5
5-Methyltetralin	4

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58093-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW19-F, 12/14/94, 09:15, received 12/15/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	8	2
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	BDL	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

ASI

ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58096-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW20-U, 12/14/94, 11:28, received 12/15/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	20
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	5
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	5
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	54	20
Total Lead (Pb) (ug/l) (EPA 7421)	BDL	6
Total Manganese (Mn) (ug/l) (EPA 6010A)	140	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	50
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	5
Total Zinc (Zn) (ug/l) (EPA 6010A)	24	20

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.8	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	1.0
2,6-Dinitrotoluene (2,6-DNT)	BDL	1.0
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	53	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	8	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	4	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	3	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240)	Estimated Concentration (ug/l)	
Butane	16	-
2-methyl-2-Propanol	10	-

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58096-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
unknown glycerol triester	24	-
unknown glycerol triester	23	-
unknown glycerol triester	16	-
unknown glycerol triester	14	-
Glycerol tricaprylate	10	-
unknown glycol derivative	9	-
6-Aminohexanoic acid	8	-
unknown glycol derivative	8	-
Decanoic acid, octadecyl ester	7	-
unknown glycol derivative	7	-
2,2'-[Ethylidenebis(oxy)]bispropane	6	-
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol]	5	-
(Santowhite antioxidant)		-
n-Octacosane (C28)	5	-
n-Nonacosane (C29)	4	-
unknown thiacycloalkane	4	-
n-Triacontane (C30)	4	-

Respectfully submitted,

By: Denise A. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58096-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-BED-MW20-F, 12/14/94, 11:28, received 12/15/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041).....	BDL	25
Dissolved Arsenic (As) (ug/l) (EPA 7060).....	BDL	25
Dissolved Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1.25
Dissolved Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	2
Dissolved Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421).....	BDL	12
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)....	140	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740).....	BDL	25
Dissolved Silver (Ag) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58171-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-REACTOR2-U, 12/15/94, received 12/16/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.2	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	20	20
Total Lead (Pb)(ug/l)(EPA 7421).....	9.6	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	470	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	70	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	90	20

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	0.6	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.10
2,6-Dinitrotoluene (2,6-DNT)	1.1	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	13	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	1.2	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	23	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	1.8	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	1.2	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	8	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240)	Estimated Concentration	
2-methyl-Propane	9	-
Cyclohexane	6	-

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58171-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
Molecular Sulfur	600	-
6-Aminohexanoic acid	400	-
unknown glycerol triester	360	-
unknown glycerol triester	250	-
4,4'-Butylidenebis[2-(1,1-dimethylethyl) -5-methylphenol] (Santowhite antioxidant)	140	-
unknown steroid (MW=388)	93	-
unknown steroid (MW=388)	37	-
unknown C18 isoparaffinic hydrocarbon	32	-
unknown C20 isoparaffinic hydrocarbon	29	-
unknown C18 isoparaffinic hydrocarbon	27	-
unknown C18 isoparaffinic hydrocarbon	25	-
unknown fatty acid ester	18	-
2-Ethyl-1-hexanol	14	-
unknown steroid (MW=388)	12	-
unknown isoparaffinic hydrocarbon (C28?)	12	-
n-Hentriacontane (C31)	12	-
Octadecanoic acid	12	-
unknown C14 cycloparaffinic hydrocarbon	10	-
unknown isoparaffinic hydrocarbon (C30?)	10	-
n-Pentadecane (C15)	9	-

Note: A very broad peak was observed in the BNA analysis which appears to be a fatty alcohol.

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58171-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-REACTOR2-F, 12/15/94, received 12/16/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb)(ug/l)(EPA 7041).....	BDL	10
Dissolved Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Dissolved Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Dissolved Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Dissolved Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Copper (Cu)(ug/l)(EPA 6010A).....	20	20
Dissolved Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Dissolved Manganese (Mn)(ug/l)(EPA 6010A)....	120	40
Dissolved Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Dissolved Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Dissolved Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Dissolved Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57992-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-DM-MW22-U, 12/12/94, 10:07, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	16	1.0

Report No. 57992-3

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	20
Total Copper (Cu) (ug/l) (EPA 6010A)	32	20
Total Lead (Pb) (ug/l) (EPA 7421)	4	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	1800	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	47	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL UJ	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	0.5	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	63	20

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	(ug/l)	(ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	26	BQ 2-13-95 ~~6.4~~ 0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	570	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	250	0.10
2,6-Dinitrotoluene (2,6-DNT)	10	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	1.1
3,4-Dinitrotoluene (3,4-DNT)	2.6	2.1
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	2.6	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	5.2	0.16
2-Nitrotoluene (2-NT)	BDL UJ	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	4.4	0.94
1,3-Dinitrobenzene (1,3-DNB)	400	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

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Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57992-4

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-DM-MW22-F, 12/12/94, 10:07, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041).....	BDL	2
Dissolved Arsenic (As) (ug/l) (EPA 7060).....	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A).....	20	20
Dissolved Lead (Pb) (ug/l) (EPA 7421).....	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)....	970	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A).....	60	20
Dissolved Selenium (Se) (ug/l) (EPA 7740).....	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58173-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-DRILLWATER-U, 12/15/94, 11:16, received 12/16/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N) (mg/l) (EPA 353.2)	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb) (ug/l) (EPA 7041)	BDL	2
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Total Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Total Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	20	20
Total Lead (Pb) (ug/l) (EPA 7421)	3.1	3
Total Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Total Zinc (Zn) (ug/l) (EPA 6010A)	110	20

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	13	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	1.6	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	0.4	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20
Tentatively identified compounds (EPA 8240)	None found	-

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Acid Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10
Base/Neutral Extractable Organics (EPA 8270)		
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Base/Neutral Extractable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

BDL - Below Detection Limit

Report No. 58173-1

RESULTS

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)	Detection Limit (ug/l)
unknown Dodecanoic acid ester.....	140	-
unknown Dodecanoic acid ester.....	14	-
unknown fatty acid ester.....	13	-
unknown Decanoic acid ester.....	6	-
unknown fatty acid ester.....	5	-
2-(Methylthio)-benzothiazole.....	4	-
N-Methyl-3,5-dinitrobenzeneamine.....	4	-

Respectfully submitted,

By: Denise S. Dlier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 18, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58173-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-DRILLWATER-F, 12/15/94, 11:16, received 12/16/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041).....	10	2
Dissolved Arsenic (As) (ug/l) (EPA 7060).....	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091).....	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131).....	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421).....	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)....	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470).....	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A).....	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740).....	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A).....	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841).....	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A).....	240	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dice

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

February 28, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 59627-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-Drill Water-2, 2/13/95, 11:15, received 2/14/95

RESULTS

Nitroaromatics and Nitramines by HPLC [water] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	1.1	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1.7	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L Deier

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110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092
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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

August 31, 1995

Attention: Ms. Debbie Raede

Report No. 65124-1

Sample: Potable Water, grab, USACE, Plum Brook Ordnance Works, #04, 8/15/95, 10:45, received 8/16/95

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deer

LABORATORY REPORTS

WEST POND SURFACE WATER SAMPLES

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 23, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56658-1

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW1-U, 10/25/94, 10:30, received 10/26/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	17	5
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	BDL	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	190	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	BDL	20

BDL - Below Detection Limit

Report No. 56658-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.5	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	0.5	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	0.3	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Ilier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 23, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56658-2

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW1-F, 10/25/94, 10:30, received 10/26/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	150	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56649-3

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW2-U, 10/25/94, 12:20, received 10/26/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	21	5
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	BDL	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	260	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	20	20

BDL - Below Detection Limit

Report No. 56649-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	0.6	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	2.3	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56649-4

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW2-F, 10/25/94, 12:20, received 10/26/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	210	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	23	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56647-4

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW3-U, 10/25/94, 12:55, received 10/26/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	21	5
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	77	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	230	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	43	20

BDL - Below Detection Limit

Report No. 56647-4

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	0.6	0.55
3,4-Dinitrotoluene (3,4-DNT)	0.6	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	2.4	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56647-3

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW3-F, 10/25/94, 12:55, received 10/26/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	210	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Olin

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ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56649-1

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW4-U, 10/25/94, 14:00, received 10/26/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	24	5
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	BDL	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	260	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	46	20

BDL - Below Detection Limit

Report No. 56649-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	0.6	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	2.5	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 6, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56649-2

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW4-F, 10/25/94, 14:00, received 10/26/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	200	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Klein

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56730-1

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW5-U, received 10/28/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	220	33
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	10	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	BDL	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	1600	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	20	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	70	20

BDL - Below Detection Limit

Report No. 56730-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	0.8	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	54	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L. Dier

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56730-2

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW5-F, received 10/28/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	1300	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deer

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56647-2

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW7-U, 10/25/94, 12:55, received 10/26/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	20	5
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	54	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	240	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	26	20

BDL - Below Detection Limit

Report No. 56647-2

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	2.2	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise L. Teer

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ANALYTICAL SERVICES, INC.

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 5, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56647-1

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-WA-SW7-F, 10/25/94, 12:55, received 10/26/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	230	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL VJ	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deir

LABORATORY REPORTS

EQUIPMENT BLANKS AND TRIP BLANKS

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56814-1

Sample: Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-PR-S1-0.0/2.0, 10/31/94, 10:56, received 11/1/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Total Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Total Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Total Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Total Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Report No. 56814-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	0.3	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	3.6	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

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ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

FAX (404) 734-4201 ● Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56814-2

Sample: Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-BG-S3-0.5/3.0, 10/31/94, 15:50, received 11/1/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Total Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Total Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Total Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Total Zinc (Zn) (ug/l) (EPA 6010A)	20	20

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

Volatile Organics (EPA 8240)

Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane	BDL	10
1,2-Dibromoethane	BDL	10

Tentatively identified compounds (EPA 8240) None found

Acid Extractable Organics (EPA 8270)		
4-Chloro-3-methylphenol	BDL	20
2-Chlorophenol	BDL	10
2,4-Dichlorophenol	BDL	10
2,4-Dimethylphenol	BDL	10
4,6-Dinitro-2-methylphenol	BDL	50
2,4-Dinitrophenol	BDL	50
2-Methylphenol	BDL	10
3-Methylphenol	BDL	10
4-Methylphenol	BDL	10
2-Nitrophenol	BDL	10
4-Nitrophenol	BDL	50
Pentachlorophenol	BDL	5
Phenol	BDL	10
2,4,5-Trichlorophenol	BDL	10
2,4,6-Trichlorophenol	BDL	10

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Base/Neutral Extactable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Acenaphthene	BDL	2
Acenaphthylene	BDL	2
Anthracene	BDL	10
Benzoic Acid	BDL	50
Benzo(a)anthracene	BDL	2
Benzo(b)fluoranthene	BDL	2
Benzo(k)fluoranthene	BDL	4
Benzo(ghi)perylene	BDL	2
Benzo(a)pyrene	BDL	3
Benzyl Alcohol	BDL	20
Bis(2-chloroethoxy)methane	BDL	10
Bis(2-chloroethyl)ether	BDL	10
Bis(2-chloroisopropyl)ether	BDL	10
Bis(2-ethylhexyl)phthalate	BDL	3
4-Bromophenyl phenyl ether	BDL	10
Benzyl butyl phthalate	BDL	2
4-Chloroaniline	BDL	20
2-Chloronaphthalene	BDL	10
4-Chlorophenyl phenyl ether	BDL	10
Chrysene	BDL	10
Dibenzo(a,h)anthracene	BDL	3
Dibenzofuran	BDL	10
Di-n-butylphthalate	BDL	2
1,3-Dichlorobenzene	BDL	10
1,4-Dichlorobenzene	BDL	10
1,2-Dichlorobenzene	BDL	10
3,3'-Dichlorobenzidine	BDL	20
Diethylphthalate	BDL	2

BDL - Below Detection Limit

Report No. 56814-2

RESULTS

Base/Neutral Extactable Organics (EPA 8270)	Result (ug/l)	Detection Limit (ug/l)
Dimethylphthalate	BDL	2
2,4-Dinitrotoluene	BDL	10
2,6-Dinitrotoluene	BDL	10
Di-n-octylphthalate	BDL	3
Fluoranthene	BDL	2
Fluorene	BDL	2
Hexachlorobenzene	BDL	2
Hexachlorobutadiene	BDL	10
Hexachlorocyclopentadiene	BDL	10
Hexachloroethane	BDL	10
Indeno(1,2,3-cd)pyrene	BDL	10
Isophorone	BDL	10
2-Methylnaphthalene	BDL	10
Naphthalene	BDL	10
2-Nitroaniline	BDL	50
3-Nitroaniline	BDL	50
4-Nitroaniline	BDL	20
Nitrobenzene	BDL	10
N-Nitrosodiphenylamine	BDL	10
N-Nitrosodi-n-propylamine	BDL	10
Phenanthrene	BDL	10
Pyrene	BDL	10
1,2,4-Trichlorobenzene	BDL	10

Tentatively identified compounds (EPA 8270)	Estimated Conc. (ug/l)
Diacetone alcohol (Aldol-condensation product)	21
unknown cycloparaffin, BP=69, MW>191	15
Unknown, BP=57, MW>171	4

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Dier

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110 TECHNOLOGY PARKWAY ● NORCROSS, GA 30092 ● (404) 734-4200

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 28, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah Raede

Report No. 56722-1

Sample: Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-WA-SED2, 10/27/94, 16:05, received 10/28/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Total Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Total Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Total Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Total Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Total Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Total Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Total Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Total Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Total Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Total Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Total Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Total Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Total Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Total Zinc (Zn) (ug/l) (EPA 6010A)	50	20

BDL - Below Detection Limit

Report No. 56722-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous](EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Oliver

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57990-1

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-WA-DM-MW2-U, 12/12/94, 08:10, received 12/13/94

RESULTS

	Result	Detection Limit
Nitrate Nitrogen (N)(mg/l)(EPA 353.2).....	0.3	0.1
PPL Metals + Mn (Groundwater)		
Total Antimony (Sb)(ug/l)(EPA 7041).....	BDL	2
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	10
Total Beryllium (Be)(ug/l)(EPA 7091).....	BDL	1
Total Cadmium (Cd)(ug/l)(EPA 7131).....	BDL	1
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 7421).....	BDL	3
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	10
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	0.5
Total Zinc (Zn)(ug/l)(EPA 6010A).....	37	20

BDL - Below Detection Limit

Report No. 57990-1

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	BDL	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 13, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 57990-2

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-WA-DM-MW2-F, 12/12/94, 08:10, received 12/13/94

RESULTS

PPL Metals + Mn (Groundwater)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 7041)	2	2
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	10
Dissolved Beryllium (Be) (ug/l) (EPA 7091)	BDL	1
Dissolved Cadmium (Cd) (ug/l) (EPA 7131)	BDL	1
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 7421)	BDL	3
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	10
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	0.5
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	BDL	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Weier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 23, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56658-3

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-WA-SW2-U, 10/25/94, 11:20, received 10/26/94

RESULTS

	Result	Detection Limit
Total Suspended Solids (mg/l)(EPA 160.2).....	BDL	5
PPL Metals + Mn (Surface Water)		
Total Antimony (Sb)(ug/l)(EPA 6010A).....	BDL	50
Total Arsenic (As)(ug/l)(EPA 7060).....	BDL	30
Total Beryllium (Be)(ug/l)(EPA 6010A).....	BDL	10
Total Cadmium (Cd)(ug/l)(EPA 6010A).....	BDL	10
Total Chromium (Cr)(ug/l)(EPA 6010A).....	BDL	10
Total Copper (Cu)(ug/l)(EPA 6010A).....	BDL	20
Total Lead (Pb)(ug/l)(EPA 6010A).....	BDL	25
Total Manganese (Mn)(ug/l)(EPA 6010A).....	BDL	40
Total Mercury (Hg)(ug/l)(EPA 7470).....	BDL	0.5
Total Nickel (Ni)(ug/l)(EPA 6010A).....	BDL	20
Total Selenium (Se)(ug/l)(EPA 7740).....	BDL	40
Total Silver (Ag)(ug/l)(EPA 6010A).....	BDL	10
Total Thallium (Tl)(ug/l)(EPA 7841).....	BDL	50
Total Zinc (Zn)(ug/l)(EPA 6010A).....	39	20

BDL - Below Detection Limit

Report No. 56658-3

RESULTS

Nitroaromatics and Nitramines by HPLC [aqueous] (EPA 8330)

	Result (ug/l)	Detection Limit (ug/l)
2,4,6-Trinitrotoluene (2,4,6-TNT)	BDL	0.64
1,3,5-Trinitrobenzene (1,3,5-TNB)	BDL	0.45
Nitrobenzene (NB)	BDL	0.65
2,4-Dinitrotoluene (2,4-DNT)	BDL	0.10
2,6-Dinitrotoluene (2,6-DNT)	BDL	0.10
4-Amino-2-nitrotoluene (4-Am-2-NT)	BDL	0.55
3,4-Dinitrotoluene (3,4-DNT)	BDL	0.21
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	BDL	1.57
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	BDL	0.16
2-Nitrotoluene (2-NT)	BDL	0.41
3-Nitrotoluene (3-NT)	BDL	1.4
4-Nitrotoluene (4-NT)	BDL	0.62
2-Amino-4-nitrotoluene (2-Am-4-NT)	BDL	0.94
1,3-Dinitrobenzene (1,3-DNB)	0.2	0.15

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Olier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

December 23, 1994

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 56658-4

Sample: Surface Water, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-E-WA-SW2-F, 10/25/94, 11:20, received 10/26/94

RESULTS

PPL Metals + Mn (Surface Water)	Result	Detection Limit
Dissolved Antimony (Sb) (ug/l) (EPA 6010A)	BDL	50
Dissolved Arsenic (As) (ug/l) (EPA 7060)	BDL	30
Dissolved Beryllium (Be) (ug/l) (EPA 6010A)	BDL	10
Dissolved Cadmium (Cd) (ug/l) (EPA 6010A)	BDL	10
Dissolved Chromium (Cr) (ug/l) (EPA 6010A)	BDL	10
Dissolved Copper (Cu) (ug/l) (EPA 6010A)	BDL	20
Dissolved Lead (Pb) (ug/l) (EPA 6010A)	BDL	25
Dissolved Manganese (Mn) (ug/l) (EPA 6010A)	BDL	40
Dissolved Mercury (Hg) (ug/l) (EPA 7470)	BDL	0.5
Dissolved Nickel (Ni) (ug/l) (EPA 6010A)	BDL	20
Dissolved Selenium (Se) (ug/l) (EPA 7740)	BDL	40
Dissolved Silver (Ag) (ug/l) (EPA 6010A)	BDL	10
Dissolved Thallium (Tl) (ug/l) (EPA 7841)	BDL	50
Dissolved Zinc (Zn) (ug/l) (EPA 6010A)	21	20

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

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LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 17, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58049-3

Sample: Trip Blank, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-T-12/13/94, 12/13/94, received 12/14/94

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58049-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	1.2	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20

Tentatively identified compounds (EPA 8240): None found

BDL - Below Detection Limit

Respectfully submitted,

By: Denise A. Deier

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58098-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-T-12/14/94, 12/14/94, received 12/15/94

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10

BDL - Below Detection Limit

Report No. 58098-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	1.1	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20
Tentatively Identified Compounds (EPA 8240)	None found	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Dier

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS

110 TECHNOLOGY PARKWAY • NORCROSS, GA 30092 • (404) 734-4200

FAX (404) 734-4201 • Federal I.D. #58-1625655

LABORATORY REPORT

Dames & Moore - Atlanta
6 Piedmont Center, Suite #500
3525 Piedmont Road
Atlanta, GA 30305

January 19, 1995

P.O. No. ATL - 4429

Attention: Ms. Deborah L. Raede

Report No. 58179-3

Sample: Groundwater, grab, USACE, Plum Brook Ordnance Works, Project #24637-035-009, PB-T-12/15/94, 12/15/94, received 12/16/94

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Acetone	BDL	20
Benzene	BDL	1
Bromodichloromethane	BDL	1
Bromoform	BDL	1
Bromomethane	BDL	2
2-Butanone	BDL	20
Carbon disulfide	BDL	20
Carbon tetrachloride	BDL	1
Chlorobenzene	BDL	1
Chlorodibromomethane	BDL	1
Chloroethane	BDL	2
2-Chloroethylvinyl ether	BDL	2
Chloroform	BDL	1

BDL - Below Detection Limit

Report No. 58179-3

RESULTS

Volatile Organics (EPA 8240)	Result (ug/l)	Detection Limit (ug/l)
Chloromethane	BDL	2
1,1-Dichloroethane	BDL	1
1,2-Dichloroethane	BDL	1
1,1-Dichloroethene	BDL	1
trans-1,2-Dichloroethene	BDL	1
1,2-Dichloropropane	BDL	1
cis-1,3-Dichloropropene	BDL	1
trans-1,3-Dichloropropene	BDL	1
Ethylbenzene	BDL	1
2-Hexanone	BDL	10
Methylene chloride	BDL	1
4-Methyl-2-pentanone	BDL	10
Styrene	BDL	1
1,1,2,2-Tetrachloroethane	BDL	1
Tetrachloroethene	BDL	1
Toluene	BDL	1
1,1,1-Trichloroethane	BDL	1
Trichloroethene	BDL	1
Vinyl acetate	BDL	10
Vinyl chloride	BDL	0.4
Xylenes	BDL	1
cis-1,2-Dichloroethene	BDL	1
1,2-Dibromo-3-chloropropane (DBCP) (ug/l)(EPA 504)	BDL	0.20
1,2-Dibromoethane (EDB)(ug/l)(EPA 504)	BDL	0.20
Tentatively identified compounds (EPA 8240)	None found	-

BDL - Below Detection Limit

Respectfully submitted,

By: Denise S. Deier

APPENDIX K

BIOLOGICAL ACTIVITY LABORATORY REPORTS

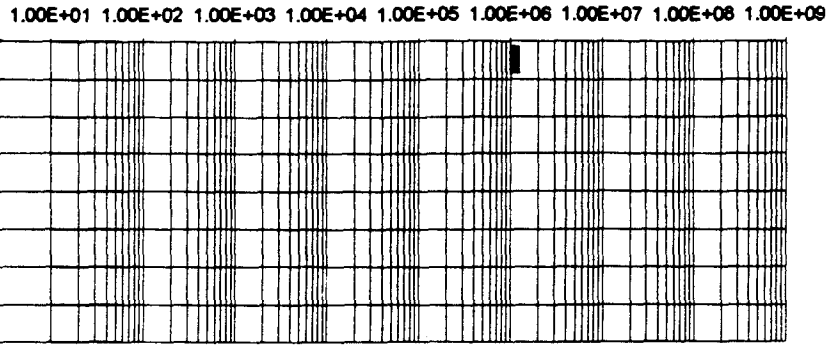
Section II - Microbial Data Summary continued

All values in cfu/ml

Groundwater Samples
Total populations

Low and High indicate 95% Confidence Range

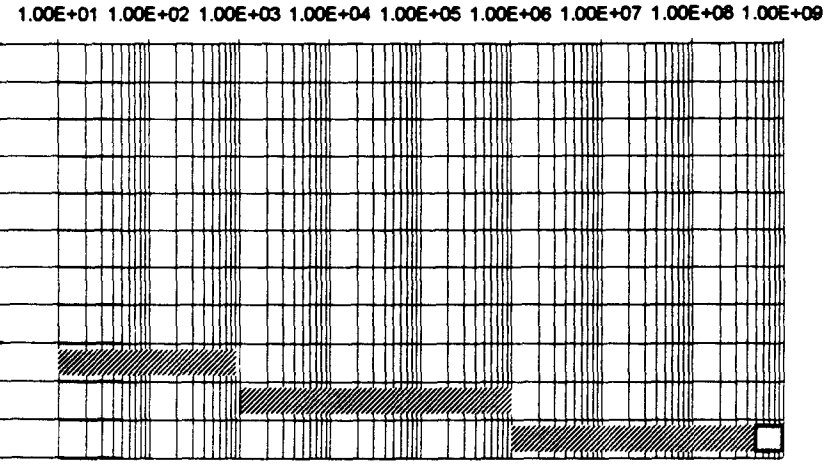
	Mean	Low	High
WA-SW2	1.14E+06	1.04E+06	1.24E+06



Groundwater Samples
Degrader populations

Low and High indicate 95% Confidence Range

	Mean	Low	High
WA-SW2	< 1E+01	NA	NA



Marginal inoculum = Degrader populations below 1.0E+03 are indicative of severe limitations and likely require major augmentation of site conditions to attain adequate cell mass to attain measurable biotransformation rates.

Inoculum levels = Degrader populations between 1.0E+03 and 1.0E+06 are amenable to site augmentation but generally are insufficient to attain adequate biotransformation without increased populations.

Active degradation levels = Degrader populations greater than 1.0E+06 are generally of sufficient magnitude to support measurable biotransformation. Additional site augmentation may still be required to attain desireable rates of transformation.

Assay conditons

	Carbon source	% Carbon (v/v)	Incubation Temperature	Growth Conditions	Degrees of Freedom** Totals	Degraders
WA-SW2	TNT	0.3	22	Aerobic	9	10

Note: All samples have PB prefix

* cfu/ml = colony forming units per ml of groundwater

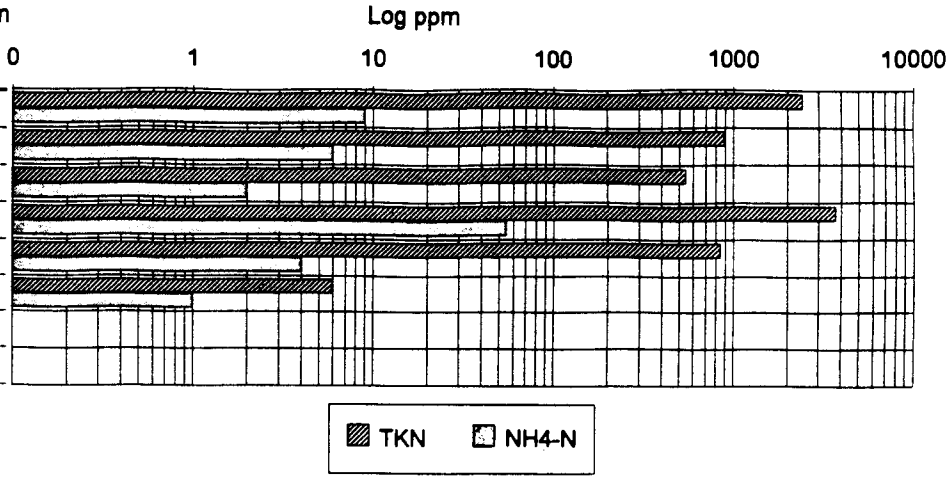
** Degrees of freedom is number of replicates minus one. This parameter is used in calculation of 95% confidence intervals.

Section III - Nutrient Conditions

Nitrogen All units in mg/kg or ppm

	TKN	NH4-N
PR-S13; 3.0-10.	2460	9.0
PR-S7; 3.0-10.0f	894	6.0
WA-S17	550	2.0
WA-SED5; 0.2-0	3746	55.0
WA-SED5; 0.5-1	854	4.0
WA-SW2	6.0	1.0

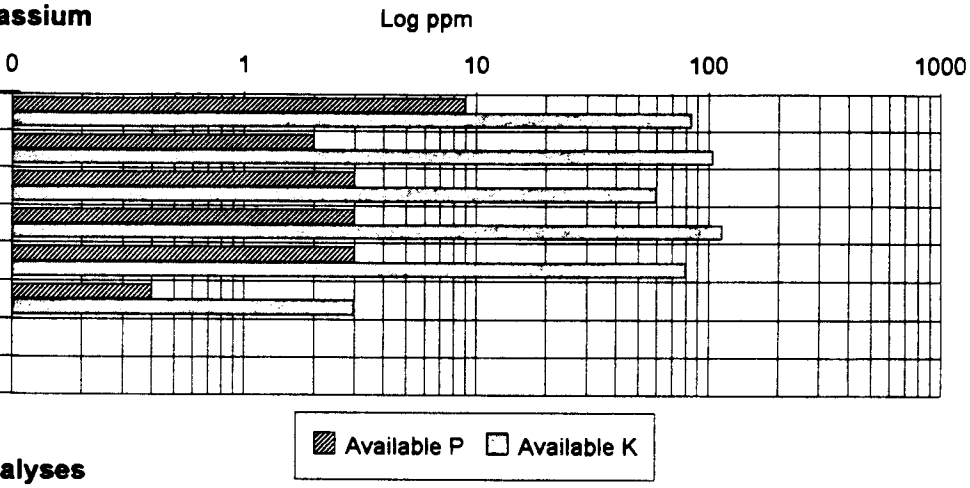
Note: All samples have PB prefix



Available Phosphorus and Potassium

	Avail P	Avail K
PR-S13; 3.0-10.	9	85
PR-S7; 3.0-10.0f	2	105
WA-S17	3	60
WA-SED5; 0.2-0	3	115
WA-SED5; 0.5-1	3	80
WA-SW2	0.4	3.0

Note: All samples have PB prefix



Organic Matter and Related Analyses

Guideline Published Threshholds*		C:N	C:P
Wis Dept. Natural Resources	Below:	40	120
Nat'l Academy of Sciences	Below:	6	30

	% Organic Matter	TOC**	Calculated Ratios C:N	Calculated Ratios C:P	Mg ppm	Ca ppm	Cation Exc Capacity Meq/100g	pH	NO3-N ppm	SO4-S ppm
PR-S13; 3.0-10.	1.7%	6,630	3	737	NR	NR	NR	8.2	366.5	181.0
PR-S7; 3.0-10.0f	0.9%	3,510	4	1,755	NR	NR	NR	8.2	17.0	41.5
WA-S17	0.8%	3,120	6	1,040	NR	NR	NR	7.3	1.0	92.5
WA-SED5; 0.2-0	2.5%	9,750	3	3,250	NR	NR	NR	7.9	10.0	22.5
WA-SED5; 0.5-1	1.0%	3,900	5	1,300	NR	NR	NR	8.3	3.0	553.5
WA-SW2	n/a	140	28	350	NR	NR	NR	8.6	<0.5	40

Note: All samples have PB prefix

* Sources: Natural Biodegradation as a Remedial Action Option - Interim Guidance, Wisconsin Dept of Nat Res. (1993) and In-situ Bioremediation: When Does It Work?, B. Rittman, Ed., National Academy of Sciences, 1993 p 117.

** Estimated total organic carbon (expressed in ppm) calculated from % organic matter - See Methods.

n/a = Not applicable

Note To determine C:N and C:P ratios, phosphorus is expressed as available phosphorus, total organic carbon (TOC) is calculated from percent organic carbon and total organic nitrogen is calculated as total Kjeldahl nitrogen (TKN) minus ammonium nitrogen.

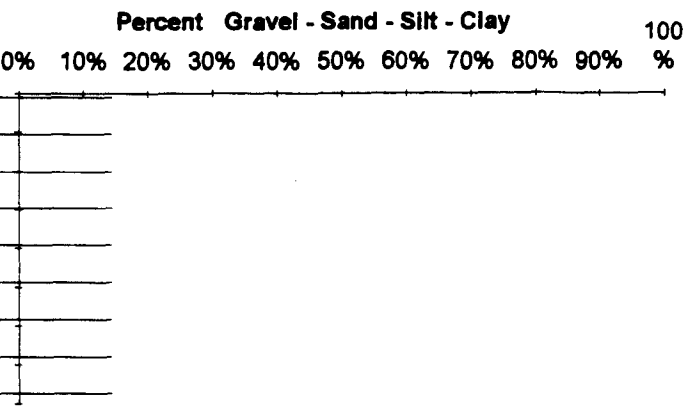
Section IV - Soil Physical Conditions

Particle size

	Gravel Fraction	Sand	Silt	Clay
PR-S13; 3.0-10.	NR	NR	NR	NR
PR-S7; 3.0-10.0f	NR	NR	NR	NR
WA-S17	NR	NR	NR	NR
WA-SED5; 0.2-0	NR	NR	NR	NR
WA-SED5; 0.5-1	NR	NR	NR	NR
WA-SW2	n/a	n/a	n/a	n/a

Note: All samples have PB prefix

n/a=not applicable
NR=not requested

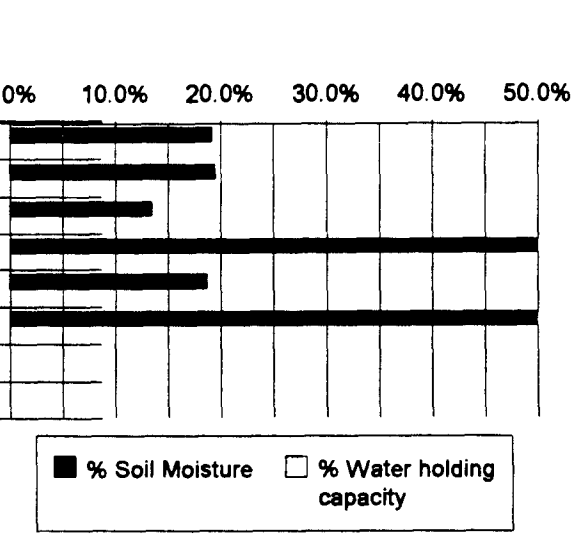


Soil Oxygen and Moisture Conditions

	% Air-filled pore space	% Moisture	% Solids	% Water Holding Capacity	Moisture as % Water Holding Capacity
PR-S13; 3.0-10.	NR	19.2%	80.8%	NR	NR
PR-S7; 3.0-10.0f	NR	19.5%	80.5%	NR	NR
WA-S17	NR	13.5%	86.5%	NR	NR
WA-SED5; 0.2-0	NR	55.1%	44.9%	NR	NR
WA-SED5; 0.5-1	NR	18.7%	81.3%	NR	NR
WA-SW2	n/a	100.0%	n/a	NR	n/a

Note: All samples have PB prefix

n/a=not applicable
NR=not requested



Sampling company Dames & Moore, Inc.
Contact Deborah L. Raede Sampler J. Deatherage
Phone 404-262-2915 Project # 24637-035-009
Fax 404-233-2271 Project name Plum Brook Ordnance
Site contaminant Explosives Residues, Metals (Lorain, Sandusky, Ottio)
(used to determine degrader microbial populations)

Requested analyses

Sample ID	Lab use only	Date	Time	Comp.	Grab	No. of jars/ vials	Contaminant* Sample of free product included? Yes __ No __	Comparative Enumeration Assay - Aerobic (soil or gw)	Comparative Enumeration Assay - microaerophilic (soil or gw)	Standard nutrient panel (soil or gw) - incl. TKN, ammonium nitrogen, available P and K, pH, % OM (s), % solids (s)	Cation exchange capacity (soil)	Particle size analysis (soil)	Percent air-filled pore space (soil)	Soil moisture holding capacity	Bulk density (soil)	Total minerals (soil or gw)	Heavy metals (soil or gw)	Other Nitrate/Nitrogen	Other Sulfate/Sulfur
PB-WA-S17-3.0/5.0		10-19-94	1115		X	2	N/A	✓		✓								✓	✓

Relinquished by: Eric M Sammels
Date/time 10-19-94, 1435
Received by: Melynn Haugh
Date/time 10/20/94, 9^45 AM

Comments: Refer to Dames & Moore P.O. 4425

Sample condition:

BioRenewal Technologies, Inc.
The Faraday Center
2800 South Fish Hatchery Road
Madison, WI 53711
(608)276-8980
Fax (608)273-6989

* If available, a sample of free product is preferred for use as the carbon source for enumerating the degrader microbial populations.

Send Invoice to:
Name Deborah L. Raede
Company Dames & Moore
Address 3525 Piedmont Road
City Atlanta State GA Zip 30305
Phone 404-262-2915

Site Information

Site Name	Plum Brook Ordanance Works	Number samples	6
Location	Sandusky, OH	Sample Type	5 soil, 1 groundwater
Contaminant	TNT		
Consultant	Dames& Moore	Date received	20-Oct-94
Proj. Contact	Rick Samuels	Date of this Report	29-Nov-94
Project Ref ID	24637-035-009	BioRenewal Job Code	OF

Section I - Summary of Bioremediation Data

Nutrient/physical factors are as suggested by Wisconsin DNR guidelines for site characterization requirements for natural biodegradation. Microbial factors are shown according to bio-engineering norms.

	Soil microbial populations: Exceeds norm for: Passive	Active	Soil moist. content: % of field capacity	% Air-filled pore space	pH	% TON of organic matter	C:N	C:P
Suggested guideline	>1E+06	>1E+03	25-85%	>10%	5.5-8.5	>1.5%	<40	<120
Note Ref.	1	2	3	4	5	6	7	8
PR-S13; 3.0-10.0ft					✓	✓	✓	✗
PR-S7; 3.0-10.0ft					✓	✓	✓	✗
WA-S17					✓	✓	✓	✗
WA-SED5; 0.2-0.5ft					✓	✓	✓	✗
WA-SED5; 0.5-1.5ft					✓	✓	✓	✗
WA-SW2	Guidelines valid for soils only at this time.							

Note: All samples have PB prefix

The nutrient/physical paprameters summarized above, in the case of unsaturated zone soils, reflect suggested minimum Wis Dept of Nat Res "site characterization requirements for natural biodegradation projects" as presented on pp 10-11 in Interim Guidance for Natural Biodegradation as a Remedial Action Option Dated February 8, 1993. BioRenewal stress that these "suggested guidelines" are only intended to provide a working frame of reference for evaluation. Each site is unique and requires professional judgement in order to select an appropriate remedial design. We provide this information in recognition that our clients need to work within the guidelines suggested by the state. Further, we hope this will facilitate continued evolution of a working framework for evaluating sites as to the potential for bioremediation whether through site augmentation or natural attenuation.

Notes: **Check indicates that sample meets guideline. Blank indicates no detect or data not available for that sample.**
✗ **indicates sample does not meet guideline.**

1) Microbial population levels in soils generally accepted as potentially adequate to support passive biodegradation. These levels are based on bio-engineering norms and not WDNR guidelines.
2) Microbial population levels in soils generally accepted as minimum to serve as an "inoculum" for implementing active bioremedial strategies.
3) See page 10, WDNR as referenced above. The suggested optimum range is 50-80% (P. 6).
4) See page 8 and 10, WDNR. WDNR suggests a minimum air-filled porosity in soil of 10% is necessary for adequate ozygen diffusion in the soil gas to support biodegradation.
5) See pages 7 and 11, WDNR.
6) See pages 9 and 11, WDNR. Total Organic Nitrogen (calculated from TKN values minus ammonium nitrogen values) divided by organic matter.
7) See pages 9 and 11, WDNR.
8) See pages 9 and 11, WDNR.

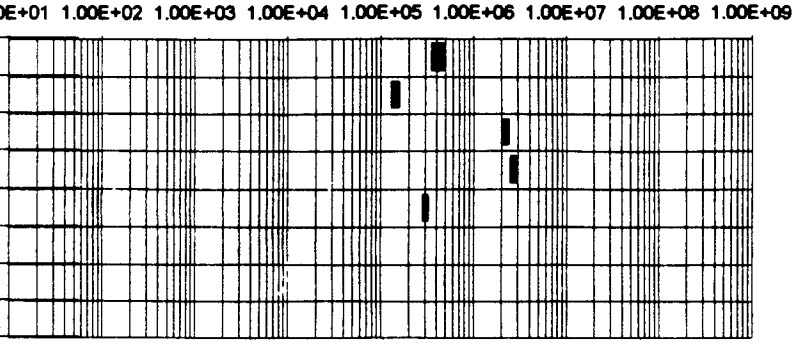
Section II - Microbial Data Summary

All values in cfu/gm (DSW)

Soil Samples
Total populations

Low and High indicate 95% Confidence Range

	Mean	Low	High
PR-S13; 3.0-10.	4.22E+05	3.64E+05	4.86E+05
PR-S7; 3.0-10.0f	1.46E+05	1.35E+05	1.59E+05
WA-S17	2.22E+06	2.05E+06	2.39E+06
WA-SED5; 0.2-0	2.75E+06	2.56E+06	2.99E+06
WA-SED5; 0.5-1	3.08E+05	2.92E+05	3.24E+05

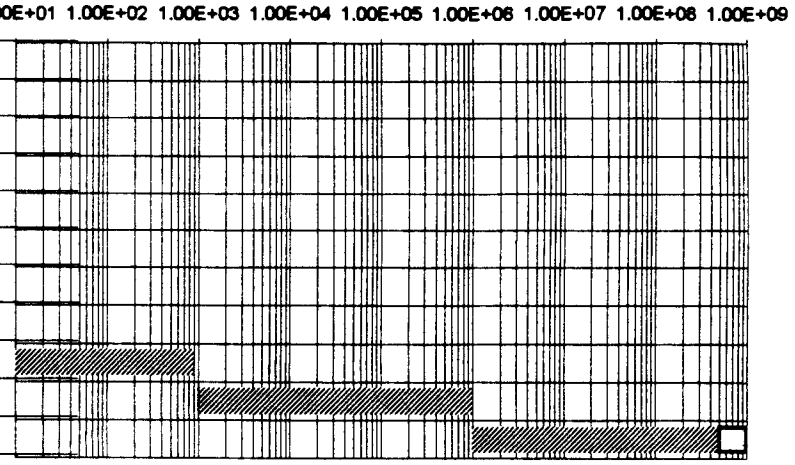


Note: All samples have PB prefix

Soil Samples
Degrader populations

Low and High indicate 95% Confidence Range

	Mean	Low	High
PR-S13; 3.0-10.	< 1E+02	NA	NA
PR-S7; 3.0-10.0f	< 1E+02	NA	NA
WA-S17	< 1E+02	NA	NA
WA-SED5; 0.2-0	< 2E+02	NA	NA
WA-SED5; 0.5-1	< 1E+02	NA	NA



Note: All samples have PB prefix

Marginal inoculum

Inoculum levels

Active degradation levels

Marginal inoculum = Degrader populations below 1.0E+03 are indicative of severe limitations and likely require major augmentation of site conditions to attain adequate cell mass to attain measurable biotransformation rates.

Inoculum levels = Degrader populations between 1.0E+03 and 1.0E+06 are amenable to site augmentation but generally are insufficient to attain adequate biotransformation without increased populations.

Active degradation levels = Degrader populations greater than 1.0E+06 are generally of sufficient magnitude to support measurable biotransformation. Additional site augmentation may still be required to attain desireable rates of transformation.

Assay conditons	Carbon source	% Carbon (v/v)	Incubation Temperature	Growth Conditions	Degrees of Freedom** Totals	Degraders
PR-S13; 3.0-10.0ft	Aerobic	0.3	22	Aerobic	4	10
PR-S7; 3.0-10.0ft	Aerobic	0.3	22	Aerobic	4	9
WA-S17	Aerobic	0.3	22	Aerobic	8	10
WA-SED5; 0.2-0.5ft	Aerobic	0.3	22	Aerobic	9	10
WA-SED5; 0.5-1.5ft	Aerobic	0.3	22	Aerobic	9	9

Note: All samples have PB prefix

* cfu/gm (DSW) = colony forming units per gm of dry soil weight

** Degrees of freedom is number of replicates minus one. This parameter is used in calculation of 95% confidence intervals.

Sampling company Dames + Moore, Inc.
Contact Deborah L. Raede Sampler J. Enches/B. Stukel
Phone 404-262-2915 Project # 24637-035-009
Fax 404-233-2271 Project name Plum Brook
Site contaminant Explosives Residues, Metals (state)
(used to determine degrader microbial populations)

Requested analyses

Sample ID	Lab use only	Date	Time	Comp.	Grab	No. of jars/ vials	Contaminant* Sample of free product included? Yes __ No __	Comparative Enumeration Assay - Aerobic (soil or gw)	Comparative Enumeration Assay - microaerophilic (soil or gw)	Standard nutrient panel (soil or gw) - incl. TKN, ammonium nitrogen, available P and K, pH, % OM (s), % solids (s)	Cation exchange capacity (soil)	Particle size analysis (soil)	Percent air-filled pore space (soil)	Soil moisture holding capacity	Bulk density (soil)	Total minerals (soil or gw)	Heavy metals (soil or gw)	Other Nitrate/Nitrogen	Other Sulfate/Sulfur
PB-WA-SW2		10-25-94	1220		X	4	N/A	✓		✓							✓	✓	

Relinquished by: P. Westermann
Date/time 10-25-94 1630
Received by: Megan Haugh
Date/time 10/26/94 10:20 AM

Comments: O+M P.O. 4425

Sample condition:

BioRenewal Technologies, Inc.
The Faraday Center
2800 South Fish Hatchery Road
Madison, WI 53711
(608)276-8980
Fax (608)273-6989

* If available, a sample of free product is preferred for use as the carbon source for enumerating the degrader microbial populations.

Send Invoice to:
Name Deborah L. Raede
Company Dames + Moore
Address 3525 Piedmont Rd
City Atlanta State GA Zip 30067
Phone 404-262-2915

Sampling company Dames + Moore
Contact Deborah Raede Sampler
Phone 404-262-2915 Project # 24637-035-009
Fax 404-233-2271 Project name Plum Brook Ordnance Works
Site contaminant Explosives residues, metals (state)
(used to determine degrader microbial populations)

Requested analyses

Sample ID	Lab use only	Date	Time	Comp.	Grab	No. of jars/ vials	Contaminant* Sample of free product included? Yes __ No ✓	Comparative Enumeration Assay - Aerobic (soil or gw)	Comparative Enumeration Assay - microaerophilic (soil or gw)	Standard nutrient panel (soil or gw) - incl. TKN, ammonium nitrogen, available P and K, pH, % OM (s), % solids (s)	Cation exchange capacity (soil)	Particle size analysis (soil)	Percent air-filled pore space (soil)	Soil moisture holding capacity	Bulk density (soil)	Total minerals (soil or gw)	Heavy metals (soil or gw)	Other Nitrate/Nitrogen	Other Sulfate/Sulfur
PB-WA-SED5-0.5/1.5		10-28-94	1100	X		2	—	✓		✓							✓	✓	
PB-WA-SED5-0.2/0.5		10-28-94	1100	X		2	—	✓		✓							✓	✓	

Relinquished by:	Date/time	Comments:	Sample condition:
P Westermann	10-28-94 1630		
Received by:	Date/time		
[illegible]	10/29/94, ~6 pm		

BioRenewal Technologies, Inc.
The Faraday Center
2800 South Fish Hatchery Road
Madison, WI 53711
(608)276-8980
Fax (608)273-6989

* If available, a sample of free product is preferred for use as the carbon source for enumerating the degrader microbial populations.

Send Invoice to:
Name Deborah Raede
Company Dames + Moore
Address 3525 Piedmont Rd Bldg 6 Suite 500
City Atlanta State GA Zip 30305
Phone 404-262-2915

Sampling company Dames + Moore
Contact Deborah Raede Sampler
Phone 404-262-2915 Project # 24637-035-009
Fax 404-233-2271 Project name Plum Brook Ordnance Works
Site contaminant Explosives residues, metals (state)
(used to determine degrader microbial populations)

Requested analyses

Sample ID	Lab use only	Date	Time	Comp.	Grab	No. of jars/ vials	Contaminant* Sample of free product included? Yes __ No ✓	Comparative Enumeration Assay - Aerobic (soil or gw)	Comparative Enumeration Assay - microaerophilic (soil or gw)	Standard nutrient panel (soil or gw) - incl. TKN, ammonium nitrogen, available P and K, pH, % OM (s), % solids (s)	Cation exchange capacity (soil)	Particle size analysis (soil)	Percent air-filled pore space (soil)	Soil moisture holding capacity	Bulk density (soil)	Total minerals (soil or gw)	Heavy metals (soil or gw)	Other Nitrate/Nitrogen	Other Sulfate/Sulfur
PB-PR-S13 3.0/10.0		10/31/94	1030		X	2	N/A	✓		✓								✓	✓
PB-PR-S7 3.0/10.0		10/31/94	1430		X	2	N/A	✓		✓								✓	✓

Relinquished by: Eric M Samuels — Date/time 10/31/94, 1600
Received by: Megan Haugh — Date/time 11/1/94, 10^05 AM

Comments: Dames + Moore P.O. 4425

Sample condition:

BioRenewal Technologies, Inc.
The Faraday Center
2800 South Fish Hatchery Road
Madison, WI 53711
(608)276-8980
Fax (608)273-6989

* If available, a sample of free product is preferred for use as the carbon source for enumerating the degrader microbial populations.

Send invoice to:
Name: Deborah Raede
Company: Dames + Moore
Address: 3525 Piedmont Rd Bldg 6 Suite 500
City: Atlanta State: GA Zip: 30305
Phone: 404-262-2915

APPENDIX L

DATA QUALITY ASSESSMENT

DATA QUALITY ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
PLUM BROOK STATION/NASA
SANDUSKY, OHIO

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LIST OF ACRONYMS AND ABBREVIATIONS

ASI	Analytical Services, Inc.
BDL	below the laboratory detection limit
COE	U.S. Army Corps of Engineers
EPA	U.S. Environmental Protection Agency
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spike duplicate
PQL	Practical Quantitation Limit
QC	quality control
PVC	polyvinyl chloride
RPD	relative percent difference
SVOCs	semivolatile organic compounds
TICs	Tentatively Identified Compounds
*u*g/L	micrograms per liter
*u*m	micron
VOCs	volatile organic compounds

1.0 INTRODUCTION

This report provides the Data Quality Assessment of the analytical laboratory results for samples collected from October to December 1994 for Dames & Moore's investigation of the former Plum Brook Ordnance Works in Sandusky, Ohio. The Data Quality Assessment includes:

(1) an evaluation of the laboratory performance and procedures in analyzing the samples and reporting the results of the analysis, and

(2) an assessment of the field quality control (QC) program which included collection and laboratory analysis of replicate samples, equipment blanks, and trip blanks.

All samples for this investigation were analyzed for chemical concentrations of explosives residues using U.S. Environmental Protection Agency (EPA) method 8330 and for concentrations of 14 metals, the 13 priority pollutant metals and manganese. Background soil samples and groundwater samples collected from the bedrock monitoring wells were analyzed for concentrations of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). All groundwater samples were analyzed for concentrations of nitrates. Selected sediment, surface water, and groundwater samples were analyzed for general chemistry parameters. Samples were analyzed by Dames & Moore's subcontracted analytical laboratory, Analytical Services, Inc. (ASI). ASI is a U.S. Army Corps of Engineers (COE) validated laboratory. Its Federal Identification Number is #58-1625655.

The Data Quality Assessment was performed in accordance with guidance provided in the "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (EPA, February 1993) and the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (EPA, February 1994).

A Practical Quantitation Limit (PQL) was established for reporting of results for the analysis of explosives residues by EPA Method 8330 for water samples. A discussion of the establishment of the PQL is provided with the laboratory reports in a separate appendix.

2.0 LABORATORY PERFORMANCE AND PROCEDURES

The Statement of Work for the Plum Brook Ordnance Works Investigation provided for a Date Quality Assessment to be performed for approximately 10 percent of the samples collected for the investigation. Dames & Moore selected 13 sets of laboratory data to be reviewed for Data Quality Assessment. Each set of laboratory data was provided in a laboratory report with a unique report number. A list of the samples included in these data sets was provided to the U.S. Army Corps of Engineers, Nashville District project manager for approval prior to initiating the review.

To the extent possible, data sets which included samples from each of the four media that were sampled (soil, sediment, surface water, and groundwater). These data sets included:

- 53 soil samples, 17 from the Red Water Ponds areas, 32 from the TNT areas, and four from background locations, all of which are listed in Table 2-1;
- Five sediment samples from the West Area Red Water Ponds Area which are listed in Table 2-2;
- Four surface water samples from the West Area Red Water Ponds Area which are listed in Table 2-3; and
- Nine ground water samples including samples from two overburden wells at the West Area Red Water Ponds, five overburden wells at the TNT areas, one bedrock well at the Pentolite Road Red Water Ponds, and one bedrock well at TNT Area A, which are listed in Table 2-4.

Also, to the extent possible, data sets that included replicate samples, equipment blanks, and trip blanks were selected for review.

The laboratory review portion of the Data Quality Assessment was performed to provide a critical review of the laboratory analysis and reported chemical results. Data quality assessments of laboratory-generated data routinely identify problems associated with analytical measurements, even from the most experienced and capable laboratories. To confidently use any of the data within the data set, the data user should understand the limitations and qualifications of the data.

TABLE 2-1

SOIL SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-TNTA-S5-1.0/2.0	56728-1	Total Metals, Explosives Residues
PB-TNTA-S5-2.5/3.5	56728-2	Total Metals, Explosives Residues
PB-TNTA-S6-1.0/2.0	56728-3	Total Metals, Explosives Residues
PB-TNTA-S6-2.5/3.5	56728-4	Total Metals, Explosives Residues
PB-TNTA-S7-1.0/2.0	56728-5	Total Metals, Explosives Residues
PB-TNTA-S7-2.5/3.5	56728-6	Total Metals, Explosives Residues
PB-TNTA-S8-2.5/3.5	56728-7	Total Metals, Explosives Residues
PB-TNTA-S10-2.5/3.5	56728-8	Total Metals, Explosives Residues
PB-TNTA-S11-2.5/3.5	56728-9	Total Metals, Explosives Residues
PB-TNTA-S25-0.0/1.5	56822-1	Total Metals, Explosives Residues
PB-TNTA-S26-0.0/1.5	56822-2	Total Metals, Explosives Residues
PB-TNTA-S27-2.5/3.5	56728-10	Total Metals, Explosives Residues
PB-TNTA-S31-0.0/1.0	56822-3	Total Metals, Explosives Residues
PB-TNTA-S32-0.0/1.0	56822-4	Total Metals, Explosives Residues
PB-TNTB-S16-0.0/2.0	56417-1	Total Metals, Explosives Residues
PB-TNTB-S17-0.0/1.5	56417-2	Total Metals, Explosives Residues
PB-TNTB-S18-0.5/1.5	56417-3	Total Metals, Explosives Residues
PB-TNTB-S19-0.5/2.0	56417-5	Total Metals, Explosives Residues
PB-TNTB-S20-0.5/1.5	56417-6	Total Metals, Explosives Residues
PB-TNTB-S21-0.0/2.0	56417-7	Total Metals, Explosives Residues
PB-TNTB-S27-2.5/3.5	56417-8	Total Metals, Explosives Residues
PB-TNTB-S28-0.5/1.5	56417-4	Total Metals, Explosives Residues
PB-TNTC-S17-0.0/1.5	56447-1	Total Metals, Explosives Residues
PB-TNTC-S18-0.0/1.5	56447-2	Total Metals, Explosives Residues
PB-TNTC-S19-0.5/2.0	56447-4	Total Metals, Explosives Residues
PB-TNTC-S20-0.0/1.25	56447-5	Total Metals, Explosives Residues
PB-TNTC-S21-0.5/1/0	56447-9	Total Metals, Explosives Residues
PB-TNTC-S22-0.5/1.0	56491-10	Total Metals, Explosives Residues
PB-TNTC-S23-0.0/2.0	56447-6	Total Metals, Explosives Residues
PB-TNTC-S24-0.0/1.75	56447-8	Total Metals, Explosives Residues
PB-TNTC-S28-0.0/1.5	56447-3	Total Metals, Explosives Residues
PB-TNTC-S29-0.0/2.0	56447-7	Total Metals, Explosives Residues
PB-WA-S4-0.0/0.5	56822-7	Total Metals, Explosives Residues
PB-WA-S7-0.0/2.0	56491-1	Total Metals, Explosives Residues
PB-WA-S7-2.0/5.0	56491-2	Total Metals, Explosives Residues

TABLE 2-1
(Continued)

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-WA-S8-0.0/2.0	56491-3	Total Metals, Explosives Residues
PB-WA-S8-2.0/5.0	56491-4	Total Metals, Explosives Residues
PB-WA-S9-0.0/2.0	56491-6	Total Metals, Explosives Residues
PB-WA-S9-2.0/5.0	56491-7	Total Metals, Explosives Residues
PB-WA-S16-0.0/2.0	56491-8	Total Metals, Explosives Residues
PB-WA-S16-2.0/4.0	56491-9	Total Metals, Explosives Residues
PB-WA-S20-0.0/0.5	56822-5	Total Metals, Explosives Residues
PB-WA-S22-2.0/5.0	56491-5	Total Metals, Explosives Residues
PB-WA-S23-0.0/0.5	56822-6	Total Metals, Explosives Residues
PB-PR-S8-0.0/2.0	56822-8	Total Metals, Explosives Residues
PB-PR-S8-2.0/5.0	56822-9	Total Metals, Explosives Residues
PB-PR-S17-0.0/2.0	56822-10	Total Metals, Explosives Residues
PB-PR-17-2.0/5.0	56822-11	Total Metals, Explosives Residues
PB-PR-29-2.0/5.0	56822-12	Metals, Explosives Residues Total
PB-BG-S4-0.5/30	56812-1	Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BG-S8-0.5/3.0	56812-2	Total Metals, Explosives Residues, Volatiles, Semivolatiles
PG-BG-S5-0.5/3.0	56812-3	Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BG-S5-3.0/5.0	56812-4	Total Metals, Explosives Residues, Volatiles, Semivvolatiles

TABLE 2-2

SEDIMENT SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-WA-SED1-0.2/1.7	56781-1	General Chemistry, Total Metals, Explosives Residues
PB-WA-SED1-1.7/2.5	56781-2	Total Metals, Explosives Residues
PB-WA-SED3-1.0/2.0	56781-5	Total Metals, Explosives Results
PB-WA-SED8-0.2/1.7	56781-3	General Chemistry, Total Organic Carbon
PB-WA-SED3-0.2/1.0	56781-4	Total Metals, Explosives Residues

TABLE 2-3

SURFACE WATER SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-WA-SW3-F	56647-3	Dissolved Metals
PB-WA-SW3-U	56647-4	General Chemistry, Total Suspended Solids, Total Metals, Explosives Residues
PB-WA-SW7-F	56647-1	Dissolved Metals
PB-WA-SW7-U	56647-2	General Chemistry, Total Suspended Solids, Total Metals, Explosives Residues

TABLE 2-4

GROUNDWATER SAMPLES INCLUDED IN LABORATORY DATA QUALITY ASSESSMENT

Sample I.D.	Laboratory Report Number	Analysis Requested
PB-TNTA-MK-MW22-U	57935-4	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-MK-MW22-F	57935-5	Dissolved Metals
PB-TNTA-MK-MW23-U	57935-3	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-MK-MW23-F	57935-6	Dissolved Metals
PB-TNTA-DM-MW10-U	57985-1	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-DM-MW10-F	57985-2	Dissolved Metals
PB-TNTA-DM-MW23-U	57985-3	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTA-DM-MW23-F	57985-4	Dissolved Metals
PB-TNTB-MK-MW16-U	57935-1	Nitrate Nitrogen, Total Metals, Explosives Residues
PB-TNTB-MK-MW16-F	57935-2	Dissolved Metals
PB-WA-DM-MW2-U	57992-1	General Chemistry, Nitrate Nitrogen, Total Metals, Explosives Residues
PB-WA-DM-MW2-F	57992-2	Dissolved Metals
PB-WA-DM-MW22-U	57992-3	General Chemistry, Nitrate Nitrogen, Total Metals, Explosives Residues
PB-WA-DM-MW22-F	57992-4	Dissolved Metals
PB-BED-MW18-U	58042-1	Nitrate Nitrogen, Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BED-MW18-F	58042-2	Dissolved Metals
PB-BED-MW15-U	58046-1	Nitrate Nitrogen, Total Metals, Explosives Residues, Volatiles, Semivolatiles
PB-BED-MW15-F	58046-2	Dissolved Metals

Overall, the quality of the data is acceptable. The data quality assessment has identified aspects of the analytical data that require qualification. Data qualifiers have been placed next to the results on the laboratory reports so that the data user can quickly assess the qualitative and/or quantitative reliability of the reported result.

2.1 EVALUATION OF DATA PACKAGE DELIVERABLES

Dames & Moore reviewed the data packages to ensure that all required deliverables were provided. The following items were included with each data package:

- Laboratory-assigned Identification Code
- Field-assigned Sample Designation
- Sample Matrix
- Date of Sampling
- Date of Receipt at the Laboratory
- Code for Applicable Chain-of-Custody Documents
- Reference to Specific Method Used
- Date of Sample Preparation
- Date of Sample Analysis
- Signature of Person(s) Authorized to Release Data
- Chain-of-Custody Documentation
- COE Cooler Receipt Forms

The following QC information was also included with each data package:

- Method Blank Data
- Method Blank Summaries (indicating which samples are associated with each method blank)
- Recovery and Precision of Matrix Spike/Matrix Spike Duplicate (MS/MSD), where applicable
- Surrogate Recoveries, where applicable
- Recovery and Precision of Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD), where applicable
- Case Narrative

2.2 ASSESSMENT OF ORGANIC PARAMETERS

The organic data in each data package was reviewed to evaluate the following parameters:

- Holding Times
- Method Blanks
- System Monitoring Compounds
- Surrogate Spikes
- MS/MSD
- LCS/LCSD
- Tentatively Identified Compounds (TICs)

The results of the review for each parameter are discussed individually below.

Explanations of the qualifiers assigned to the reported results for organic compounds based on the Data Quality Assessment are listed below.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".

NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

2.2.1 Holding Times

Holding times were reviewed for all samples evaluated in the Data Quality Assessment. Samples that were analyzed or extracted outside the specified holding times are discussed below.

- Soil samples 56822-8 to 56822-12 collected from the Pentolite Road Red Water Ponds were analyzed for explosives residues 39 days outside the hold time criteria. Sample 56822-12 was a duplicate of sample 56823-6. Sample 56823-6 was analyzed for explosives residues within the hold time criteria. Concentrations for all compounds were reported to be below the laboratory detection limit (BDL). Professional judgement must be used when evaluating the hold times of non-aqueous matrices. Upon review of the data, the corresponding sample results are qualified. Positive results are qualified "J". Results below the method detection limits are qualified "UJ". Samples from the surrounding area and at corresponding depths exhibited similar results.

- Sample 58046-1, a groundwater sample from bedrock well BED-MW15, was re-analyzed for VOCs 2 days outside the hold time criteria. Positive results are qualified "J" and sample quantitation limits are qualified "UJ". Since this sample was properly preserved with hydrochloric acid (pH < 2), the integrity of the sample is assumed to be good.

All other samples for all matrices analyzed for explosives residues, VOCs, or SVOCs were extracted and analyzed within the hold time criteria.

2.2.2 Method Blanks

Method blanks were reported as BDL for all target compounds.

2.2.3 System Monitoring Compounds (VOCs)

All recovery values for VOCs analysis were within acceptance limits.

2.2.4 Surrogate Spikes (SVOCs and Explosives Residues)

All recovery values for explosives residues were within acceptance limits.

For sample 58046-1, a groundwater sample from bedrock well BED-MW15, SVOC surrogate recoveries for nitrobenzene-D5 and 2-fluorobiphenyl were greater than the upper acceptance limit. Detected SVOCs are qualified "J". Surrogate compounds are used as a means of evaluating laboratory performance; however, matrix effect, interferences, and high concentrations of analytes may present unique problems that are outside the control of the laboratory. Data are not qualified with respect to surrogate recovery unless two or more SVOC surrogates within the same fraction are out of specification.

2.2.5 MS/MSD

MS compounds could not be quantified for the explosives residues analysis for the three reports discussed below.

- For report 57992, the explosives residues MS recovery for 2-nitrotoluene could not be quantitated due to matrix interference. In conjunction with the LCS recovery data, the compound 2-nitrotoluene is qualified "UJ" for samples 57992-1 and 57992-3 (target compound concentration is BDL for both samples).

- For reports 58042 and 58046, the explosives residues MS compounds could not be quantitated due to matrix interference. The MS for these reports was performed on sample 58027-3MS. Even though the matrix of these three samples is considered ground water, samples 58027-3 (PB-TNTB-MK-MW17-U), 58042-1 (PB-BED-MW18-U) and 58046-1 (PB-BED-MW15-U) are from different areas on the site and are from different types of monitoring wells. Therefore, no qualification is applied based on MS results alone.

All recovery values for VOCs and SVOCs were within acceptable limits.

2.2.6 LCS/LCSD

For reports 57935, 57992, 58042 and 58046, explosives residues LCS recoveries for 2-nitrotoluene exceeded the lower acceptance limit (50 percent). Since 2-nitrotoluene is also a target compound, its values in the associated samples are qualified. Concentrations reported above the detection limit are qualified "J". Concentrations reported as BDL are qualified "UJ". Low LCS recoveries for 2-nitrotoluene are present in almost all of the ground water data packages. LCS/LCSD recovery values are used to determine laboratory performance and method accuracy. Action taken on the LCS recovery is based on both the number of compounds that are outside of the recovery criteria and the magnitude of the noncompliance.

All recovery values for VOCs and SVOCs were within acceptable limits.

2.2.7 TICs (VOCs and SVOCs)

TIC results qualified "NJ" are tentatively identified with approximate concentrations.

TIC results qualified "N" indicate the presence of an analyte for which there is presumptive evidence to make a "tentative identification".

2.3 ASSESSMENT OF INORGANIC PARAMETERS

The inorganic and general chemistry Data Quality Assessment is based upon the following parameters:

- Holding Times
- Method Blanks
- LCS/LCSD
- MS/MSD

The results of the review for each parameter are discussed individually below.

Explanations of the qualifiers assigned to the reported results for inorganic compounds based on the Data Quality Assessment are listed below.

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

J - The associated value is an estimated quantity.

R - The data are unusable. (Note: Analyte may or may not be present.)

UJ - The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

2.3.1 Holding Times

All samples were digested and analyzed within the required hold time criteria.

2.3.2 Method Blanks

Method blanks were reported as BDL for all target analytes.

2.3.3 LCS/LCSD

For report 56812, the LCS recovery for beryllium (72 percent) exceeded the lower acceptance limit (75 percent). Positive results are qualified "J". Results reported as BDL are qualified "UJ".

2.3.4 MS/MSD

2.3.4.1 MS/MSD Assessment for Soil and Sediment Samples

Due to the non-homogenous nature of soil and sediment samples, if qualification is appropriate based on MS/MSD results, only the unspiked sample collected from the same sample location as the spiked sample is qualified when both samples are processed in the same batch.

- Report 56417 included eight soil samples. The MS and MSD recoveries for beryllium (74 and 73 percent) exceeded the lower acceptance limit (75 percent) in sample 56417-1MS; therefore, the reported concentration for beryllium in sample 56417-1 is qualified. Since the result is reported as BDL, the qualification is "UJ". Also, the MS recovery for thallium (74 and 68 percent) exceeded the lower acceptance limit (75 percent) in sample 56417-5MS; therefore, the reported concentration for thallium in sample 56417-5 is qualified. Since the result is reported as BDL, the qualification is "UJ".

- Report 56447 included nine soil samples. The samples were analyzed for silver and antimony in batch QM3835. The MS and MSD recoveries for silver (57 and 58 percent) and antimony (66 and 67 percent) exceeded the lower acceptance limit (75 percent). Sample 56447-1 was used for the MS and MSD samples for batch QM3825. Therefore, silver and antimony results for sample 56447-1 are qualified. Results reported as BDL are qualified as estimated "UJ". Positive results are qualified as estimated "J".

  Samples included in report 56447 were analyzed for thallium in batch QM3855. The MS and MSD recoveries for thallium were low (74 and 77 percent). The MS and MSD samples were prepared from sample 56448-1. Therefore, sample 56448-1 is qualified for thallium in report 56448.

- Report 56491 included 10 soil samples. The samples were analyzed for antimony in batch QM3848 for which the MS and MSD recoveries for antimony (72 and 73 percent) were below the lower acceptance limit (75 percent). Sample 56448-1 was used to prepare the MS and MSD samples for batch QM3848. The associated soil sample 56448-1 is qualified for antimony on report 56448. No samples included in report 56491 are qualified.

- Report 56728 included 10 soil samples. The samples were analyzed for ICP metals in two batches (QM3878 and QM3885). The MS and MSD recoveries for silver (65 and 63 percent, 67 and 70 percent) and antimony (74 and 71 percent, and 71 and 71 percent) exceeded the lower acceptance limit (75 percent) for both batches. Sample 56728-6 was used for the MS and MSD in batch QM3885. Therefore, this sample was qualified. Results reported as BDL are qualified as estimated "UJ". Sample 56720-2 was used for the MS and MSD in batch QM3878. This sample is also qualified on report 56720.

- Report 56822 included 10 soil samples. The samples were analyzed for ICP metals in two batches (QM3929 and QM3930). The MS and MSD recoveries for silver (59 and 61 percent, 69 and 68 percent) and antimony (73 and 72 percent, and 62 and 62 percent) exceeded the lower acceptance limit (75 percent) for both batches. Sample 56822-2 was used for the MS and MSD in batch QM3929. Sample 56822-8 was used for the MS and MSD in batch QM3930. Both samples are qualified for silver and antimony. Results reported as BDL are qualified as estimated "UJ".

- Report 56812 included four background soil samples. MS and MSD recoveries were low for antimony (42 and 42 percent), beryllium (71 and 71 percent), and silver (53 and 54 percent). The samples were re-analyzed. In the re-analysis, beryllium MS and MSD recoveries were acceptable. The beryllium results reported in report 56812 are from the re-analysis and are not qualified. The MS and MSD recoveries for antimony (48 and 54 percent) and silver (58 and 64 percent) were low on the re-analysis. Therefore, antimony and silver results are qualified for the samples used for the MS and MSD for the original analysis (56810-1) and the re-analysis (56824-1).

2.3.4.2 MS/MSD Assessment for Groundwater and Surface Water Samples

- Report 57935 included six groundwater samples. The samples were analyzed for selenium in two batches. The MS and MSD recoveries for selenium (68 and 31 percent, 73 and 74 percent) in both batches exceeded the lower acceptance limit (75 percent). Therefore, selenium results are qualified. Results reported as BDL are qualified as estimated "UJ".

- Report 57985 included four groundwater samples. These samples were analyzed for selenium in batch QM5042. The MS and MSD recoveries for selenium (73 and 74 percent) exceeded the lower acceptance limit (75 percent). However, the MS and MSD samples for batch QM5042 were run on a sample that was not collected at the Plum Brook site. The LCS and LCSD samples which were run on reagent water were acceptable. Therefore, the selenium values for the four samples included in report 57985 were not qualified.

- Report 58042 included two groundwater samples. The MS/MSD recoveries for total selenium (35 and 32 percent) and dissolved lead (53 and 53 percent), dissolved selenium (16 and 14 percent) and dissolved thallium (56 and 59 percent) exceeded the lower acceptance limit (75 percent). Results reported as BDL are qualified "UJ". The MSs for this batch were performed on samples 58093-1MS and 58027-4MS. The selenium results would normally be considered unusable because the MS and MSD results were below 30 percent. However, since there was no MS analysis performed on a sample from sample batches 58042 or 58046 and matrix interference was credited with the low recovery, the dissolved selenium results were deemed usable with qualification.

- Report 58046 included two groundwater samples. The MS and MSD recoveries for total selenium (35 and 32 percent) and dissolved lead (53 and 53 percent),

dissolved selenium (16 and 14 percent) and dissolved thallium (56 and 59 percent) exceeded the lower acceptance limit (75 percent). Results reported as BDL are qualified "UJ". The MSs for this batch were performed on samples 58093-1MS and 58027-4MS. Since there was no MS analysis performed on a sample from sample batches 58042 or 58046 and matrix interference was credited with the low recovery, the dissolved selenium results were deemed usable with qualification.

- Report 57992 included four groundwater samples. The MS/MSD recoveries for total selenium (35 and 32 percent) exceeded the lower acceptance limit (75 percent). Therefore, total selenium results are qualified. Results reported as BDL are qualified as estimated "UJ".

- Report 56647 included four surface water samples. The MS and MSD recoveries for dissolved silver (66 and 66 percent) exceeded the lower acceptance limit (75 percent). Sample 56647-1 was used for the MS; therefore, only this sample is qualified. Results reported as BDL are qualified as estimated "UJ".

3.0 COMPARISON OF REPLICATE SAMPLE RESULTS

Replicate samples are collected for two primary reasons:

1. To evaluate the analytical laboratory's precision, defined as its ability to generate the same result in repeated tests of the same sample.
2. To evaluate the variability of the samples collected in the field; and

Replicate QC samples were collected at a rate of 10 percent of the field samples collected. Twenty-one split soil samples were collected, four from TNT Area A, three from TNT Area B, three from TNT Area C, six from the Pentolite Road Red Water Ponds, four from the West Area Red Water Ponds, and one from a background soil boring. One split sediment sample was collected at the west pond at the West Area Red Water Ponds. One duplicate surface water sample was collected at the west pond at the West Area Red Water Ponds. Three duplicate groundwater samples were collected, two from overburden wells and one from a bedrock well.

Sample variability and laboratory precision are assessed through the evaluation of the relative percent difference (RPD) between replicate samples. RPD is defined as the difference between two values divided by the average of the values, expressed as a percent. The RPD criteria are only applied to those results which were greater than five times the detection limit. Professional judgement should be employed when evaluating replicate sample RPDs. Soil and sediment matrices are generally not homogeneous even after homogenization and RPDs in excess of 100 percent are not uncommon.

For this assessment, the following RPD criteria have been used as guidelines:

	Water Matrices	Soil Matrices
Organic Parameters	100 percent	100 percent
Inorganic Parameters	50 percent	100 percent

3.1 COMPARISON OF SPLIT SOIL SAMPLE RESULTS

The 21 sample split pairs were all analyzed for 14 explosives residues analytes and 14 metals, the 13 priority pollutant metals and manganese. The one background soil split pair samples were also analyzed for concentrations of VOCs and SVOCs.

Results for those analytes/compounds which were detected at or above their detection limit for either the field or QC sample of the split sample pair are presented in Table 3-1. For analytes not listed in these tables, the result for both the field sample and the split sample were BDL.

Overall, the results for the split soil samples indicated good agreement between the field and split samples. Results that are above the acceptable criteria established for this review are discussed below.

3.1.1 Explosives Residues in Soil Samples

Twenty-one pairs of split soil samples were analyzed for 14 explosives residues analytes providing a total of 294 explosives residues data pairs for comparison. RPDs were within acceptable limits for all but two of the data pairs. The RPDs that exceeded the acceptable limit are shaded on Table 3-1.

- For sample PB-TNTA-S16-0.0/2.0 and its split PB-TNTA-S29-0.0/2.0, analysis for 2,4,6-trinitrotoluene exhibited an RPD of 110.2.
- For sample PB-TNTB-S18-0.5/1.5 and its split PB-TNTB-S28-0.5/1.5, analysis for 2,4-dinitrotoluene exhibited an RPD of 137.5.

The most likely reason for the RPDs in excess of 100 percent in these two sample pairs is the non-homogenous nature of the soil matrix.

TABLE 3-1

SUMMARY OF SOIL SPLIT SAMPLE RESULTS

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTA-S11-2.5/3.5 Split: PB-TNTA-S27-2.5/3.5	56728	Antimony	6010A, 7000	mg/Kg	5.8	BDL	NA	5.8
		Arsenic	6010A, 7000	mg/Kg	4.8	4.8	NA	3.5
		Chromium	6010A, 7000	mg/Kg	22	18	20.0	1.2
		Lead	6010A, 7000	mg/Kg	15	13	NA	2.9
		Manganese	6010A, 7000	mg/Kg	270	590	74.4	4.7
		Nickel	6010A, 7000	mg/Kg	29	26	10.9	2.3
		Zinc	6010A, 7000	mg/Kg	60	57	5.1	2.3
Field: PB-TNTA-S4-1.5/5.0 Split: PB-TNTA-S28-1.5/5.0	56720	Chromium	6010A, 7000	mg/Kg	9.8	10.2	4.0	1.2
		Copper	6010A, 7000	mg/Kg	3.1	BDL	NA	2.4
		Lead	6010A, 7000	mg/Kg	4.8	5.3	NA	3
		Manganese	6010A, 7000	mg/Kg	349	259	29.6	4.8
		Nickel	6010A, 7000	mg/Kg	9.3	9.4	NA	2.4
		Zinc	6010A, 7000	mg/Kg	27	30	10.5	2.4
Field: PB-TNTA-S16-0.0/2.0 Split: PB-TNTA-S29-0.0/2.0	56803	2,4,6-TNT	8330	mg/Kg	19	5.5	110.2	0.25
		2,4-DNT	8330	mg/Kg	1.5	2.7	57.1	0.25
		2,6-DNT	8330	mg/Kg	1.3	1.5	14.3	0.26
		3,4-DNT	8330	mg/Kg	BDL	0.4	NA	0.25
		Chromium	6010A, 7000	mg/Kg	46	52	12.2	1.1
		Copper	6010A, 7000	mg/Kg	BDL	4.4	NA	2.2
		Lead	6010A, 7000	mg/Kg	38	55	36.6	2.7
		Manganese	6010A, 7000	mg/Kg	132	121	8.7	4.4
		Nickel	6010A, 7000	mg/Kg	6.6	6.6	NA	2.2
		Zinc	6010A, 7000	mg/Kg	209	253	19.0	2.2

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTA-S24-1.5/3.0 Split: PB-TNTA-S30-1.5/3.0	56809	2,4-DNT	8330	mg/Kg	0.3	0.3	NA	0.25
		2,6-DNT	8330	mg/Kg	BDL	0.5	NA	0.26
		3,4-DNT	8330	mg/Kg	0.6	0.8	NA	0.25
		Chromium	6010A, 7000	mg/Kg	6.2	5.2	17.5	1
		Lead	6010A, 7000	mg/Kg	3.3	3.4	NA	2.6
		Manganese	6010A, 7000	mg/Kg	86	80	7.2	4.1
		Nickel	6010A, 7000	mg/Kg	5.2	5.2	NA	2.1
		Zinc	6010A, 7000	mg/Kg	19	17	11.1	2.1
Field: PB-TNTB-S11-2.5/3.5 Split: PB-TNTB-S27-2.5/3.5	56416, 56417	2,4,6-TNT	8330	mg/Kg	2.2	1.8	20.0	0.25
		4-Am-DNT	8330	mg/Kg	1.3	1.1	NA	0.25
		2-Am-DNT	8330	mg/Kg	3.8	3.3	14.1	0.25
		Antimony	6010A, 7000	mg/Kg	11	9	NA	6
		Arsenic	6010A, 7000	mg/Kg	20	16	NA	3.6
		Beryllium	6010A, 7000	mg/Kg	BDL	1.3	NA	1.2
		Cadmium	6010A, 7000	mg/Kg	1.3	BDL	NA	1.2
		Chromium	6010A, 7000	mg/Kg	13	12	8.0	1.2
		Copper	6010A, 7000	mg/Kg	46	57	21.4	2.4
		Lead	6010A, 7000	mg/Kg	25	29	14.8	3
		Manganese	6010A, 7000	mg/Kg	190	268	34.1	4.8
		Nickel	6010A, 7000	mg/Kg	61	80	27.0	2.4
		Zinc	6010A, 7000	mg/Kg	93	134	36.1	2.4
Field: PB-TNTA-S18-0.5/1.5 Split: PB-TNTA-S28-0.5/1.5	56417	2,4,6-TNT	8330	mg/Kg	20000	29000	36.7	0.25
		1,3,5-TNB	8330	mg/Kg	10	14	33.3	0.25
		2,4-DNT	8330	mg/Kg	150	810	137.5	0.25
		2,6-DNT	8330	mg/Kg	170	230	30.0	0.26
		4-Am-2-NT	8330	mg/Kg	BDL	0.3	NA	0.25

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTA-S18-0.5/1.5 Split: PB-TNTA-S28-0.5/1.5 (Continued)	56417 (Continued)	3,4-DNT	8330	mg/Kg	0.3	0.6	NA	0.25
		4-Am-DNT	8330	mg/Kg	11	BDL	NA	0.25
		2-Am-DNT	8330	mg/Kg	BDL	2.5	NA	2.5
		1,3-DNB	8330	mg/Kg	0.7	1	NA	0.25
		Antimony	6010A, 7000	mg/Kg	17	18	NA	5.3
		Arsenic	6010A, 7000	mg/Kg	4.4	BDL	NA	3.2
		Chromium	6010A, 7000	mg/Kg	12	16	28.6	1.1
		Copper	6010A, 7000	mg/Kg	35	205	141.7	2.1
		Lead	6010A, 7000	mg/Kg	962	1078	11.4	2.7
		Manganese	6010A, 7000	mg/Kg	118	119	0.8	4.3
		Nickel	6010A, 7000	mg/Kg	9.3	9.7	NA	2.1
		Zinc	6010A, 7000	mg/Kg	214	873	121.3	2.1
Field: PB-TNTB-S21-0.0/2.0 Split: PB-TNTB-S29-0.0/2.0	56417, 56448	2,4,6-TNT	8330	mg/Kg	0.3	BDL	NA	0.25
		Chromium	6010A, 7000	mg/Kg	7.1	19	91.2	1.1
		Lead	6010A, 7000	mg/Kg	3.8	9.6	NA	2.7
		Manganese	6010A, 7000	mg/Kg	117	219	60.7	4.2
		Nickel	6010A, 7000	mg/Kg	9.2	13.2	NA	2.1
		Zinc	6010A, 7000	mg/Kg	138	205	39.1	2.1
Field: PB-TNTC-S16-0.5/1.0 Split: PB-TNTC-S27-0.5/1.0	56411	2,4-DNT	8330	mg/Kg	1	0.5	NA	0.25
		2,6-DNT	8330	mg/Kg	1	0.4	NA	0.26
		Chromium	6010A, 7000	mg/Kg	15	20	28.6	1.2
		Copper	6010A, 7000	mg/Kg	8	BDL	NA	2.5
		Lead	6010A, 7000	mg/Kg	15	8	NA	3.1
		Manganese	6010A, 7000	mg/Kg	642	617	4.0	4.9
		Nickel	6010A, 7000	mg/Kg	36	31	14.9	2.5
		Zinc	6010A, 7000	mg/Kg	22	23	4.4	2.5

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-TNTC-S18-0.0/1.5 Split: PB-TNTC-S28-0.0/1.5	56447	Antimony	6010A, 7000	mg/Kg	8.1	5.8	NA	5.3
		Arsenic	6010A, 7000	mg/Kg	6	4.8	NA	3.2
		Chromium	6010A, 7000	mg/Kg	5.2	5.8	NA	1.1
		Copper	6010A, 7000	mg/Kg	5.9	7	NA	2.1
		Lead	6010A, 7000	mg/Kg	35	32	9.0	2.6
		Manganese	6010A, 7000	mg/Kg	1376	1682	20.0	4.2
		Nickel	6010A, 7000	mg/Kg	8.5	10.1	NA	2.1
		Zinc	6010A, 7000	mg/Kg	72	77	6.7	2.1
Field: PB-TNTC-S23-0.0/2.0 Split: PB-TNTC-S29-0.0/2.0	56447	Chromium	6010A, 7000	mg/Kg	6.6	5.2	NA	1.4
		Lead	6010A, 7000	mg/Kg	6	5.6	NA	3.4
		Manganese	6010A, 7000	mg/Kg	164	123	28.6	5.5
		Nickel	6010A, 7000	mg/Kg	7.8	5.3	NA	2.7
		Zinc	6010A, 7000	mg/Kg	29	20	36.7	2.7
Field: PB-PR-S11-5.0/10.0 Split: PB-PR-S25-5.0/10.0	56813, 56816	Arsenic	6010A, 7000	mg/Kg	BDL	9.8	NA	3.7
		Chromium	6010A, 7000	mg/Kg	15	15	0.0	1.2
		Copper	6010A, 7000	mg/Kg	16	13	20.7	2.5
		Lead	6010A, 7000	mg/Kg	11	13	NA	3.1
		Manganese	6010A, 7000	mg/Kg	720	1100	41.8	4.9
		Nickel	6010A, 7000	mg/Kg	30	40	28.6	2.5
		Zinc	6010A, 7000	mg/Kg	58	52	10.9	2.5
Field: PB-PR-S10-5.0/10.0 Split: PB-PR-S26-5.0/10.0	56811, 56816	1,3,5-TNB	8330	mg/Kg	5.2	3.9	28.6	0.25
		2,4-DNT	8330	mg/Kg	2.2	1.1	NA	0.25
		1,3-DNB	8330	mg/Kg	2.5	2.1	17.4	0.25
		Antimony	6010A, 7000	mg/Kg	BDL	6.7	NA	6.3
		Arsenic	6010A, 7000	mg/Kg	12	13	NA	3.8
		Chromium	6010A, 7000	mg/Kg	18	19	5.4	1.3

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-PR-S10-5.0/10.0 Split: PB-PR-S26-5.0/10.0 (Continued)	56811, 56816 (Continued)	Copper	6010A, 7000	mg/Kg	9.4	7.7	NA	2.5
		Lead	6010A, 7000	mg/Kg	11	10	NA	3.2
		Manganese	6010A, 7000	mg/Kg	490	420	15.4	5.1
		Nickel	6010A, 7000	mg/Kg	25	29	14.8	2.5
		Zinc	6010A, 7000	mg/Kg	56	62	10.2	2.5
Field: PB-PR-S12-5.0/10.0 Split: PB-PR-S27-5.0/10.0	56813, 56816	1,3,5-TNB	8330	mg/Kg	2.8	2.8	0.0	0.25
		2,4-DNT	8330	mg/Kg	1.6	0.8	NA	0.25
		2,6-DNT	8330	mg/Kg	0.3	BDL	NA	0.26
		1,3-DNB	8330	mg/Kg	1.5	0.9	NA	0.25
		Arsenic	6010A, 7000	mg/Kg	9.3	12	NA	3.6
		Chromium	6010A, 7000	mg/Kg	14	16	13.3	1.2
		Copper	6010A, 7000	mg/Kg	14	11	NA	2.4
		Lead	6010A, 7000	mg/Kg	9.2	12	NA	3
		Manganese	6010A, 7000	mg/Kg	410	530	25.5	4.8
		Nickel	6010A, 7000	mg/Kg	20	26	26.1	2.4
		Zinc	6010A, 7000	mg/Kg	47	59	22.6	2.4
Field: PB-PR-S14-5.0/10.0 Split: PB-PR-S28-5.0/10.0	57081	2,4,6-TNT	8330	mg/Kg	340	280	19.4	0.25
		1,3,5-TNB	8330	mg/Kg	18	8.5	71.7	0.25
		2,4-DNT	8330	mg/Kg	19	10	62.1	0.25
		2,6-DNT	8330	mg/Kg	2.9	1.8	46.8	0.26
		3,4-DNT	8330	mg/Kg	1.7	1.1	NA	0.25
		4-Am-DNT	8330	mg/Kg	2	0.8	NA	0.25
		2-NT	8330	mg/Kg	0.9	BDL	NA	0.25
		1,3-DNB	8330	mg/Kg	6.7	3.9	52.8	0.25
		Arsenic	6010A, 7000	mg/Kg	4.3	5.6	NA	3.7
		Chromium	6010A, 7000	mg/Kg	15	20	28.6	1.2

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-PR-S14-5.0/10.0	57081	Copper	6010A, 7000	mg/Kg	7	3.6	NA	2.5
Split: PB-PR-S28-5.0/10.0	(Continued)	Lead	6010A, 7000	mg/Kg	11	9.5	NA	3.1
(Continued)		Manganese	6010A, 7000	mg/Kg	260	570	74.7	4.9
		Nickel	6010A, 7000	mg/Kg	21	20	4.9	2.5
		Zinc	6010A, 7000	mg/Kg	85	54	44.6	2.5
Field: PB-PR-S18-2.0/5.0	56823, 56822	Arsenic	6010A, 7000	mg/Kg	6.4	6.2	NA	3.6
Split: PB-PR-S29-2.0/5.0		Chromium	6010A, 7000	mg/Kg	14	13	7.4	1.2
		Copper	6010A, 7000	mg/Kg	8.6	13	NA	2.4
		Lead	6010A, 7000	mg/Kg	12	10	NA	3
		Manganese	6010A, 7000	mg/Kg	390	380	26	4.8
		Nickel	6010A, 7000	mg/Kg	17	15	12.5	2.4
		Zinc	6010A, 7000	mg/Kg	43	44	2.3	2.4
Field: PB-PR-S23-0.0/0.5	56823	2,4-DNT	8330	mg/Kg	1	0.9	NA	0.25
Split: PB-PR-S30-0.0/0.5		1,3-DNB	8330	mg/Kg	0.4	0.4	NA	0.25
		Chromium	6010A, 7000	mg/Kg	7.1	8.3	15.6	1.1
		Lead	6010A, 7000	mg/Kg	8.7	8.5	NA	2.9
		Manganese	6010A, 7000	mg/Kg	180	150	18.2	4.6
		Nickel	6010A, 7000	mg/Kg	6	5.9	NA	2.3
		Zinc	6010A, 7000	mg/Kg	26	24	8.0	2.3
Field: PB-WA-S5-0.0/2.0	56448	1,3,5-TNB	8330	mg/Kg	0.6	0.5	NA	0.25
Split: PB-WA-S21-0.0/2.0		2,4-DNT	8330	mg/Kg	0.3	BDL	NA	0.25
		Arsenic	6010A, 7000	mg/Kg	4.7	5.2	NA	3.7
		Chromium	6010A, 7000	mg/Kg	35	16	74.5	1.2
		Copper	6010A, 7000	mg/Kg	BDL	6	NA	2.5
		Lead	6010A, 7000	mg/Kg	19	15	NA	3.1
		Manganese	6010A, 7000	mg/Kg	1012	695	37.1	4.9

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-WA-S5-0.0/2.0	56448	Nickel	6010A, 7000	mg/Kg	35	29	18.8	2.5
Split: PB-WA-S21-0.0/2.0 (Continued)	(Continued)	Zinc	6010A, 7000	mg/Kg	91	72	23.3	2.5
Field: PB-WA-S8-2.0/5.0	56491	Arsenic	6010A, 7000	mg/Kg	5.3	5	NA	3.2
Split: PB-WA-S22-2.0/5.0		Cadmium	6010A, 7000	mg/Kg	1.4	1.6	NA	1.1
		Chromium	6010A, 7000	mg/Kg	13	12	8.0	1.1
		Copper	6010A, 7000	mg/Kg	2.4	14	NA	2.1
		Lead	6010A, 7000	mg/Kg	7.4	8.5	NA	2.6
		Manganese	6010A, 7000	mg/Kg	621	3300	136.6	4.2
		Nickel	6010A, 7000	mg/Kg	16	52	105.9	2.1
		Zinc	6010A, 7000	mg/Kg	34	37	8.5	2.1
Field: PB-WA-S20-0.0/0.5	56822	1,3,5-TNB	8330	mg/Kg	0.7	0.5	NA	0.25
Split: PB-WA-S23-0.0/0.5		2,4-DNT	8330	mg/Kg	0.4	0.4	NA	0.25
		1,3-DNB	8330	mg/Kg	0.3	BDL	NA	0.25
		Arsenic	6010A, 7000	mg/Kg	4.6	5	NA	3.6
		Chromium	6010A, 7000	mg/Kg	16	18	11.8	1.2
		Copper	6010A, 7000	mg/Kg	2.9	3.1	NA	2.4
		Lead	6010A, 7000	mg/Kg	12	13	NA	3
		Manganese	6010A, 7000	mg/Kg	190	290	41.7	4.8
		Nickel	6010A, 7000	mg/Kg	16	18	11.8	2.4
		Zinc	6010A, 7000	mg/Kg	45	51	12.5	2.4
Field: PB-WA-S17-5.0/10.0	56494	2,4,6-TNT	8330	mg/Kg	2.1	3	35.3	0.25
Split: PB-WA-S24-5.0/10.0		1,3,5-TNB	8330	mg/Kg	4.2	3.1	30.1	0.25
		2,4-DNT	8330	mg/Kg	3.3	3.8	14.1	0.25
		2,6-DNT	8330	mg/Kg	0.3	0.3	NA	0.26
		4-Am-DNT	8330	mg/Kg	BDL	0.3	NA	0.25
		2-Am-DNT	8330	mg/Kg	0.5	BDL	NA	0.25

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
μ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

TABLE 3-1
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Sample Result	Split Sample Result	RPD	Detection Limit
Field: PB-WA-S17-5.0/10.0 Split: PB-WA-S24-5.0/10.0 (Continued)	56494 (Continued)	1,3-DNB	8330	mg/Kg	1.9	1.5	23.5	0.25
		Arsenic	6010A, 7000	mg/Kg	5.4	BDL	NA	3.6
		Chromium	6010A, 7000	mg/Kg	11.2	11.2	0.0	1.2
		Copper	6010A, 7000	mg/Kg	11.3	5.3	NA	2.4
		Lead	6010A, 7000	mg/Kg	11.4	11	NA	3
		Manganese	6010A, 7000	mg/Kg	274	198	32.2	4.8
		Nickel	6010A, 7000	mg/Kg	18	15	18.2	2.4
		Zinc	6010A, 7000	mg/Kg	50	43	15.1	2.4
Field: PB-BG-S4-0.5/3.0 Split: PB-BG-S8-0.5/3.0	56812	Toluene	8240	µg/Kg	3.5	BDL	NA	1.0
		Trichloroethene	8240	µg/Kg	BDL	4.6	NA	1.0
		Xylenes	8240	µg/Kg	3.5	BDL	NA	1.0
		Cis-1,2-dichloroethene	8240	µg/Kg	BDL	1.3	NA	1.0
		Antimony	6010A, 7000	mg/Kg	7.6	6.4	NA	6.0
		Arsenic	6010A, 7000	mg/Kg	17	19	NA	3.6
		Chromium	6010A, 7000	mg/Kg	13	10	26.1	1.2
		Copper	6010A, 7000	mg/Kg	34	27	23.0	2.4
		Lead	6010A, 7000	mg/Kg	27	23	16.0	3.0
		Manganese	6010A, 7000	mg/Kg	24	8.7	NA	4.8
		Nickel	6010A, 7000	mg/Kg	11	9.4	NA	2.4
		Zinc	6010A, 7000	mg/Kg	13	10	NA	2.4

BDL = Below Detection Limit
RPD = Relative Percent Difference
mg/kg = milligrams per kilogram
µ/kg = micrograms per kilogram
NA = Calculation of RPD is Not Applicable because both results (field sample and split sample) were not greater than or equal to five times the detection limit.

3.1.2 Metals in Soil Samples

Twenty-one pairs of split soil samples were analyzed for 14 metals providing a total of 294 metals data pairs for comparison. RPDs were within acceptable limits for all but four data pairs. The RPDs that exceeded the acceptable limit are shaded on Table 3-1.

- For sample PB-TNTB-S18-0.5/1.5 and its split PB-TNTB-S28-0.5/1.5, analysis for copper exhibited an RPD of 141.7.
- Also for sample PB-TNTB-S18-0.5/1.5 and its split PB-TNTB-S28-0.5/1.5, analysis for zinc exhibited an RPD of 121.3.
- For sample PB-WA-S8-2.0/5.0 and its split PB-WA-S22-2.0/5.0, analysis for manganese exhibited RPD of 136.6.
- Also for sample PB-WA-S8-2.0/5.0 and its split PB-WA-S22-2.0/5.0, analysis for nickel exhibited an RPD of 105.9.

The most likely reason for the RPDs in excess of 100 percent in these sample pairs is the non-homogenous nature of the soil matrix.

3.1.3 VOCs and SVOCs in Soil Samples

One pair of split soil samples from a background location was analyzed for VOCs and SVOCs. Toluene and xylenes were detected in the sample BG-S4-0.5/3.0 at concentrations of 3.5 *u*g/Kg each but were not detected in the QC split sample BG-S8-0.5/3.0. Trichloroethene and cis-1,2-dichloroethene were detected in QC sample BG-S8-0.5/3.0 at concentrations of 4.6 *u*g/Kg and 1.3 *u*g/Kg, respectively, but were not detected in sample BG-S4-0.5/3.0. RPDs cannot be calculated when the value for one sample is BDL. All four of the VOCs were detected at concentrations that are only slightly greater than the respective detection limits. Due to the non-homogeneous nature of soil samples, it is not unusual for VOCs to be detected at these low levels in one of a pair of split samples and not the other.

No SVOCs were detected in either of the two samples of the split sample pair.

3.2 COMPARISON OF SPLIT SEDIMENT SAMPLE RESULTS

One pair of split sediment samples was analyzed for 14 explosives residues analytes and 14 metals, the 13 priority pollutant metals and manganese.

No explosives residues were detected in either sample of the split sample pair.

Results for metals which were detected at or above their detection limit for either the field or QC sample of the split sample pair are presented Table 3-2. For metals not listed in these tables, the result for both the field sample and the split sample were BDL.

The results indicate good agreement between the field and split samples. RPDs were all within acceptable limits.

3.3 COMPARISON OF DUPLICATE SURFACE WATER SAMPLE RESULTS

One pair of duplicate surface water samples was analyzed for concentrations of 14 explosives residues analytes; total and dissolved concentrations of 14 metals, the 13 priority pollutant metals and manganese; and total suspended solids.

Results for those analytes/compounds which were detected at or above their detection limit for either the field or QC sample of the duplicate sample pair are presented Table 3-3. For analytes not listed in the tables, the result for both the field sample and the duplicate sample were BDL.

The results indicate good agreement between the field and duplicate samples. RPDs were all within acceptable limits.

TABLE 3-2
SUMMARY OF SEDIMENT SPLIT SAMPLE RESULTS

SAMPLE:	PB-WA-SED2-0.2/1.0	MATRIX:	SEDIMENT
DUPLICATE:	PB-WA-SED7-0.2/1.0	ASI REPORT No.:	56722

PARAMETER	UNITS	FIELD RESULT	SPLIT RESULT	RPD	DETECTION LIMIT
Metals, Total, EPA 6010A, 7000					
Chromium	mg/Kg	22	10	75.0	1.6
Lead	mg/Kg	17	16	NA	4
Manganese	mg/Kg	190	160	17.1	6.3
Nickel	mg/Kg	19	13	NA	3.2
Zinc	mg/Kg	94	63	39.5	3.2

RPD = Relative Percent Difference

mg/Kg = milligrams per Kilogram

NA = Calculations of RPD is Not Applicable because both results (field and split samples) were not greater than or equal to five times the detection limit.

TABLE 3-3
SUMMARY OF SURFACE WATER DUPLICATE SAMPLE RESULTS

SAMPLE: PB-WA-SW3-U,F			MATRIX: SURFACE WATER		
DUPLICATE: PB-WA-SW7-U,F			ASI REPORT No.: 56647		
PARAMETER	**UNITS**	**FIELD RESULT**	**DUPLICATE RESULT**	**RPD**	**DETECTION LIMIT**
Explosives, EPA 8330					
4-Amino-2-nitrotoluene (4-Am-2-NT)	µg/L	0.6	BDL	NA	0.55
3,4-Dinitrotoluene (3,4-DNT)	µg/L	0.6	BDL	NA	0.21
3-Nitrotoluene (3-NT)	µg/L	2.4	2.2	NA	1.4
Metals, Total, EPA 6010A, 7000					
Lead	µg/L	77	54	NA	25
Manganese	µg/L	230	240	4.3	40
Zinc	µg/L	43	26	NA	20
Metals, Dissolved, EPA 6010A, 7000					
Manganese	µg/L	210	230	9.1	40
Total Suspended Solids, EPA 160.2					
TSS	mg/L	21	20	NA	5

BDL = Below Detection Limit.

RPD = Relativ Percent Difference

µg/L = micrograms per liter

mg/L = milligrams per liter

NA = Calculation of RPD is Not Applicable because both results (field and duplicate samples) were not greater than or equal to five times detection limit.

3.4 COMPARISON OF DUPLICATE GROUNDWATER SAMPLE RESULTS

Three pairs of duplicate groundwater samples were analyzed. Two of the duplicate sample pairs were collected from overburden wells and were analyzed for concentrations of explosives residues, total and dissolved metals, and nitrates. One of the duplicate sample pairs was collected from a bedrock well and was analyzed for explosives residues, total and dissolved metals, nitrates, VOCs, and SVOCs. Results for those analytes/compounds which were detected at or above their detection limit for either the field or QC sample of the duplicate sample pair are presented Table 3-4. For analytes not listed in the tables, the result for both the field sample and the duplicate sample were BDL.

The results indicate good agreement between the field and duplicate samples. RPDs were all within acceptable limits.

TABLE 3-4

SUMMARY OF GROUNDWATER DUPLICATE SAMPLE RESULTS

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Result	Split Result	RPD	Detection Limit
Field: PB-WA-DM-MW2-U,F Split: PB-WA-DM-MW22-U,F	57992	2,4,6-TNT	8330	µg/L	34	26	26.7	0.64
		1,3,5-TNB	8330	µg/L	550	570	3.6	0.45
		2,4-DNT	8330	µg/L	320	250	24.6	0.1
		2,6-DNT	8330	µg/L	12	10	18.2	0.1
		3,4-DNT	8330	µg/L	75	2.6	NA	2.1
		4-Am-DNT	8330	µg/L	4.2	2.6	47.1	1.57
		2-Am-DNT	8330	µg/L	5.7	5.2	9.2	0.16
		2-Am-4-NT	8330	µg/L	4.1	4.4	7.1	0.94
		1,3-DNB	8330	µg/L	470	400	16.1	0.15
		Total Chromium	6010A,7000	µg/L	14	BDL	NA	10
		Total Copper	6010A,7000	µg/L	38	32	17.1	20
		Total Lead	6010A,7000	µg/L	10	4	85.7	3
		Total Manganese	6010A,7000	µg/L	1600	1800	11.8	40
		Total Nickel	6010A,7000	µg/L	63	47	29.1	20
		Total Thallium	6010A,7000	µg/L	BDL	0.5	NA	0.5
		Total Zinc	6010A,7000	µg/L	88	63	33.1	20
		Dissolved Copper	6010A,7000	µg/L	20	20	0.0	20
		Dissolved Manganese	6010A,7000	µg/L	1000	970	3.0	40

RPD = Relative Percent Difference
BDL = Below Detection Limit
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = Calculation of RPD is Not Applicable because both result (field and duplicate samples) were not greater than or equal to five times the detection limit.

TABLE 3-4
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Result	Split Result	RPD	Detection Limit
Field: PB-WA-DM-MW2-U,F Split: PB-WA-DM-MW22-U,F (Continued)	57992 (Continued)	Dissolved Nickel	6010A,7000	µg/L	60	60	0.0	20
		Nitrate	353.2	mg/L	15	16	6.5	1
Field: PB-TNTA-DM-MW10-U,F Split: PB-TNTA-DM-MW23-U,F	57985	2,4,6-TNT	8330	µg/L	10	10	0.0	0.64
		1,3,5-TNB	8330	µg/L	BDL	0.5	NA	0.45
		2,4-DNT	8330	µg/L	11	10	9.5	0.1
		4-Am-2-NT	8330	µg/L	2.4	2.2	8.7	0.55
		3,4-DNT	8330	µg/L	BDL	0.3	NA	0.21
		4-Am-DNT	8330	µg/L	8.7	7.9	9.6	1.57
		2-Am-DNT	8330	µg/L	31	29	6.7	0.16
		2-Am-4-NT	8330	µg/L	1.3	1.3	0.0	0.94
		1,3-DNB	8330	µg/L	1.7	1.5	12.5	0.15
		Total Lead	6010A,7000	µg/L	7	7	0.0	3
		Total Manganese	6010A,7000	µg/L	980	880	10.8	40
		Total Zince	6010A,7000	µg/L	110	34	105.6	20
		Dissolved Manganese	6010A,7000	µg/L	960	830	14.5	40
		Nitrate	353.2	mg/L	0.3	0.3	0.0	0.1
Field: PB-BED-MW18-U,F Split: PB-BED-MW21-U,F	58042, 58029	2,6-DNT	8330	µg/L	1.4	1.2	15.4	1
		4-Am-2-NT	8330	µg/L	BLD	2	NA	5.5
		3,4-DNT	8330	µg/L	2.2	2.9	27.5	2.1

RPD = Relative Percent Difference
BDL = Below Detection Limit
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = Calculation of RPD is Not Applicable because both result (field and duplicate samples) were not greater than or equal to five times the detection limit.

TABLE 3-4
(Continued)

Samples	ASI Report No.	Parameter	EPA Method	Units	Field Result	Split Result	RPD	Detection Limit
Field: PB-BED-MW18-U,F Split: PB-BED-MW21-U,F (Continued)	58042, 58029 (Continued)	Total Copper	6010A,7000	µg/L	36	36	0.0	20
		Total Manganese	6010A,7000	µg/L	89	90	1.1	40
		Total Zinc	6010A,7000	µg/L	20	27	29.8	20
		Dissolved Manganese	6010A,7000	µg/L	80	80	0.0	40
		Dissolved Zinc	6010A,7000	µg/L	BDL	20	NA	20
		Nitrate	353.2	mg/L	0.2	0.4	66.7	0.1
		Benzene	8240	µg/L	14	16	13.3	2
		Carbon disulfide	8240	µg/L	160	90	56.0	40
		Ethylbenzene	8240	µg/L	79	120	41.2	2
		Toluene	8240	µg/L	72	93	25.5	2
		Zylenes	8240	µg/L	350	520	39.1	2
		2,4-Dimethylphenol	8240	µg/L	19	17	11.1	10
		Naphthalene	8240	µg/L	17	15	12.5	10

RPD = Relative Percent Difference
BDL = Below Detection Limit
µg/L = micrograms per liter
mg/L = milligrams per liter
NA = Calculation of RPD is Not Applicable because both result (field and duplicate samples) were not greater than or equal to five times the detection limit.

4.0 EVALUATION OF EQUIPMENT BLANKS

Seven equipment blanks were collected during the investigation. Sample results for those analytes/compounds which were detected at or above their detection limit in the equipment blanks are presented in Table 4-1.

No explosives residues analytes were detected above the PQL in any of the equipment blank samples.

For the majority of the analytes detected in the equipment blanks, the concentrations reported were $\leq$ 2X detection limit.

- Nitrates were detected in three equipment blanks, PB-E-WA-DM-MW2-U, PB-E-BED-MW18-U, and PB-E-TNTA-DM-MW10-U, at concentrations of 0.3 milligrams per liter (mg/L), 0.3 mg/L, and 0.2 mg/L, respectively. These concentrations are only slightly above the detection limit of 0.1 mg/L. All three of these equipment blanks were prepared for groundwater monitoring well sampling equipment.

- Zinc was detected in six of the seven equipment blanks including the equipment blanks for the sediment sample and surface water sample collected at the West Area Red Water Ponds; the equipment blank prepared for the background soil boring; and three equipment blanks prepared for groundwater monitoring well sampling equipment. The zinc concentrations in these samples are listed in Table 4-1.

  Equipment blank PB-E-WA-SED2 was prepared for the polyvinyl chloride (PVC) piping and sample preparation materials used to collect a sediment sample at the west pond of the West Area Red Water Ponds. It was prepared by pouring distilled water through a section of PVC pipe into the sample bowl containing the sampling spoon. The water was then poured into the required sample bottles. Zinc was detected in equipment blank PB-E-WA-SED2 at a concentration of 50 micrograms per liter (*u*g/L). It is possible that the zinc observed in the equipment blank is from the PVC pipe.

  The detection limit for zinc was 20 *u*g/L in all these samples.

- Antimony was detected in two equipment blanks, PB-E-BED-MW18-F and PB-E-WA-DM-MW2-F, at concentrations of 12 *u*g/L and 2 *u*g/L, respectively. Both of these equipment blanks were prepared for filtered samples for metals analysis. The equipment blanks for dissolved (filtered) metals were filtered through a 0.45 micron (*u*m) filter in the field and then preserved with nitric acid (pH < 2). It is possible that the antimony observed in the equipment blanks is from the 0.45 *u*m filter.

TABLE 4-1

EQUIPMENT BLANK RESULTS ABOVE DETECTION LIMIT

Sample Identification	Analyte		
	Nitrate Nitrogen mg/L	Zinc µg/L	Antimony µg/L
PB-E-WA-DM-MW2-U	0.3	37	
PB-E-WA-DM-MW2-F			2
PB-E-BED-MW18-U	0.3	28	
PB-E-BED-MW18-F			12
PB-E-TNTA-DM-MW10-U	0.2		
PB-E-WA-SW2-U		39	
PB-E-WA-SW2-F		21	
PB-E-WA-SED2		50	
PB-E-BG-S3-0.5/3.0		20	

mg/L = milligrams per liter
µg/L = micrograms per liter

- TICs were detected in equipment blanks PB-E-BED-MW18-U and PB-E-BG-S3-0.5/3.0. These were the only two equipment blanks that were analyzed for VOCs and SVOCs.

5.0 TRIP BLANKS

Three trip blanks were submitted, one with each cooler that contained water samples to be analyzed for VOCs. The trip blank identifications are T-12/13/95; T-12/14/94; and T-12/15/94. The dates in the sample identification correspond to the sample collection and shipment dates. VOCs were detected in two of the three trip blanks.

- In sample PB-T-12/13/94, tetrachloroethene was detected at a concentration of 1.2 *u*g/L. Since this sample is a trip blank, the most likely reason for the presence of tetrachloroethene is laboratory contamination, possibly carryover. This concentration is only slightly above a detection limit of 1.0 *u*g/L.

- In sample PB-T-12/14/94, toluene was detected at a concentration of 1.1 *u*g/L. The analysis of the trip blank was preceded by the analysis of sample 58094-1 during the same run/batch. Toluene was detected in sample 58094-1 at a concentration of 190 *u*g/L. The most likely reason for the presence of toluene in the trip blank is carryover from sample 58094-1. This concentration is only slightly above a detection limit of 1.0 *u*g/L.

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U.S. Environmental Protection Agency, 1993, USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February 1993.

U.S. Environmental Protection Agency, 1994, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994.

APPENDIX B

RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION OF RED WATER POND AREAS, IT CORPORATION, AUGUST 2000 (ELECTRONIC DELIVERABLE ONLY)

APPENDIX B

RISK ASSESSMENT AND DIRECT-PUSH INVESTIGATION OF RED WATER POND AREAS, IT CORPORATION, AUGUST 2000 (ELECTRONIC DELIVERABLE ONLY)

Final Report
Risk Assessment and Direct-Push Investigation of Red Water Pond Areas Former Plum Brook Ordnance Works Sandusky, Ohio

Volume I - Text, Tables, and Figures

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List of Acronyms

ABS	absorption factor
AF	adherence factor
AOC	area of concern
AR/COC	analysis request/chain of custody
ARAR	applicable or relevant and appropriate requirement
ARP	assessment receptor profile
ASTM	American Society for Testing and Materials
AT	averaging time
BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BHHRA	baseline human health risk assessment
BNA	base neutral/acid extractable compound
BSC	background screening criterion
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethyl benzene, and xylene
BW	body weight
CDI	chronic daily intake
CLP	Contract Laboratory Program
cm/hr	centimeters per hour
COC	chemical(s) of concern
COPC	chemical(s) of potential concern
COPEC	chemical(s) of potential ecological concern
CRQL	contract-required quantitation limit
CSEM	conceptual site exposure model
CT	central tendency
D&M	Dames & Moore, Inc.
DA	dose absorbed
DERP	Defense Environmental Restoration Program
DNAP	Ohio Division of Natural Areas & Preserves

List of Acronyms *(Continued)*

DNB	dinitrobenzene
DNT	dinitrotoluene
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DPI	direct-push investigation
DQE	data quality evaluation
ED	exposure duration
EF	exposure frequency
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ESBSNP	Erie Sand Barrens State Nature Preserve
ESCM	ecological site conceptual model
ET	exposure time
FCM	food chain multiplier
FI	fractional term
FRL	late forest
FRM	moderate forest
FUDS	formerly used defense sites
g/m^3	grams per cubic meter
GAF	gastrointestinal absorption factor
GSA	General Services Administration
GWI	groundwater investigation
HEAST	Health Effects Summary Assessment Table
HI	hazard index
HHRA	human health risk assessment
HQ	hazard quotient
ICI	International Consultants Incorporated
IDL	instrument detection limit
IDW	investigation-derived waste
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
IT	IT Corporation

List of Acronyms *(Continued)*

kg	kilogram
K_{oc}	organic carbon/water partition coefficient
K_{ow}	octanol/water partition coefficient
LOAEL	lowest-observed-adverse-effects level
: g	microgram
: g/kg	micrograms per kilogram
: g/L	micrograms per liter
m^3	cubic meter
m^3/day	cubic meters per day
MDC	maximum detected concentration
mg/cm^2	milligrams per square centimeter
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
MK	Morrison-Knudsen Ferguson Corporation
msl	mean sea level
NASA	National Aeronautics and Space Administration
NCEA	National Center for Environmental Assessment
NOAEL	no-observed-adverse-effects level
NWI	National Wetland Inventory
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OFE	early old field
OME	Ontario Ministry of the Environment and Energy
PAH	polynuclear aromatic hydrocarbon
PBOW	Plum Brook Ordnance Works
PBS	Plum Brook Station
PC	permeability coefficient
PCB	polychlorinated biphenyl
PCDD/PCDF	polychlorinated dibenzo-p-dioxin/dibenzofuran
PEF	particulate emission factor
PEL	probable effect level

List of Acronyms *(Continued)*

POW	palustrine open water
ppb	parts per billion
PPE	personnel protective equipment
ppm	parts per million
PRG	preliminary remediation goal
PRRWP	Pentolite Road Red Water Ponds
QAPP	quality assurance project plan
QC	quality control
RBRC	risk-based remediation criteria
RBSC	risk-based screening concentration
RBSEV	risk-based screening ecotoxicity value
RfC	reference concentration
RfD	reference dose
RME	reasonable maximum exposure
RTE	rare, threatened, or endangered
RTV	reference toxicity value
SA	surface area
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SF	slope factor
SOW	scope of work
SQL	sample quantitation limit
SSAP	site-specific sampling and analysis plan
SVOC	semivolatile organic compound
T&E	threatened and endangered
TAL	target analyte list
TCL	target compound list
TEL	threshold effect level
TF	transfer factor
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	total organic carbon

List of Acronyms *(Continued)*

UCL	upper confidence limit
URF	unit risk factor
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USCS	U.S. Soil Conservation Service
UTL	upper tolerance limit
VOC	volatile organic compound
WARWP	West Area Red Water Ponds

1.0 Introduction

The U.S. Army is conducting studies of the environmental impact of suspected hazardous waste sites at properties previously owned by the U.S. Department of Defense (DOD). The U.S. Army Corps of Engineers (USACE) is pursuing this work under the Defense Environmental Restoration Program (DERP) for formerly used defense sites (FUDS). The former Plum Brook Ordnance Works (PBOW) located in the city of Sandusky, Erie County, Ohio is a DERP FUDS project and is being managed and technically overseen by the Nashville District of USACE. Figure 1-1 shows the geographic location of the former PBOW site. IT Corporation (IT) performed a direct-push investigation (DPI) of soil and groundwater at two Red Water Pond Areas (the West Area Red Water Ponds [WARWP] and the Pentolite Road Red Water Ponds [PRWWP]) on PBOW in June and November 1998. This work was performed under Delivery Order 0016 of Contract No. DACA62-94-D-0031.

1.1 Scope of Work and Project Objectives

As specified in the scope of work (SOW) (USACE, 1997), the DPI included preparation of site-specific work plans, completion of various field investigation activities, evaluation of analytical results from samples collected during the field investigation, preparation and submittal of reports characterizing activities, conclusions, and recommendations for further actions. Based on the findings of previous investigations, this DPI acquired supplemental data soil and groundwater contamination in both Red Water Ponds Areas. As nitroaromatic compounds have historically been detected primarily in the overburden water-bearing zone, particular focus was placed on this zone. Figure 1-2 identifies both areas investigated in relation to other site features. Specific objectives of the DPI were to:

- Delineate the vertical and lateral extent of contamination in the overburden water-bearing zone in the Red Water Ponds Areas to support a potential future remedial action.
- Collect data for use in fate and transport modeling of the subject areas.

Activities completed during the field investigation included direct-push sampling of soil and groundwater, a land survey, and handling investigation-derived waste (IDW). Groundwater and soil samples collected for chemical analysis included primary samples and field quality control (QC) samples. Soil samples were also collected for geotechnical testing. To address identified data gaps

from preliminary risk assessment evaluations, IT returned to PBOW to collect ten collocated surface water and sediment samples from the two Red Water Ponds Areas in November 1998.

1.2 Site History and Potential for Contamination

The 9,009-acre PBOW site was built in early 1941 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives began on December 16, 1941 and continued until 1945. It is estimated that more than 1 billion pounds of explosives were manufactured during the 4-year operating period.

After plant operations ceased in 1945, decontamination of TNT, acid, pentolite, and DNT processing lines began; decontamination of the lines was completed during the last quarter of 1945. The property was initially transferred to the Ordnance Department, then to the War Assets Administration after it was certified decontaminated by the U.S. Army. In 1949, PBOW was transferred to the General Services Administration (GSA).

The National Aeronautics and Space Administration (NASA) acquired PBOW on March 15, 1963 and is presently utilizing the site. On April 18, 1978, NASA declared approximately 2,152 acres of land as excess. The Perkins Township Board of Education acquired 46 acres of the excess and uses this area as a bus transportation center. GSA retains the remaining acreage and currently has a use agreement with the Ohio National Guard for 604 acres of the land. NASA presently controls approximately 6,400 acres and is using the site to conduct space research as a satellite operation of NASA's Glenn Research Center in Cleveland, Ohio. The details of these land transactions are listed in the site management plan and can be found at the NASA Plum Brook Station (PBS).

Potential contaminants in the groundwater at PBOW, based on review of historical use of the site and findings of previous investigations, may include nitroaromatic compounds (explosive residuals), volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides/polychlorinated biphenyls (PCB), cyanide, and dissolved metals.

1.3 Summary of Previous Environmental Studies

The following sections summarize results from previous investigations at the two Red Water Ponds Areas. Identified sample locations may be referenced on figures in Chapter 2.0.

1.3.1 West Area Red Water Ponds

In 1984, Battelle Laboratories collected a surface soil sample from the spoils area at the WARWP area. Concentrations of nitroaromatics were detected in the low-parts per million (ppm) range using a now obsolete analytical method (International Consultants Incorporated [ICI], 1995).

Prior to 1985, a number of studies were conducted on the surface water and sediment from the Red Water Pond Areas. In the western pond at the WARWP area, 34 bottom sediment samples were collected in a grid pattern by Ohio National Guard environmental health personnel and screened for TNT and DNT derivatives. The highest values of TNT and DNT found in the sediment were less than 1 ppm. In 1989, IT conducted an investigation to confirm or deny the presence of residual chemical contamination from PBOW operations. Six surface soil samples were collected from 0 to 2 feet below ground surface (bgs) from borings IT-MW02, IT-SB07, IT-SB09, IT-SB10, IT-SB11, and IT-SB12 located at the WARWP area. No VOCs or SVOCs were detected. Four nitroaromatic compounds (1,3-dinitrobenzene [DNB], 1,3,5-trinitrobenzene [TNB], 2,4-DNT, and 2,4,6-TNT) were detected, with the highest concentrations (greater than 600 micrograms per kilogram [：g/kg]) detected at IT-SB12. Manganese was also detected at a concentration exceeding that of the background sample. Monitoring well IT-MW02 was installed downgradient from the WARWP area. A groundwater sample was collected for analysis of VOCs, SVOCs, nitroaromatic compounds, nitrates, sulfates, pH, and metals. Analytical results indicated concentrations of some VOCs and SVOCs were detected in the low (less than 20 micrograms per liter [：g/L]) parts per billion (ppb) range. Nitroaromatics (up to 160 ：g/L), chromium (0.12 ：g/L), manganese (3.0 ：g/L), and sulfate (950 ：g/L) were also detected.

In 1991, Science Applications International Corporation (SAIC) conducted a preliminary assessment to evaluate past waste management and hazardous material handling processes. Based on this assessment, SAIC determined that hazardous substances had been released to the environment at the WARWP area (USACE, 1997).

In 1993, a site inspection was conducted by Morrison-Knudsen Ferguson Corporation (MK) to assess the threat posed by the site on human health and the environment, and to determine the need for additional investigations. MK analyzed sediment and surface water from Pipe Creek near the WARWP area for VOCs, SVOCs, and nitroaromatics. The surface water had no detectable contaminants, but the sediment had a few VOCs and SVOCs in the low-ppb range. No nitroaromatics were detected (ICI, 1995). Four monitoring wells (MK-MW09, MK-MW10, MK-MW11, and

MK-MW12) were installed in the vicinity of the WARWP area (MK, 1994). Groundwater was collected from the four new wells and IT-MW02 for analyses of VOCs, SVOCs, nitroaromatic compounds, nitrates, sulfates, and metals. VOCs, SVOCs, and nitroaromatics were not detected in any groundwater samples (ICI, 1995).

In 1994, Dames & Moore, Inc. (D&M) conducted an investigation to evaluate groundwater occurrence and flow conditions in the overburden and bedrock water-bearing zones; assess groundwater quality in the overburden water-bearing zone; and investigate the baseline groundwater quality of the bedrock water-bearing zone to evaluate the necessity of additional work at PBOW (D&M, 1997a). Two bedrock wells (BED-MW14 and BED-MW19) and two overburden wells (WA-MW01 and WA-MW02) were installed in the vicinity of the WARWP area. Hydrogeologic data indicated that groundwater flow in the overburden exhibited a strong downward vertical component and the presence of groundwater was strongly seasonally dependent. The general groundwater flow in both water-bearing zones was determined to be to the north toward Lake Erie. Groundwater samples were analyzed for VOCs, base neutral/acid extractable compounds (BNA), nitroaromatics, and metals. Significant concentrations of nitroaromatics were determined to be present adjacent to the ponds in both the overburden and the bedrock aquifers. VOCs and BNAs were also present in the bedrock wells. Some metals (antimony, manganese, and nickel) were also detected at concentrations exceeding their maximum contaminant levels (D&M, 1997a).

In 1996, IT conducted a groundwater investigation (GWI) focusing on the western portion of the facility; the investigation consisted of installing three overburden monitoring wells, redeveloping existing monitoring wells, and collecting groundwater samples for laboratory analysis. In addition, one monitoring well (IT-MW10) and one temporary piezometer (IT-MW07) were installed in the vicinity of the Red Water Ponds Area. It was determined that the overburden material had been impacted by nitroaromatic compounds in the central portion of the WARWP area and that inorganic compounds were present at concentrations exceeding the risk-based screening concentrations throughout the area (IT, 1997). It was recommended that further evaluation of the metals in the groundwater be performed to determine whether they were derived from an on-site source of contamination or were related to background conditions. IT determined that the bedrock water-bearing zone was impacted by nitroaromatics and other organic compounds north of the WARWP area, but the bedrock aquifer did not exhibit impacts by any of these constituents in the central portion of the area. Inorganic compounds were also present north of this area. It is concluded that further evaluation would be needed to

determine the nature and extent of contamination in these areas, after background levels are established for metals in groundwater.

During a November 1997 groundwater sampling event, IT discovered that two of the overburden wells at the WARWP area (IT-MW02 and WA-MW02) and one bedrock well (PB-BED-MW14) had red-colored water, suggesting the presence of nitroaromatics. The latest (May, 1998) analytical results for these wells indicate elevated concentrations of nitroaromatics. The analytical results of these samples were documented in a separate report (IT, 1999).

1.3.2 Pentolite Road Red Water Ponds

In 1989, IT conducted an evaluation to determine whether residual chemical contamination was present (IT, 1991). A shallow monitoring well (IT-MW05) was installed on the northern edge of the Red Water Ponds, in the suspected downgradient direction. Soil borings IT-SB13 through IT-SB18 were also drilled, and soil samples were collected. 2,4-DNT and 2,6-DNT were detected in the soil at concentrations of at least 0.740 ppm and sodium concentrations in samples from six of the borings exhibited concentrations significantly above the measured background levels (ICI, 1995).

A site inspection was conducted by MK from June through July 1993 to assess the threat posed to human health and the environment and to determine the need for any additional investigation. MK collected and analyzed surface and sediment samples from a drainage ditch along Pentolite Road north of the PRRWP area. Samples were analyzed for VOCs, SVOCs, and nitroaromatic compounds. No samples from the Pentolite Road ditch showed detectable levels of contaminants (MK, 1994).

From May to June of 1994, D&M conducted a GWI to evaluate groundwater conditions in several areas at PBOW. The SOW included an assessment of groundwater quality in the overburden and bedrock water-bearing zones at the PRRWP area. Overburden monitoring wells PR-MW7, PR-MW8, and PR-MW9 and bedrock monitoring wells BED-15 and BED-16 were installed. The investigation found that the groundwater flow in the overburden exhibited a strong downward vertical component, and the presence of groundwater in the overburden was seasonally dependent. Groundwater sample results indicated that nitroaromatics were present in the overburden water-bearing zone, while lower levels of nitroaromatics were present in the bedrock water-bearing zone (D&M, 1997a).

From the sitewide GWI performed by IT in September through October of 1996, it was determined that the overburden water-bearing zone in the PRRWP area had been impacted by nitroaromatic compounds. The bedrock water-bearing zone was also determined to exhibit impacts by benzene, toluene, ethyl benzene, and total xylenes (BTEX), SVOCs, and nitroaromatic compounds (IT, 1997).

During the November 1997 groundwater sampling event, IT discovered that three of the overburden wells at the PRRWP area (PR-MW07, PR-MW08, and PR-MW09) had red-colored water, suggesting the presence of nitroaromatics. The analytical results from the latest samples (May, 1998) exhibited elevated concentrations of nitroaromatic compounds. The analytical results of these samples are reported in a separate report (IT, 1999) addressing the GWI.

1.4 Summary of Existing Site Conditions

The former PBOW site is currently owned by the NASA and is operated as the PBS of the NASA Glenn Research Center in Cleveland, Ohio. Most of the aerospace testing facilities built in the 1960s at the site are on standby or inactive status. The site is located approximately 4 miles south of Sandusky, Ohio and is specifically located in the Perkins, Oxford, Huron, and Milan Townships. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the west by County Road 43, and on the east by U.S. Highway 250. The areas surrounding PBOW is mostly agricultural and residential.

The topography of PBOW site is characterized by a fairly flat ground surface that slopes gradually northward toward Lake Erie at an average gradient of less than 2 percent. Elevations at the site range from 675 feet above mean sea level (msl) along the southeast edge of the site to about 625 feet msl in the northern portion of the installation at Bogart Road. Eleven streams exist within the site and flow toward Lake Erie. Plum Brook, Ransom Brook, and Pipe Creek are the three major streams and are being monitored by NASA PBS. The climate in north central Ohio is a typical continental climate showing significant influence by Lake Erie. Mean annual precipitation is 33.90 inches. The average monthly precipitation is approximately 1.65 inches for February and 3.70 inches for the month of July.

Devonian and Silurian carbonate and clastic rocks, generally dipping to the southeast, characterize bedrock geology at PBOW. The thickness of glacial till or lacustrine deposits range from approximately 5 feet or less for most of the site to approximately 20 feet in the northern border of the site. In many locations, bedrock is exposed on the ground surface. According to the PBOW

preliminary assessment (SAIC, 1991) some karst features are present in the carbonate rocks forming the water-bearing formation underneath the soil cover.

2.0 Field Activities

Field activities were conducted by IT personnel and IT-retained subcontractors during June and November 1998. Mr. Keith Peecook, the environmental coordinator for NASA PBS, acted as the project contact and approved drilling/digging permits and extended work hours during the course of the project. Mr. Ron Nabors of Ohio Environmental Protection Agency (OEPA) visited the site on June 25, 1998.

2.1 Direct-Push Soil Sampling

Direct-push drilling and sampling procedures were used for collection of surface and subsurface soil at 48 locations (39 boring locations for chemical analysis and 9 boring locations for geotechnical testing) (Table 2-1 and Figures 2-1 and 2-2). The direct-push technique used (i.e., Geoprobe™) consists of a hydraulic drive unit, a stainless-steel sampling point, and sampling rods. The hydraulic drive unit was positioned at the selected boring location. A hydraulically powered percussion hammer drove a 1.5-inch outside diameter sampling core to the required depth. When the probe reached the desired depth, the point was retracted, the soil sampler driven forward, and a liner filled. The core barrel was stainless-steel with an inner acetate™ liner. Sample recovery was recorded on the sample collection log (Appendix A). If there was insufficient soil recovery, the sample was collected from another borehole immediately adjacent to (less than 1 foot away from) the original location. The distance was noted, along with the general direction, on the Sample Collection Log. After the samples were collected, the hole was backfilled with any soil remaining from probe activities and grouted to the surface.

The liner was extruded from the sample tube and Teflon™ tape and vinyl end caps (red cap on the top, black cap on the bottom) were placed on each end of the liner. The field geologist described the soil sample on the Sample Collection Log and noted the headspace reading. The liner was sealed with Teflon™ tape placed on each end and covered by vinyl end caps. The sample location identification and depth was written on the upper (red) vinyl end cap. As specified in the site-specific sampling and analysis plan (SSAP) (IT, 1998a), all soil samples were analyzed for VOCs, SVOCs, target analyte list (TAL) metals, PCBs, and nitroaromatics.

2.2 Direct-Push Groundwater Sampling

Direct-push drilling and sampling procedures were used for collection of groundwater at 34 locations (14 boring locations at WARWP and 20 boring locations at PRRWP). Groundwater, when present, was collected from all the borings in which soil had been collected for chemical analysis. If groundwater was encountered before the bedrock was reached and the field geologist believed a sufficient quantity of water could be obtained, a temporary groundwater piezometer was constructed into the formation. A groundwater sample was then collected with a peristaltic pump. As specified in the SSAP, all groundwater samples were to be analyzed for VOCs, SVOCs, total TAL metals, dissolved TAL metals, nitroaromatics, PCBs, hardness, alkalinity, total organic carbon (TOC), total dissolved solids, total suspended solids, chloride, cyanide (total), nitrate, and sulfate. However, due to limited yield at some locations, not all analyses could be completed (see Section 2.7). Table 2-2 contains a summary of primary surface water and sediment for the direct-push investigation.

2.3 Surface Water/Sediment Sampling

Following completion of the direct-push investigation, IT, in consultation with the USACE, determined that collection of surface water and sediment samples at the two Red Water Ponds Areas would provide additional data needed in the ecological risk assessment (ERA) and human health risk assessment (HHRA). Therefore, IT collected collocated surface water and sediment samples from the two areas in November 1998. Four surface water and sediment samples were collected at the PRRWP area, while six surface water and sediment samples were analyzed for VOCs, SVOCs, nitroaromatics, metals, and PCBs. Surface water samples were also analyzed for hardness, and sediment samples were analyzed for TOC.

2.4 Decontamination Procedures

Decontamination of sampling equipment was performed in accordance with the procedures prescribed in Section 4.4.3 of the sitewide SAP (IT, 1996a). A decontamination pad for the drill rig and drilling equipment was set up east of Campbell Street. Specifically, the drill rig and augers were steam-cleaned before and after each use. The sampling equipment was decontaminated according to the following procedures:

- Rinse with potable water obtained from the PBS fire station.
- Wash and scrub using a brush with nonphosphatic detergent.
- Rinse with potable water.

- Rinse with deionized water (American Society for Testing and Materials [ASTM]) Type II).
- Rinse with methanol followed by a hexane rinse.
- Final rinse with deionized water (ASTM Type II). The rinse volume was at least five times the volume of methanol used.
- Air dry.
- Wrap in aluminum foil for transport to sampling locations.

2.5 Investigation-Derived Wastes

A limited amount of IDW generated during the DPI includes decontamination water and disposable personnel protective equipment (PPE). IDW was managed and handled in accordance with procedures described in the SSAP (IT, 1996a).

Decontamination water was collected in drums prior to removal of the decontamination pad. All drums were labeled with the contained materials, content volume, date of generation, and source of origin as applicable. IDW drums were staged in the IDW storage area north of the Pentolite Road pending disposal. PPE was doubled-bagged and placed in the on-site industrial dumpster.

2.6 Land Surveying

All direct-push and surface water/sediment sampling locations were surveyed in late June and November 1998 by an Ohio registered professional land surveyor. Horizontal coordinates were surveyed to the closest 1.0 foot and referenced to the Ohio State Plane Coordinate System. Vertical coordinates (land surface elevation and top of casing elevation) were surveyed to the nearest 0.01 foot and referenced to the 1929 National Geodetic Vertical Datum. The complete survey data are presented in Appendix B.

2.7 Variances/Nonconformance

Variances are defined as necessary changes to the standard operating procedures employed in the field or office activities and modification to the original SOW as specified in the SSAP (IT, 1996a) and the quality assurance project plan (QAPP) (IT, 1996b). Variances do not significantly affect the quality of the data or process being changed. However, nonconformances are defined as malfunctions,

deficiencies, or deviations that may render the quality of information or data unacceptable or indeterminate. Nonconformances were not reported during the field sampling. However, a total of 32 variances were generated as summarized in Table 2-3. The majority of the variances recorded are related to the low yield of some direct-push boreholes that did not produce sufficient quantity of groundwater for all analyses. Twelve direct-push boreholes in PRRWP area and sixteen boreholes (four were completely dry) in the WARWP did not produce enough water for the analyses of all required parameters. In addition, two direct-push locations in the WARWP area were not completed due to equipment failure following consultation with the USACE. Therefore, no soil and groundwater samples were collected from WARP-DP14, and no water sample was collected from WARP-DP10. Soil samples were collected from WARP-DP10 at 0- to 2- and 6- to 8-foot-depth intervals only. All variance logs were prepared by IT field personnel and are retained in the project files.

3.0 Analytical Program

All primary direct-push groundwater and soil samples, as well as surface water and sediment samples for chemical analysis were analyzed by Quanterra Environmental Services located in Knoxville, Tennessee. The data quality evaluation (DQE) report was prepared by an IT project chemist and is provided in Appendix C. An independent third party contractor performed data validation and the results are presented in Appendix D. The laboratory analytical data packages are included in Appendix E (complete data package) and Appendix F (blank corrected data).

3.1 Analytical Parameters and Methodologies

Chemical analyses for the DPI were performed in accordance with guidelines in the U.S. Environmental Protection Agency (EPA) document entitled *Test Methods for Evaluating Solid Waste* (SW-846) (EPA, 1986a). Methods used for analysis by the laboratory are shown in Table 3-1. All analytical data were reported in accordance with the EPA Level IV Contract Laboratory Program (CLP)-like data package and were in compliance with the EPA definitive data requirements. The regulatory compound/analyte list reported was the target compound list (TCL) for organics and the TAL for inorganics as defined by the most recent CLP SOW. These data packages have been reviewed for completeness, accuracy, and representativeness as prescribed in the QAPP (IT, 1996b). All analytical data presented in this report were validated and blank corrected. An independent subcontractor performed data validation and the validation summary is presented in Appendix D. All samples were submitted to the laboratory accompanied by an analysis request/chain of custody (AR/COC) form. The AR portion of the form provides project-specific analytical specifications and QC instruction to the laboratories. A formal COC record was included as part of the document, ensuring documentation of custody for sample transportation, storage, and eventual disposition by the laboratory. Copies of all custody documentation are included in the data packages submitted. An assessment of the analytical data with regard to the project-specific objectives is presented in Appendix B in the DQE report. In the DQE, all elements of data evaluation were compiled and used to determine the usability and overall applicability of the resulting data. Evaluation of the data using the specific data quality objectives established for the project resulted in the determination that the data set is valid and of sufficient quality to meet the objectives of the investigation. There were no significant problems observed that would adversely affect the application of the data or the success of the overall investigation.

3.2 Blank Correction

The purpose of blank analysis is to determine the existence of contamination resulting from laboratory and field activities. Blank evaluation involves qualification of data based on the results of associated field blanks, trip blanks, equipment rinsates, and laboratory method blanks. Each sample in the database has a list of associated field and laboratory blanks that are used in the evaluation process. The criteria for blank evaluation are detailed in *Region III Modifications to National Functional Guidelines for Organic Data Review* (EPA, 1994) and *Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, 1993a) and summarized as follows:

- If a parameter is found in a blank but not detected in the sample, no action is taken.
- For organics, if the sample result is greater than the contract-required quantitation limit (CRQL), but is less than the 5X or 10X multiple of the blank result, the sample result is qualified "B."
- For organics, if the sample result is less than the CRQL and less than the 5X or 10X multiple of the blank result, the sample result is qualified "B." The "J" qualifier is not used.
- For inorganics, if the sample result is greater than the instrument detection limit (IDL) but less than the 5X multiple of the blank result, the sample result is qualified "B."
- If the sample result is greater than the 5X or 10X multiple of the blank result, the sample result is not qualified.

In instances where more than one blank is associated with a given sample, qualification is based upon a comparison with the associated blank having the highest concentration of a contaminant. The results are never corrected by subtracting blank values.

4.0 Analytical Results

A total of 115 soil samples, 34 direct-push groundwater samples, 10 surface water samples, and 10 sediment samples were collected at the two Red Water Ponds Areas during the DPI. Of the soil samples, 39 are surface soil samples collected between 0 and 2 feet bgs and 76 are subsurface soil samples collected at depths between 2 feet and 10 feet bgs. As discussed in Section 2.7, not all groundwater samples could be analyzed for all parameters specified in the SSAP due to insufficient water yield. The laboratory analytical data packages are included in Appendix E (complete data package) and Appendix F (blank corrected data).

4.1 West Area Red Water Ponds

4.1.1 Surface and Subsurface Soils

A total of 19 surface soil samples and 37 subsurface soil samples were collected within the WARWP area from 19 direct-push boring locations. As previously discussed, soil samples could not be collected at the 8- to 10-foot depth in DP-10 or any sample in DP-14 due to equipment failure. The following subsections discuss detected constituents in soil samples by chemical groups. Screening and interpretation of this data is presented in Chapters 5.0 and 6.0.

4.1.1.1 Volatile Organic Compounds

Three VOCs (acetone, methylene chloride, and toluene) were detected in a small percentage of the surface and subsurface soil samples (Table 4-1). Acetone was detected in only one surface soil sample (DP-08) at a low concentration of 0.035 milligrams per kilogram (mg/kg). Low levels of methylene chloride were detected in three samples, ranging from 0.002 mg/kg to 0.0023 mg/kg, while toluene exhibited detections ranging from 0.0015 to 0.0032 mg/kg in eight samples. At least one VOC was detected in 11 borings, including DP-01, -02, -04, -06, -08, -11, -12, -13, -15, -17, and -20 (Figure 4-1).

4.1.1.2 Semivolatile Organic Compounds

A total of 13 SVOCs were detected at low concentrations in up to three surface and subsurface soil samples collected from four borings (DP-09, -11, -13, and -20) at the WARWP (Table 4-1). Fluoranthene and pyrene were the most frequently detected SVOCs, with three detections each, with detected concentrations ranging from 0.058 to 0.76 mg/kg and 0.043 to 0.55 mg/kg, respectively. Ten

SVOCs, including acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd) pyrene, and phenanthrene, were each detected in two soil samples. 2,4-DNT was only detected in one sample, the 0- to 2-foot sample collected from DP-11 (0.043 mg/kg).

4.1.1.3 Nitroaromatic Compounds

Four nitroaromatic compounds, 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, and 2,6-DNT, were detected in up to six subsurface soil samples (Figure 4-1); nitroaromatic compounds were not detected in surface samples collected at the WARWP. 1,3,5-TNB was detected in six samples from DP-03 (8 to 10 feet), DP-09 (8 to 10 feet), DP-10 (4 to 6 ft), DP-11 (8 to 10 feet), DP-13 (8 to 10 feet), and DP-18 (8 to 10 feet) at concentrations ranging from 0.28 to 4.4 mg/kg (Table 4-1). 2,4,6-TNT (0.38 mg/kg) and 2,6-DNT (1.5 mg/kg) were detected in only one sample, the 4- to 6-foot sample in DP-10. 2,4-DNT was detected in the 8- to 10-foot samples collected from DP-09, DP-10, and DP-13, with concentrations ranging from 0.49 to 6.3 mg/kg.

4.1.1.4 PCBs

There were no detected PCBs in any of the soil samples collected at the WARWP.

4.1.1.5 Inorganic Compounds

Twenty-one metals were detected in at least one soil sample collected during the DPI at the WARWP (Table 4-2). Each of the 56 soil samples exhibited detectable concentrations of aluminum, arsenic, calcium, chromium, iron, lead, manganese, nickel, vanadium, and zinc. Other metals detected in more than 80 percent of the soil samples included barium, cobalt, copper, magnesium, and potassium. Less frequently detected metals included antimony (2 samples), beryllium (22 samples), cadmium (2 samples), mercury (4 samples), selenium (1 sample), and sodium (7 samples).

4.1.1.6 Total Cyanide

Cyanide was not detected in any of the soil samples from the WARWP area.

4.1.1.7 Geotechnical Testing Results

Four soil samples were collected and analyzed for geotechnical properties, including grain size distribution, moisture content, and Atterberg limits. Soil samples were classified based on the geotechnical testing data using U.S. Soil Conservation Service (USCS) nomenclature. Geotechnical

soil samples were not collected from DP-25 due to equipment failure. The geotechnical testing results are provided in Appendix G.

4.1.2 Groundwater

A total of 14 groundwater samples were collected from direct-push borings in the WARWP area. As previously discussed, groundwater samples could not be collected from six boring locations due to insufficient water yield. In addition, limited water yield in DP-01 permitted analyses for explosives and VOCs only; neither analysis detected any constituents. The following sections discuss detected constituents in the 13 overburden groundwater samples with positive detections by chemical groups.

4.1.2.1 Volatile Organic Compounds

Five VOCs, including 2-butanone, benzene, carbon disulfide, ethyl benzene, and tetrachloroethene, were detected at low concentrations in at least one of the groundwater samples collected from seven direct-push locations (Table 4-3 and Figure 4-2). Ethyl benzene was detected only in the sample from DP-13 at a concentration of 0.19 ：g/L. The remaining four VOCs were each detected in two samples; 2-butanone was detected in DP-15 (1.2 ：g/L) and DP-19 (1.8 ：g/L), benzene in DP-02 (0.15 ：g/L) and DP-11 (0.13 ：g/L), carbon disulfide in DP-08 (0.15 ：g/L) and DP-19 (0.18 ：g/L), and tetrachloroethene in DP-08 (0.2 ：g/L) and DP-09 (0.15 ：g/L).

4.1.2.2 Semivolatile Organic Compounds

Five nitroaromatic compounds were detected under the SVOC analyses in groundwater samples collected at the WARWP, including 2,4-DNT, 2,6-DNT, 3-nitroaniline, 4,6-dinitro-2-methylphenol, and 4-nitrophenol (Table 4-3). 2,4-DNT was detected in five samples (DP-09, DP-11, DP-13, DP-16, and DP-17), with concentrations ranging from 1.8 ：g/L in DP-11 to 660 ：g/L in DP-13 (Figure 4-2). 2,6-DNT was detected in DP-09 (6.3 ：g/L), DP-13 (56 ：g/L), DP-16 (15 ：g/L), and DP-17 (18 ：g/L), while 3-nitroaniline was detected in DP-04 (3.2 ：g/L), DP-09 (5.1 ：g/L), DP-11 (2.1 ：g/L), DP-13 (15 ：g/L), DP-16 (43 ：g/L), and DP-17 (49 ：g/L). 4,6-Dinitro-2-methylphenol and 4-nitrophenol were only detected in DP-09, at concentrations of 24 and 2.4 ：g/L, respectively.

4.1.2.3 Nitroaromatic Compounds

Five nitroaromatic compounds (1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, and 2,6-DNT) were detected in groundwater samples collected from 10 of 13 direct-push locations (Table 4-3). As presented on Figure 4-2, 1,3,5-TNB was detected at five locations, with concentrations ranging from

7.2 to 680 ：g/L; 1,3-DNB at six locations ranging from 0.2 to 56 ：g/L; 2,4-DNT at six locations ranging from 1.1 to 950 ：g/L; and 2,6-DNT at three locations ranging from 0.25 to 2.7 ：g/L. 2,4,6-TNT was detected only at DP-11 with a concentration of 7.1 ：g/L.

4.1.2.4 PCBs

PCBs were not detected in any of the WARWP direct-push groundwater samples.

4.1.2.5 Inorganic Compounds

As shown on Table 4-4, a total of 21 total metals were detected in the unfiltered groundwater samples. Excluding the nutritionally essential elements of calcium, iron, magnesium, potassium, and sodium, only nine dissolved metals (filtered samples) were detected. These include aluminum, cadmium, chromium, cobalt, copper, lead, manganese, nickel, and zinc.

4.1.2.6 Total Cyanide

Cyanide was not detected in any of the direct-push groundwater samples from the WARWP.

4.1.2.7 Water Quality Parameters

Results of water quality analyses, including alkalinity, hardness, total suspended solids, total dissolved solids, TOC, nitrate, and sulfate, are presented for reference on Table 4-4.

4.1.3 Sediments

Six sediment samples were collected at the WARWP in November 1998; four samples were collected within Pipe Creek (SD-01, -02, -03, and -04) and two from the west pond (SD-05 and -06) (Figure 4-3). Each of the six samples was collected at depths of 0 to 0.5 feet below the top of sediment and was analyzed for VOCs, SVOCs, nitroaromatic compounds, metals, PCBs, and TOC. The following paragraphs discuss analytical results for these sediment samples by chemical groups.

4.1.3.1 Volatile Organic Compounds

Two VOCs were detected at low, estimated concentrations in three of the four sediment samples collected from Pipe Creek and the west pond. Acetone was detected in SD-05 (0.11 mg/kg) and SD-06 (0.071 mg/kg), and 2-butanone was detected in SD-03 (0.029 mg/kg) and SD-05 (0.021 mg/kg) (Figure 4-3).

4.1.3.2 Semivolatile Organic Compounds

Two sediment samples exhibited SVOCs at estimated concentrations (Table 4-5). Seven SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[k]fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene) were detected in SD-01 collected from Pipe Creek, while SD-04, also collected from Pipe Creek, exhibited only fluoranthene.

4.1.3.3 Nitroaromatic Compounds

Nitroaromatic compounds were not detected in any of the WARWP sediment samples.

4.1.3.4 PCBs

PCBs were not detected in any of the sediment samples collected at the WARWP.

4.1.3.5 Inorganic Compounds

Fifteen metals were detected in at least one of the six sediment samples (Table 4-5). Aluminum, arsenic, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, and zinc were detected in each of the six samples. Barium and cobalt were detected in four samples each, with concentrations ranging from 26.6 to 65 mg/kg and 6.4 to 10.9 mg/kg, respectively. Potassium was detected in SD-03 (821 mg/kg) and vanadium was detected in SD-06 (25 mg/kg).

4.1.3.6 Total Organic Carbon

Results for TOC ranged from 3,960 to 93,400 mg/kg in the six samples (Table 4-5). The two samples collected from the west pond (SD-05 and SD-06) exhibited concentrations an order of magnitude greater than those observed in other samples collected from Pipe Creek.

4.1.4 Surface Water

Six surface water samples collocated with the sediment samples previously discussed were collected at the WARWP in November 1998 (Figure 4-3). Each of the six samples was analyzed for VOCs, SVOCs, nitroaromatic compounds, metals, PCBs, and hardness. The following paragraphs discuss analytical results for these sediment samples by chemical groups.

4.1.4.1 Volatile Organic Compounds

One VOC was detected at low, estimated concentrations in five of the six surface water samples; VOCs were not detected in SW-02 (Table 4-5). Bromomethane was detected in SW-01, -03, -04, -05, and -06 at concentrations ranging from 0.16 to 0.22 ：g/L (Figure 4-3).

4.1.4.2 Semivolatile Organic Compounds

One surface water sample exhibited one SVOC at an estimated concentration (Table 4-5); di-n-octyl phthalate was detected in SW-05 (7.8 ：g/L) collected from the west pond.

4.1.4.3 Nitroaromatic Compounds

Nitroaromatic compounds were not detected in any of the WARWP surface water samples.

4.1.4.4 PCBs

PCBs were not detected in the WARWP surface water samples.

4.1.4.5 Inorganic Compounds

Twelve total metals and eleven dissolved metals were detected in at least one of the six surface water samples (Table 4-5). Excluding the nutritionally essential elements, dissolved metals were limited to aluminum, arsenic, chromium, lead, manganese, and zinc.

4.1.4.6 Hardness

Results for hardness ranged from 372,000 to 592,000 ：g/L in the six samples (Table 4-5).

4.2 Pentolite Road Red Water Ponds

4.2.1 Surface and Subsurface Soils

A total of 20 surface soil samples and 39 subsurface soil samples were collected within the PRRWP area from 20 direct-push boring locations; 1 soil sample could not be collected at the 8- to 10-foot depth in DP-03. The following subsections discuss detected constituents in soil samples by chemical groups.

4.2.1.1 Volatile Organic Compounds

Three VOCs (acetone, methylene chloride, and toluene) were detected in a small percentage of the surface and subsurface soil samples (Table 4-6). Acetone was detected in only one subsurface soil

sample (4 to 6 feet in DP-07) at an estimated concentration of 0.0082 mg/kg (Figure 4-4). Estimated levels of methylene chloride were detected in two samples: at 0.0021 mg/kg in the 8- to 10-foot sample in DP-16 and 0.0018 mg/kg in the surface sample from DP-19. Toluene was also detected at an estimated concentration of 0.0017 mg/kg at 4 to 6 feet in DP-09.

4.2.1.2 Semivolatile Organic Compounds

Three nitroaromatic compounds were detected under the SVOC analysis in six of the soil samples. 2,4-DNT was detected in one surface soil sample (0.16 mg/kg in DP-11) and five subsurface soil samples (DP-02, DP-03, DP-09, DP-15, and DP-16), while 2,6-DNT was also detected in the surface sample from DP-11 (0.05 mg/kg) and in two subsurface samples (DP-03 and DP-16). Only the 8- to 10-foot sample from DP-15 exhibited a detectable concentration of 3-nitroaniline (0.053 mg/kg) (Table 4-6).

4.2.1.3 Nitroaromatic Compounds

Six nitroaromatic compounds, 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and 4-amino-2,6-DNT, were detected in up to 11 soil samples (Table 4-6). 1,3,5-TNB was detected in nine samples from DP-01 (4 to 6 and 8 to 10 feet), DP-03 (4 to 5 feet), DP-06 (9 to 10 feet), DP-09 (8 to 10 feet), DP-10 (9 to 10 feet), DP-11 (4 to 6 and 8 to 10 feet), and DP-16 (8 to 10 feet) at concentrations ranging from 0.43 to 43 mg/kg (Table 4-6). 1,3-DNB was detected in five subsurface soil samples (DP-03, DP-10, two in DP-11, and DP-16), ranging from 0.25 to 9.3 mg/kg. Detections of 2,4,6-TNT were limited to two samples: 8 to 10 feet in DP-02 (0.38 mg/kg) and 0 to 2 feet in DP-11 (0.27 mg/kg).

2,4-DNT was detected in 11 samples ranging from 0.28 to 25 mg/kg, while 2,6-DNT was detected in 5 samples with concentrations ranging from 0.29 to 1.7 mg/kg. 4-amino-2,6-DNT was detected in one sample at a concentration of 2.7 mg/kg (0 to 2 feet in DP-11).

4.2.1.4 PCBs

There were no detected PCBs in any of the soil samples collected at the PRRWP.

4.2.1.5 Inorganic Compounds

Twenty-one metals were detected in at least one soil sample collected during the DPI at the PRRWP (Table 4-7). Each of the 59 soil samples exhibited detectable concentrations of aluminum, arsenic, chromium, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc. Other metals detected in a majority of the soil samples included barium, cobalt, and potassium. Less frequently detected metals were limited to antimony (4 samples), beryllium (10 samples), cadmium (1 sample), mercury (3 samples), selenium (8 samples), and sodium (12 samples).

4.2.1.6 Total Cyanide

Cyanide was not detected in any of the soil samples from the PRRWP area.

4.2.1.7 Geotechnical Testing Results

Five soil samples were collected and analyzed for geotechnical properties, including grain size distribution, moisture content, and Atterberg limits. Soil samples were classified based on the geotechnical testing data using USCS nomenclature. The geotechnical testing results are provided in Appendix G.

4.2.2 Groundwater

A total of 20 groundwater samples were collected from direct-push borings in the PRRWP area. As previously discussed, some sample parameters could not be collected from all boring locations due to insufficient water yield. The following sections discuss detected constituents in the overburden groundwater samples by chemical groups.

4.2.2.1 Volatile Organic Compounds

Nine VOCs, including 2-butanone, 2-hexanone, acetone, benzene, carbon disulfide, ethyl benzene, tetrachloroethene, total xylenes, and trichloroethene, were detected at low concentrations in at least one of the groundwater samples collected from direct-push locations at the PRRWP (Table 4-8). Six of the detected VOCs (2-butanone, 2-hexanone, acetone, benzene, ethyl benzene, and total xylenes) were detected only in the sample from DP-03 at estimated concentrations (Figure 4-5). Carbon disulfide was detected at estimated concentrations in DP-04, DP-08, and DP-12, while tetrachloroethene was detected in five samples (DP-02, DP-03, DP-05, DP-07, and DP-19), also at estimated concentrations. Trichloroethene was detected at estimated concentrations in two samples, DP-07 and DP-08.

4.2.2.2 Semivolatile Organic Compounds

Ten SVOCs, including eight nitroaromatic compounds, were detected under the SVOC analyses in groundwater samples collected at the PRRWP (Table 4-8). 2,4-Dinitrophenol was detected in four samples ranging from an estimated concentration of 8.3 ：g/L in DP-01 to 5,900 ：g/L in DP-10; note that DP-03 exhibited a concentration of 5,800 ：g/L. Ten samples have positive results for 2,4-DNT, ranging from 1.5 ：g/L in DP-17 to 9,200 ：g/L in DP-03, while 2,6-DNT was detected in four samples ranging from 3.3 ：g/L in DP-01 to 550 ：g/L in DP-03. 2-Nitroaniline was detected at low concentrations (1.3 and 3.2 ：g/L) in two samples. Three compounds (2-nitrophenol, 3-nitroaniline, and naphthalene) were detected in one sample each: DP-16 at 2.1 ：g/L, DP-01 at 88 ：g/L, and DP-05 at 1.9 ：g/L, respectively. 4,6-Dinitro-2-methylphenol was detected in three samples (DP-03, DP-10, and DP-15) ranging from 830 ：g/L in DP-15 to 2,300 ：g/L in DP-03. Similarly, 4-nitrophenol was detected in DP-03 (290 ：g/L) and DP-10 (210 ：g/L), as well as DP-16 (5 ：g/L). Two samples (DP-12 at 10 ：g/L and DP-14 at 3.2 ：g/L) also exhibited bis(2-ethylhexyl)phthalate.

4.2.2.3 Nitroaromatic Compounds

Five nitroaromatic compounds (1,3,5-TNB, 1,3-DNB, 2,4-DNT, 2,6-DNT, and tetryl) were detected in groundwater samples collected from direct-push locations in the PRRWP area (Table 4-8). As presented on Figure 4-5, 1,3,5-TNB was detected at DP-11 at a concentration of 600 ：g/L and tetryl at DP-13 at a concentration of 0.2 ：g/L. 1,3-DNB was detected in 11 samples, with detected concentrations ranging from 0.28 ：g/L in DP-04 to 4800 ：g/L in DP-03, while 2,4-DNT ranged from 0.47 ：g/L in DP-04 to 6800 ：g/L in DP-03 in a total of 12 samples. Seven samples exhibited 2,6-DNT, ranging from 0.28 ：g/L in DP-08 to 400 ：g/L in DP-10.

4.2.2.4 PCBs

PCBs were not detected in any of the PRRWP direct-push groundwater samples.

4.2.2.5 Inorganic Compounds

As shown on Table 4-9, a total of 20 total metals were detected in the unfiltered groundwater samples. Excluding the nutritionally essential elements of calcium, iron, magnesium, and sodium, only nine dissolved metals (filtered samples) were detected. These include arsenic, barium, chromium, cobalt, copper, lead, manganese, nickel, and zinc.

4.2.2.6 Total Cyanide

Cyanide was detected in three of the direct-push groundwater samples (DP-03, DP-09, and DP-11) from the PRRWP, ranging from 23 to 780 ：g/L (Table 4-9).

4.2.2.7 Water Quality Parameters

Results of water quality analyses, including alkalinity, hardness, total suspended solids, total dissolved solids, TOC, nitrate, and sulfate, are presented for reference on Table 4-9.

4.2.3 Sediments

Four sediment samples were collected at the PRRWP in November 1998: two within the east-west drainage ditch located adjacent to Pentolite Road and two from the ditch located on the east-southeast side of the PRRWP (Figure 4-6). Each of the four samples was collected at depths of 0 to 0.5 feet below the top of sediment and was analyzed for VOCs, SVOCs, nitroaromatic compounds, metals, PCBs, and total organic carbon. The following paragraphs discuss analytical results for these sediment samples by chemical groups.

4.2.3.1 Volatile Organic Compounds

Two VOCs were detected at low, estimated concentrations in two of the four sediment samples collected at the PRRWP (Table 4-10). Acetone was detected in SD-01 (0.051 mg/kg) and SD-03 (0.049 mg/kg) and 2-butanone was detected in SD-01 (0.011 mg/kg) and SD-03 (0.01 mg/kg) (Figure 4-6).

4.2.3.2 Semivolatile Organic Compounds

Two sediment samples exhibited SVOCs at estimated concentrations (Table 4-10). Fifteen SVOCs were detected in SD-02 and/or SD-04, including acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

4.2.3.3 Nitroaromatic Compounds

Nitroaromatic compounds were not detected in any of the PRRWP sediment samples.

4.2.3.4 PCBs

PCBs were not detected in the PRRWP sediment samples.

4.2.3.5 Inorganic Compounds

Fourteen metals were detected in at least one of the four sediment samples (Table 4-10). Aluminum, arsenic, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc were detected in each of the four samples. Barium was detected in three samples with concentrations ranging from 30.9 to 53.4 mg/kg, while potassium was detected in SD-03 (1,040 mg/kg).

4.2.3.6 Total Organic Carbon

Results for TOC ranged from 5,450 to 33,000 mg/kg in the four samples (Table 4-9).

4.2.4 Surface Water

Four surface water samples collocated with the sediment samples previously discussed were collected at the PRRWP in November 1998 (Figure 4-6). Each of the four samples was analyzed for VOCs, SVOCs, nitroaromatic compounds, metals, PCBs, and hardness. The following paragraphs discuss analytical results for these sediment samples by chemical groups.

4.2.4.1 Volatile Organic Compounds

Five VOCs were detected at low concentrations in the four surface water samples (Table 4-10). Acetone was detected in each sample, chloroform and bromomethane in SW-01 and SW-02, while bromodichloromethane and dibromochloromethane were detected only in SW-01 (Figure 4-6).

4.2.4.2 Semivolatile Organic Compounds

Two SVOCs were detected in three of the four surface water samples (Table 4-10). Phenol was detected in SW-01 (2.2 ：g/L), -02 (1.9 ：g/L), and -03 (2.3 ：g/L), while bis(2-ethylhexyl) phthalate was only detected in SW-02 (2.1 ：g/L).

4.2.4.3 Nitroaromatic Compounds

Nitroaromatic compounds were not detected in any of the PRRWP surface water samples.

4.2.4.4 PCBs

PCBs were not detected in the PRRWP surface water samples.

4.2.4.5 Inorganic Compounds

Seven total metals and twelve dissolved metals were detected in at least one of the four surface water samples (Table 4-10). Excluding the nutritionally essential elements, dissolved metals were limited to aluminum, barium, chromium, lead, manganese, vanadium, and zinc.

4.2.4.6 Hardness

Results for hardness ranged from 284,000 to 488,000 ：g/L in the four samples (Table 4-10).

5.0 Human Health Risk Assessment

5.1 Introduction

This introduction provides basic information regarding water- and land-use in the vicinity of PBOW, followed by an overview of the basis, scope, and organization of the HHRA provided by this chapter.

Two groundwater aquifer systems are utilized for drinking water in the vicinity of PBOW: a carbonate aquifer to the west and a shale aquifer to the east (USACE, 1997). PBOW is located at the approximate confluence of these two systems. There are more than 170 private drinking water wells within a 4-mile radius of PBOW that have permits from the Erie County Health Department. Unpermitted wells may also exist. Agricultural wells are also present in the vicinity of PBOW. The number of agricultural wells is uncertain, because agricultural wells in this area do not require permits.

Surface water in the immediate vicinity of PBOW consists of seeps, ponds, and creeks. The Erie County Health Department does not permit local surface water resources to be used as private drinking water sources. These surface water bodies eventually drain into Lake Erie and Sandusky Bay, which are used for recreational swimming, fishing, and boating.

Current land use is classified as industrial and future land use is classified as residential for the purpose of identifying plausible human receptors and exposure pathways in this HHRA.

The USACE (1997) describes potential future land uses of all or portions of the facility as:

- Continued industrial use (NASA activities and programs)
- Recreational use of portions of the site by hunters and fishermen
- Sale of portions of the site to state or local government or private individuals (no land-use restrictions were mentioned)
- Possible use of parts of the facility for residential or agricultural purposes
- Possible use of parts of the facility for training by the National Guard.

Construction activities may take place at this site in the future, if and when portions of the site are developed further.

This basis for this HHRA is the *Baseline Human Health Risk Assessment (BHHRA) Work Plan and Ecological Risk Assessment Work Plan* (IT, 1998b). This work plan provides the protocol for evaluating human health and ecological risks at the Red Water Ponds, which include the WARWP and the PRRWP.

This BHHRA and the underlying work plan are based upon EPA, USACE, and OEPA guidance, including, but not limited to:

- OEPA, 1993, *Closure Plan Review Guidance for RCRA Facilities*, Interim Final, OEPA Division of Hazardous Waste Management, September 1.

- EPA, 1989a, *Risk Assessment Guidance for Superfund*, Volume I, Human Health Evaluation Manual (Part A), Interim Final, Office of Emergency and Remedial Response, Washington, DC, EPA/540/1-89/002.

- EPA, 1991, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors*, Interim Final, Office of Solid Waste and Emergency Response, OSWER Directive: 9285.6-03.

- EPA, 1992a, *Supplemental Guidance to RAGS: Calculating the Concentration Term*, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9285.7-081.

- EPA, 1992b, *Dermal Exposure Assessment: Principles and Applications*, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, including Supplemental Guidance dated August 18, 1992.

- EPA, 1992c, "Guidance on Risk Characterization for Risk Managers and Risk Assessors," Memorandum from F. Henry Habicht II, Deputy Administrator, to Assistant Administrators, Regional Administrators, February 26, 1992.

- USACE, 1995, *Risk Assessment Handbook, Volume I: Human Health Evaluation*, Engineer Manual EM 200-1-4.

The scope of this HHRA is based upon an understanding of: current and potential future land use in the area of PBOW; potentially contaminated environmental media at the site; plausible contaminant transport mechanisms and pathways; and plausible current and future exposure receptor scenarios at, or in the vicinity of PBOW.

Earlier investigations summarized by USACE indicate that subsurface soil, surface water, the shallow or overburden groundwater and the bedrock groundwater aquifer are contaminated with organic compounds including explosives (predominantly TNT degradation products), VOCs, SVOCs, and possibly metals. Contaminated media evaluated in this HHRA are limited to surface water, sediment, and soil. Both shallow and deep groundwater associated with the Red Water Ponds Areas will be evaluated under a forthcoming sitewide HHRA, following additional groundwater characterization at PBOW. It is assumed that the deep groundwater aquifer could be developed as a source of potable water in the future. The shallow groundwater is not considered a source of potable water under either current or future receptor scenarios. Incidental contact with shallow groundwater (dermal contact and inhalation of VOC emissions), however, is plausible during construction projects. Therefore, incidental contact with shallow groundwater, and the potential development of the deep groundwater as a source of potable water, will be developed and evaluated as plausible exposure scenarios in a sitewide HHRA to be developed in the future.

There are a number potential human health receptor scenarios at PBOW. The group of scenarios considered in this HHRA was selected on the basis of requirements in the work plan and other regulatory and human health considerations, as discussed in Section 5.3. The receptor scenarios evaluated in this HHRA include the current and future groundskeeper, the current and future construction worker, the future indoor worker, and the future on-site resident.

The remaining sections of this HHRA are organized as follows. Section 5.2 describes the selection of chemicals of potential concern (COPC) for each medium of interest, and the estimation of source-term concentrations for each COPC in each medium. Section 5.3 describes the exposure scenarios and the rationale by which plausible receptors have been selected, the pathways by which they may be exposed, the exposure-point concentrations of COPC, and the estimated dose or contact rates for each of the COPC. Section 5.4 describes the hazard evaluation, i.e., the adverse health effects associated with each of the COPC, and the dose-response evaluation, i.e., the relationship between dose or contact rate and the magnitude of the adverse effect. Section 5.5 combines the output of the

exposure analysis and the toxicity analysis to quantify cancer risk and noncancer hazard to each receptor; identifies chemicals of concern (COC), which are the chemicals responsible for unacceptable risk or hazard estimates; develops applicable or relevant and appropriate requirements (ARAR) for the COC; and develops risk-based remediation criteria (RBRC) for the COC. Section 5.6 describes the uncertainty associated with the components of the HHRA, and discusses Monte Carlo simulation as an approach to illustrate the uncertainty about the point risk and hazard estimates. Section 5.7 briefly summarizes the protocol of the HHRA and interprets the results. References used in the preparation of this chapter are presented in Chapter 8.0.

5.2 Data Evaluation

5.2.1 Identification of COPC

As the first step in the preparation of the BHHRA, a list of chemicals present in site samples was compiled. This initial list includes all chemicals detected in any site medium. From this list, COPC have been selected as described in the following sections.

5.2.1.1 Sorting the Analytical Data

The chemicals evaluated in a given medium are limited to those detected in that medium. Chemicals for which all samples yield nondetects are considered not to be present and are not evaluated further. The data for each chemical are sorted by medium. Surface soil (generally 0 to 1 feet bgs) and subsurface soil (generally 1 to 10 feet bgs for direct exposure pathways) are considered separate media. During the DPI, several soil samples were taken from depth intervals of 0 to 2 feet or 0 to 3 feet bgs. These data were combined with data from 0 to 0.5 feet in order to achieve a sufficiently large surface soil data set from which to calculate source-term concentrations. Samples from 2 to 4 feet, and deeper intervals, were considered representative of subsurface soil. Therefore, surface soils include samples from 0 to 3 feet, while subsurface soils include data from 2 to 10 feet. No sample results were included in either the surface soil or subsurface soil data sets.

Certain receptors, e.g., the construction worker and the on-site resident, are likely to be exposed to a combination of surface and subsurface soil, which is called “total soil” in this HHRA. The construction worker may engage in projects requiring excavation to depths as great as 10 feet bgs. Residential development may include excavation and grading subsurface soil over the top of existing surface soil. The combination, however, is unlikely to be a perfect blend of surface and subsurface soil, making it

difficult to create a representative data set for total soil. In fact, the material at the surface may well be the original surface soil at one location, and newly excavated and graded subsurface soil a few inches or a few feet distant. The potential exists for the receptor to be exposed to the higher concentrations of chemicals in either surface or subsurface soil. Therefore, the total soil data set consists of the higher source-term concentration for each COPC from the surface soil and subsurface soil evaluations.

5.2.1.2 Evaluating Data Quality

The analytical data may have qualifiers from the analytical laboratory QC or from the data validation process that reflect the level of confidence in the data. Some of the more common qualifiers and their meanings are (EPA, 1989b):

- U - Chemical was analyzed for but not detected; the associated value is the sample quantitation limit (SQL).
- J - Value is estimated, probably below the contract-required quantitation limit.
- R - QC indicates that the data are unusable (chemical may or may not be present).
- B - Inorganic chemicals: the concentration is less than the contract-required detection limit but greater than the instrument detection limit. Organic chemicals: the concentration in the sample is not sufficiently higher than concentration in the blank, using the five-times, ten-times (5x, 10x) rule. A chemical is considered a nondetect unless its concentration exceeds five times the blank concentration. For common laboratory contaminants (acetone, 2-butanone [methyl ethyl ketone], methylene chloride, toluene and the phthalate esters), the sample concentration must exceed ten times the blank concentration.

"J" qualified data are used in the HHRA; "R" and "B" qualified data are not. The handling of "U" and “UJ” qualified data (nondetects) in the HHRA is described in Section 5.2.2. The use of data with other less common qualifiers is evaluated on a case-by-case basis. Generally, data for which the identity of the chemical is unclear are not used in the HHRA. If confidence is high that the chemical is present, but the actual concentration is somewhat in question, the data generally are used in the HHRA.

Two chemicals, 2,4-DNT and 2,6-DNT, were analyzed under two different analytical methods: Method 8330 for explosives and Method 8270B for SVOCs. Generally, Method 8330 provides greater sensitivity for these two compounds, as reflected in slightly lower reporting limits for Method

8330 compared with Method 8270B. Therefore, only data from Method 8330 were used for evaluating 2,4- and 2,6-DNT in the risk assessment.

5.2.1.3 Identifying Site-Related Chemicals

Identifying site-related chemicals is a matter of professional judgement that must be addressed for each chemical individually.

Chemicals that are reasonably likely to be related to operations at the Red Water Pond Areas are termed site-related chemicals in this HHRA. Chemicals present at naturally occurring concentrations or those present because of human activity entirely unrelated to former army activity are termed background chemicals. Chemicals identified as site-related were evaluated in site-related risk; chemicals identified as background were evaluated in background risk. All chemicals identified as COPC (site-related and background) were evaluated in total site risk. These designations are explained more fully in Section 5.5.

For most organic chemicals, their identification at concentrations above levels in blanks (considering the 5x, 10x rule; see Section 5.2.1.2) is presumptive evidence of site-related activity. However, there are exceptions. Inorganic or organic chemicals that are detected infrequently may be artifacts in the data that do not reflect site-related activity and are not included in the HHRA. Generally, chemicals that are detected only at low concentrations in less than 5 percent of the samples from a given medium are dropped from further consideration, unless their presence is expected based on historical information about the site. For example, nitroaromatics are expected to be site-related, but no detected nitroaromatics have been dropped from the HHRA even if their detection frequency was less than 5 percent. Chemicals detected infrequently at high concentrations may identify the existence of "hot spots" and are retained in the evaluation, unless other information exists to suggest that their presence is unlikely to be related to site activities.

Some organic chemicals may occur as a result of activity not associated with site-related releases. Such chemicals, designated anthropogenic background, may include herbicides in agricultural areas where crops are grown, and polynuclear aromatic hydrocarbons (PAH), which form by natural or anthropogenic combustion of organic matter, including fossil fuels. PAHs were detected in samples collected at the Red Water Pond Areas. However, the data are not sufficient to determine whether the concentrations measured represent anthropogenic background or site-related releases. In the absence

of sufficient background data, all the PAHs in all media are considered to be site-related chemicals and are included in site-related risk.

In addition, any class of organic compound may be considered to be of anthropogenic background if site concentrations are comparable to upgradient concentrations. For example, if concentrations of 2,4-DNT in the water of a creek meandering across (hypothetical) Site A are comparable to upgradient concentrations, it is probably appropriate to conclude that 2,4-DNT is not a site-related chemical. Although the chemical is clearly related to former PBOW activities, its presence at Site A probably does not reflect the activities that took place at that particular site. Since the 2,4-DNT in surface water does not reflect activities at Site A, it is inappropriate to select the compound as a COC for Site A and to develop RBRC for it, because remediation at Site A will not address the source of the contamination. Organic chemicals identified as anthropogenic background will not be eliminated from the HHRA; instead, they are included and evaluated in total site risk and background risk, but not in site-related risk. These designations are described fully in Section 5.5.

Identifying site-related metals is complicated by the natural background occurrence of metals in most environmental media. Background concentrations of metals reported previously (IT, 1998c) were used to identify site-related chemicals by comparing site analytical data with background data. The comparisons were based on statistical techniques and professional judgement.

The primary approach involves comparing the maximum detected concentration (MDC) from site data with a background screening criterion (BSC). The BSC represents a theoretical upper limit on background; i.e., if the MDC of site data does not exceed the BSC, it is likely that site concentrations reflect background conditions rather than a site-related release, and the chemical is considered a "background chemical." Development of the BSC depends on the nature of the background data set, which is tested for normality or lognormality with the Shapiro-Wilk test (EPA, 1992d) if the data set includes five or more samples. If the background data set fits neither a normal nor a lognormal distribution, it is considered nonparametric. Nonparametric distributions fit no reliably predictable pattern, which means that an upper limit on background cannot be predicted with confidence. Therefore, the MDC of the background data set is conservatively selected as the BSC for nonparametric background data sets. Normal and lognormal distributions, however, are somewhat more predictable, and an upper limit on background, called an upper tolerance limit (UTL), can be estimated at a quantifiable level of confidence. The background UTL is the concentration, with a

probability of 0.95 (or a confidence of 95 percent), that will capture (or cover) 95 percent of background samples if a large number of samples were taken. Chemicals with MDCs less than the background UTL are considered to represent a natural background metal for the HHRA.

The UTLs for normally distributed background data sets are calculated as follows (EPA, 1989b):

$$UTL = \bar{x} + k(\sigma) \qquad \text{Eq. 5.1}$$

where:

UTL	=	upper tolerance limit of background concentration (confidence factor of 0.95 and coverage of 95 percent)
$\bar{x}$	=	arithmetic mean
σ	=	standard deviation
k	=	tolerance factor (Appendix B, EPA, 1989b).

The same equation is used to estimate the UTL for lognormal background data sets, but the data are log-transformed before the arithmetic mean and standard deviation are calculated.

If the MDC exceeds the BSC, the chemical is considered a site-related COPC or the more rigorous Wilcoxon Rank Sum test (EPA, 1992d) was applied when the assignment of a chemical was equivocal. The more rigorous statistical analysis consists of comparing the site and background data sets to determine if both are drawn from the same population. The Wilcoxon Rank Sum test is used for this purpose because it is applicable to all data distributions, including nonparametric.

Statistical analysis was used in this HHRA as a tool to aid the exercise of professional judgement. Site data from uncontaminated areas with concentrations at the high end of background may "fail" statistical testing. The probability of this error is 5 percent under the assumptions of this 95 percent confidence, and is usually caused by limitations of sample size; i.e., the full range of actual background and site variation was not captured. The identification of metals as a site-related or background chemical is discussed in detail for each medium in the following text.

Metals and organic chemicals identified as anthropogenic background were not eliminated from the HHRA; instead, they were included and evaluated in total site risk and background risk, but not in site-related risk. These designations are described fully in Section 5.5.

The UTL method previously described was applied to the background soil data to develop BSC for soil (Table 5-1). Insufficient data were available for application of the UTL method to develop BSCs for surface water and sediment; therefore, the MDC of each metal was selected as the BSC (Tables 5-2, 5-3).

5.2.1.4 Risk-Based Screening

Risk-based screening for human health was used to focus the assessment on the site-related chemicals that may contribute significantly to overall risk. In this screen, chemical concentrations were compared with very conservative levels derived for standard exposure scenarios. The MDC was compared with the appropriate risk-based screening concentration (RBSC). If the MDC was less than or equal to the RBSC, the chemical in this medium was not considered further. If the MDC exceeded the RBSC, the chemical was considered to be a COPC.

Chemicals whose concentrations were below the RBSCs were not selected as COPC for the HHRA because it is very unlikely that they would cause significant risk. RBSCs for soil were EPA Region IX "residential soil" preliminary remediation goal (PRG) values EPA (1999) adjusted to reflect an incremental lifetime cancer risk (ILCR) of 1E-7 and a hazard index (HI) of 0.1. Because the PRG value for lead is not based on a risk calculation (EPA, 1999), the value of 400 ppm was used without modification in the screening of soil and sediment data. Because a few chemicals detected in soil are not listed among EPA Region IX PRG values, PRG values were calculated using EPA (1999) methodology to provide screening criteria (Appendix H.1).

The mechanisms by which receptors are exposed to sediment are similar to those for soil, but exposure to sediment is likely to be far less intensive. Therefore, the soil RBSCs are adjusted upward by an order of magnitude for application to sediment. In other words, the unadjusted EPA (1999) residential soil PRGs are considered to reflect an ILCR of 1E-7 and an HI of 0.1 when used for screening chemical concentrations in sediment. Similarly, exposure to surface water is likely to be far less intensive than exposure to tap water. Therefore, the tap water RBSCs are adjusted upward by an order of magnitude for application to surface water. The unadjusted EPA (1999) tap water PRGs are

considered to reflect an ILCR of 1E-7 and an HI of 0.1 when used for screening chemical concentrations in surface water.

Concern has arisen regarding potential effects on human health from inhalation of VOCs in indoor air from volatilization from subsurface soil or shallow groundwater. Potential receptors for these pathways include the on-site resident and an indoor worker. Indoor airborne concentrations of VOCs from subsurface soil, estimated as described in Section 5.3.2, were screened against the EPA (1999) ambient air PRGs adjusted to reflect an ILCR of 1E-7 and an HI of 0.1.

It is assumed that VOC concentrations that might accumulate in a building from shallow groundwater would be no higher than those encountered by a construction worker in a utilities ditch. Therefore, airborne concentrations of VOC in a utilities ditch, estimated as described in Section 3.2, will be subjected to risk-based screening to determine the need for evaluating this pathway. RBSCs for indoor air will be the EPA (1999) ambient air PRGs adjusted to reflect an ILCR of 1E-7 and an HI of 0.1. This evaluation will be performed in the forthcoming sitewide HHRA when groundwater data become available.

The risk-based screening previously described assumes that the RBSCs reflect a sufficiently conservative evaluation of the relevant exposure pathways. The sediment RBSCs may not be sufficiently conservative to screen sediment in water bodies from which fish could be harvested and consumed because they do not address bioaccumulation by fish. Similarly, the surface water RBSCs may not be sufficiently conservative to screen surface water from which fish are taken. These concerns pertain specifically to chemicals known to bioaccumulate in aquatic food chains (i.e., PCBs and mercury). However, fish consumption is not a concern at the Red Water Pond Areas because the surface water bodies do not support sport or subsistence fishing. Therefore, PCBs and mercury were subjected to the same screening criteria used for other chemicals.

5.2.1.5 Evaluating Essential Nutrients

Essential nutrients such as calcium, iron, magnesium, potassium, and sodium are usually eliminated as COPC because they are generally considered innocuous in environmental media. Other essential nutrients including chloride, iodine, and phosphorus, may be eliminated as COPC, provided that their presence in a particular medium is judged to be unlikely to cause adverse effects on human health.

5.2.2 Developing Source-Term Concentrations

5.2.2.1 Soil, Surface Water, and Sediment

Because of the uncertainty associated with characterizing contamination in environmental media, both the mean and the upper confidence limit (UCL) on the mean are usually estimated for each COPC in each medium of interest. The upper 95 percent UCL on the mean is generally referred to as the UCL. In general, unusually high values are included in the calculation of the UCL because high values seldom appear as statistical outliers in environmental data. Inclusion of outliers increases the overall conservatism of the risk estimate, or may identify areas that require evaluation as hot spots.

Data sets consisting of five or more data points are tested for normality and lognormality with the Shapiro-Wilk test (EPA, 1992d) using the software package STATISTICA™, or equivalent. Either a normal or lognormal UCL is calculated, whichever provided the better fit in the Shapiro-Wilk test. A nonparametric confidence limit is used when the data fit neither a normal or lognormal distribution.

The UCL is calculated for a normal distribution as follows (EPA, 1992a):

$$UCL = \bar{x} + t_{1-\alpha,n-1} \times (s/\sqrt{n}) \qquad \text{Eq. 5.2}$$

where:

UCL = upper 95th confidence limit on the arithmetic mean concentration (calculated)
$\bar{x}$ = sample arithmetic mean
t_1 = critical value for Student's *t*-test
" = 0.05 (95 percent confidence limit for a one-tailed test)
n = number of samples in the data set
s = sample standard deviation.

The UCL is calculated for a lognormal distribution as follows (Gilbert, 1987):

$$UCL = e^{\left(\bar{y} + (0.5 \cdot s_y^2) + \left[H_{0.95} \cdot \frac{s_y}{(n-1)^{0.5}}\right]\right)} \qquad \text{Eq. 5.3}$$

where:

UCL = upper 95th confidence limit on the arithmetic mean concentration (calculated)

$\bar{y}$ = $\sum y/n$ = sample arithmetic mean of the log-transformed data, y = ln x
s_y = sample standard deviation of the log-transformed data
n = number of samples in the data set
$H_{0.95}$ = value for computing the one-sided upper 95 percent confidence limit on a lognormal mean from standard statistical tables (Land, 1975).

The data point selected as the nonparametric UCL is the 95 percent UCL rank order on the arithmetic mean of the data set. It is estimated by ranking the data observations from smallest to largest. The UCL is converted to a percentile by interpolation. The rank order of the data point selected as the UCL is estimated from the following equation (Gilbert, 1987).

$$u = p(n+1) + Z_{1-\alpha}\sqrt{np(1-p)} \qquad \text{Eq. 5.4}$$

where:

u = rank order of value selected as upper confidence limit, calculated
p = percentile corresponding to the arithmetic mean (50th percentile or 0.5)
n = number of samples in the data set
α = confidence limit (95 percent)
$Z_{1-\alpha}$ = normal deviate variable.

Analytical results are presented as "nondetects" ("U" qualifier) whenever chemical concentrations in samples do not exceed the detection limit or SQL for the analytical procedures for those samples. Generally, the detection limit is the lowest concentration of a chemical that can be "seen" above the normal, random noise of an analytical instrument or method. To apply the previously mentioned statistical procedures to a data set with nondetects, a concentration value must be assigned to nondetects. Nondetects are assumed to be present at one-half the SQL (EPA, 1989a), although judgement may be used in those cases where matrix interference or other phenomena drive the SQL unusually high.

The most common cause of elevated SQL is sample dilution, usually necessitated because one or more chemicals are present at concentrations exceeding the range of the method calibration curve. SQLs are typically designated as unusually high when they are above the highest positive detection. Their use in the data set may result in the 95 percent UCL exceeding the MDC, which would impart a bias to the HHRA. Unusually high SQL results such as these are typically deleted from the data set.

During the HHRA calculations, it was observed that several of the lognormal COPC data sets in subsurface soil yielded UCL estimates lower than expected. In some cases, the UCL was less than the arithmetic mean, which is not logical. These observations triggered a detailed examination, which revealed that, in every case of a suspicious UCL, the number of nondetects (included at one-half the SQL) exceeded 50 percent of the data set. In effect, statistical testing showed that the SQLs are lognormally distributed; the few detections contributed only to the tail of the distribution. Therefore, the UCL calculation based on a lognormal distribution effectually returned the UCL of the SQLs (actually, of one-half the SQLs), influenced relatively little by the few detections included in the data set. This situation was remedied by applying the recommendation of EPA (1992d), which is to override the UCL method previously described, and to consider all data sets that consist of more than 50 percent nondetects to be nonparametric, regardless of the outcome of the Shapiro-Wilk test.

The exposure unit concept was applied to create data sets and develop source-term concentrations for certain receptors. The exposure unit represents the area to which a receptor would be exposed, within which his exposure is assumed to be random. For example, the groundskeeper is assumed to work randomly at any location on the entire site and is not expected to work at any single location for the entire time assumed for exposure (25 years). Therefore, all site data were used to develop source-term concentrations to assess risks to the groundskeeper. On the other hand, a typical residence or the area of exposure for a construction worker may not exceed 1 acre and a subset of the total data might be more appropriate to assess the associated risks. Application of the unit exposure concept is discussed further in Section 5.5.3.3.

For this HHRA, the groundskeeper was assumed to be exposed to surface soil in the current and future site-use evaluations. Therefore, data from all surface soil samples were used to calculate the source concentration for the groundskeeper exposure assessment. The resident was assumed to be exposed to total soil, a combination of surface soil and subsurface soil, because residential development of the site would involve excavation and grading, which would distribute subsurface soil on the surface and obscure the distinction between surface and subsurface soil. It was assumed that the future resident would reside at a randomly chosen lot on the site. The construction worker was assumed to be exposed to total soil, a combination of surface soil and subsurface soil, in both the current and future site-use scenarios, because construction activities are expected to involve excavation and grading.

The UCL or MDC, whichever is smaller, is selected as the source-term concentration, and is understood to represent a conservative estimate of average for use in the HHRA or in various transport models used to estimate exposure-point concentrations. If the data set consists of fewer than five data points, the MDC is generally selected as the source-term concentration.

5.2.2.2 Groundwater

As previously noted in Section 5.1, it is anticipated that bedrock groundwater and associated risks will be evaluated on a sitewide basis in additional studies to be completed at a later date. At that time, risk from potential groundwater contamination may be evaluated under both current conditions (at the time of the field investigation) and under estimated future conditions.

5.2.3 Summary of COPC Selection

Summay tables have been prepared for each medium, by site, with the following information:

- Chemical name
- Frequency of detection
- Arithmetic mean of site concentrations
- Range of detected concentrations
- Range of detection limits
- Statistical distribution
- UCL on the arithmetic mean
- Background screening criterion, if available
- Appropriate RBSC, if available
- Selection as COPC
- Rationale for consideration as COPC, including whether or not COPC is background related
- Representative exposure concentration used in HHRA.

Footnotes in the tables provide the rationale for rejection of a chemical as a COPC.

5.2.3.1 West Area Red Water Ponds

COPC for surface soil (Table 5-4) include four metals, one nitroaromatic TNT impurity or degradation product, and four PAHs, all present at concentrations below reporting limits. The metals are present at levels comparable to background except for chromium, which is present at levels slightly higher than background, as confirmed by the Wilcoxon Rank Sum Test (Appendix H.2). COPC for subsurface soil (Table 5-5) include five metals, all of which are present at levels comparable to background; six nitroaromatic TNT impurities or degradation products; and four PAHs, all present at concentrations below reporting limits. Concentrations of nitroaromatic compounds are much higher in subsurface soil than surface soil, reflecting the general mobility of these chemicals and their tendencies to leach and infiltrate to greater depths. No VOCs in indoor air from subsurface soil were selected as COPC because their modeled concentrations were far below their RBSCs for ambient air (Table 5-6). COPC in total soil include all the COPC in surface and subsurface soil (Table 5-7). All the metal COPC are attributed to background except for chromium.

COPC identified in surface water at the WARWP (Table 5-8) include three metals and three nitroaromatic compounds. All were judged to be site-related, which probably reflects the small size of the background data set for metals in surface water. COPC in sediment (Table 5-9) are limited to arsenic, which was judged to be site-related. It should be noted that the MDC of arsenic in the sediment (11.3 mg/kg) is substantially less than the BSC for arsenic in soil (71 mg/kg). This suggests that the selection of arsenic as site-related probably reflects deficiencies in the sediment background data set rather than an actual site-related release.

5.2.3.2 Pentolite Road Red Water Ponds

COPC for surface soil (Table 5-10) include three metals, all of which are present at levels comparable to background, and five nitroaromatic TNT impurity or degradation products. PAHs were not detected in surface soil at the PRRWP. COPC for subsurface soil (Table 5-11) include five metals, all of which are present at levels comparable to background, and six nitroaromatic compounds, including TNT. PAHs were not detected in subsurface soil at the PRRWP. Concentrations of nitroaromatic compounds are higher in subsurface soil than surface soil, reflecting the general mobility of these chemicals and their tendency to migrate to greater depths.

No VOCs in indoor air from subsurface soil were selected as COPC because their modeled concentrations were far below their RBSCs for ambient air (Table 5-12). COPC in total soil include all the COPC in surface and subsurface soil (Table 5-13). All the metal COPC are attributed to background.

No COPC identified were in surface water at the PRRWP (Table 5-14). COPC in sediment are limited to arsenic, which was judged to be present at background levels (Table 5-15).

5.3 Exposure Assessment

Exposure is the contact of a receptor with a chemical or physical agent. An exposure assessment estimates the type and magnitude of potential exposure of a receptor to COPC found at or migrating from a site (EPA, 1989a). An exposure assessment includes the following steps:

- Characterize the physical setting.
- Identify the contaminant sources, release mechanisms, and migration pathways.
- Identify the potentially exposed receptors.
- Identify the potential exposure pathways.
- Estimate exposure concentrations.
- Estimate chemical intakes or contact rates.

5.3.1 Conceptual Site Exposure Model

The conceptual site exposure model (CSEM) provides the basis for identifying and evaluating the potential risks to human health in the BHHRA. The CSEM (Figure 5-1) includes the receptors appropriate to all plausible land-use scenarios, and the potential exposure pathways. Graphically presenting all possible pathways by which a potential receptor may be exposed, including all sources, release and transport pathways, and exposure routes, facilitates consistent and comprehensive evaluation of risk to human health, and helps ensure that potential pathways are not overlooked. The elements of a CSEM include:

- Source (i.e., initially contaminated environmental) media
- Contaminant release mechanisms
- Contaminant transport pathways
- Intermediate or transport media
- Exposure media
- Receptors
- Routes of exposure.

Contaminant release mechanisms and transport pathways are not relevant for direct receptor contact with a contaminated source medium.

The receptors and pathways in Figure 5-1 reflect plausible scenarios developed from information regarding site background and history, topography, climate, and demographics as presented in the work plan (IT, 1998b). Asterisks identify exposure pathways that are complete and addressed in the HHRA. Justification for exclusion of other pathways is provided in the figure footnotes.

5.3.1.1 Physical Setting

The physical setting of the Red Water Ponds Areas is summarized in Chapter 1.0 of this document. Selected features relevant to site HHRA work are described in Section 5.1 of this chapter. Although brief, the description supports the receptors and exposure pathways illustrated in Figure 5-1. Greater detail is provided in documents by USACE (1997) and IT (1997).

5.3.1.2 Contaminant Sources, Release Mechanisms, and Migration Pathways

Contaminant sources, release mechanisms, and migration pathways are presented in Figure 5-1. Briefly, red water from the TNT manufacturing process was pumped to the Red Water Ponds. Contaminants in water may partition to sediment. Overflow and runoff may have spread contamination over the surrounding surface soil. Infiltration may have carried contaminants into the subsurface soil or groundwater. Contaminated shallow groundwater may discharge to the surface water, returning contaminants to the Red Water Ponds.

5.3.1.3 Receptors and Exposure Pathways

Receptors, selected to represent the upper-bound on exposure from all plausibly exposed groups of people at the Red Water Ponds Areas, and the pathways by which they may be exposed, are summarized in Figure 5-1 and Table 5-16. The exposure variable values used in the contaminant intake models are compiled in Table 5-17.

Most HHRAs are based on a reasonable maximum exposure (RME) assumption. The intent of the RME assumption is to estimate the highest exposure level that could reasonably be expected to occur, but not necessarily the worst possible case (EPA, 1989a, 1991). It is interpreted as reflecting the 90 to 95th percentile on exposure. In keeping with EPA (1991) guidance, variables chosen for a baseline

RME scenario for intake or contact rate, exposure frequency (EF), and exposure duration (ED) are generally upper-bounds. Other variables, e.g., body weight (BW) and exposed skin surface area (SA), are generally central or average values. In the case of contact rates consisting of multiple components, e.g., dermal contact with soil or water, which consists of a dermal absorption factor (ABS) and soil-to-skin adherence factor (AF) for soil, and permeability coefficient (PC) and exposure time (ET) for water, only one variable, ABS or PC needs to be an upper-bound. The conservatism built into the individual variables ensures that the entire estimate for contact rate is more than sufficiently conservative.

The averaging time (AT) for noncancer evaluation is the product of ED (years) times 365 days per year, to estimate an average daily dose over the entire exposure period (EPA, 1989a). For cancer evaluation, AT is the product of 70 years, the assumed human lifetime, times 365 days per year, to estimate an average daily dose prorated over a lifetime, regardless of the EF or ED. This methodology assumes that the risk from short-term exposure to a high dose of a given carcinogen is equivalent to long-term exposure to a correspondingly lower dose, provided that the total lifetime doses are equivalent. This approach is consistent with current EPA (1986b) policy of carcinogen evaluation, although it introduces considerable uncertainty into the cancer HHRA.

A fractional term (FI) is introduced into the COPC intake equations to account for scenarios in which exposure to a potentially contaminated medium associated with the site is less than total daily exposure to that medium. For example, if the site of interest is small, so that a groundskeeper may spend only one-half of his working time at the site, an FI of 0.5 is applied to the soil ingestion and dermal intake equations. An FI is used also if a receptor's exposure is split between two comparable media. For example, if a construction worker is exposed to both soil and pond sediment, FIs are introduced that apportion his exposure between the two media. The default value of FI is 1.0.

5.3.1.3.1 Groundskeeper

The groundskeeper scenario was designed to evaluate the upper-bound for site worker exposure to surface soil in the current and future site-use scenario. Direct exposure pathways include incidental ingestion and dermal contact with soil. Inhalation of dust, raised by operating lawn mowers or other equipment, was also evaluated. It was assumed that relatively high dust concentrations would be produced within the groundskeeper's breathing zone, with little opportunity for dilution by the large volume of ambient air. In the future, the groundskeeper may be exposed to groundwater developed as

a source of potable water. Scenarios and pathways for exposure to groundwater will be developed in the sitewide HHRA when groundwater data become available.

Generally, in IT's experience, surface soil that has been in place for extended periods and has not been recently contaminated is not a significant source of airborne VOCs because infiltration and dissipation over time would have reduced residues at the surface to toxicologically insignificant levels. VOCs, however, were detected in surface soil, albeit at concentrations below RBSCs, probably from soil at the bottom of the 0 to 1 foot bgs depth range from which surface soil samples were taken. Had VOCs in surface soil been identified as COPC, it would have been assumed that concentrations in air estimated by the activity-based dust emissions model would have been sufficiently conservative for the HHRA.

It was assumed that any contact with surface water or sediment would be infrequent, and grounds-keeper exposure to these media is not considered.

The groundskeeper is assumed to be a 70-kilogram (kg) adult who works 8 hours per day, approximately 5 days per week year-round on the site, for a total of 250 days per year for 25 years (EPA, 1991). The respiratory rate for the groundskeeper is assumed to be 20 cubic meters (m^3)/8-hour workday (2.5 m^3/hour), and the soil incidental ingestion rate is assumed to be 100 milligrams per day (mg/day).

Recent studies evaluating soil adherence that consider the nature of the activity performed and the different body regions were reviewed by EPA (1997a). Measurements of soil adherence to hands, arms, legs, feet, and face for 29 groundskeepers revealed AFs ranging from 8E-4 milligrams per square centimeter (mg/cm^2) (legs) to 1.5E-1 (hands). The AF weight-averaged across these body regions (i.e., adjusted to reflect the different surface areas of the different body regions) for males and females is 9E-3 mg/cm^2, which is used in this evaluation. The surface area of body regions evaluated for groundskeepers include approximately 11,300 cm^2 (EPA, 1997a).

5.3.1.3.2 Construction Worker

The construction worker scenario was created to evaluate short-term exposure to subsurface, as well as surface soil (total soil) in either a current or future land-use scenario. Relevant exposure pathways include incidental ingestion and dermal contact. Inhalation of VOC vapor and dust raised by operating

construction equipment was also evaluated. Construction activity may uncover subsurface soil concentrations of VOCs, facilitating emission of the vapors into the construction worker's breathing zone.

The construction worker may also be exposed to surface water and sediment during projects such as installation of underground utilities or work on or near the ponds. Dermal contact is the most significant pathway for exposure to surface water. Incidental ingestion of surface water is also possible, but is not expected to be nearly as significant as dermal contact. Inhalation of VOCs from surface water is also possible, but the large volumes of outdoor air and natural air currents are expected to dilute airborne concentrations so that this pathway is expected to less significant than dermal contact, which is quantified. For these reasons, incidental ingestion and inhalation of VOCs are not quantified.

The construction worker may be exposed to shallow groundwater by dermal contact during construction projects. Inhalation of VOCs that volatilize from shallow groundwater is another plausible exposure pathway. In the future, the construction worker may be exposed to deep groundwater developed as a source of potable water. Scenarios and pathways for exposure to shallow and deep groundwater will be developed in the sitewide HHRA when groundwater data become available.

The construction worker was assumed to be a 70-kg adult who works 8 hours per day, approximately 5 days per week on the site, for a total of 6 months (EPA, 1991). The respiratory rate for the construction worker was assumed to be 20 m^3/8-hour workday (2.5 m^3/hour) (EPA, 1991). Excavation, grading, installation, or repair of underground utilities and similar activities requiring constant contact with the soil or earth-moving or grading equipment result in intensive exposure to soil and were assumed to last for 3 months. Construction activities such as building erection result in less intensive exposure to soil and were also assumed to last for 3 months. Soil ingestion rates of 480 (EPA, 1993b) and 100 mg/day (EPA, 1991) were assumed for the intensive and less intensive soil contact periods, respectively resulting in a time-weighted average rounded to 290 mg/day.

An AF for a construction worker of 8E-2 mg/cm^2 is estimated using the same method as previously described for the groundskeeper, combining EPA (1997a) data for construction workers, utility workers, and equipment operators to capture the full range of activities likely to be performed by this receptor. The body regions evaluated for construction workers include the hands, arms, legs, feet, and face, which total approximately 11,300 cm^2.

As previously noted, the construction worker may be exposed to surface water and sediment during the 6-month construction period. Dermal exposure to surface water and sediment is assumed to occur on 4 hours per day, or one-half the normal workday. An FI of 0.5 is assumed for both the soil and sediment pathways to apportion the construction worker's time equally between the two media. The incidental ingestion rate for sediment is assumed to be 480 mg/day, because contact with sediment during the construction period may be intense. It is assumed that the arms, forearms, and hands, an SA of approximately 3,100 cm^2 (EPA, 1997a), is exposed to surface water and sediment. An AF for sediment of 0.24 mg/cm^2 (EPA, 1997a) is estimated for the hands and arms using the same method as described for the groundskeeper exposure to soil, using data for construction workers, utility workers, and equipment operators.

5.3.1.3.3 On-Site Resident

The on-site resident scenario was created to evaluate the upper-bound for exposure to surface water, sediment, and soil under the future land-use scenario. The resident was assumed to be exposed to total surface and subsurface soil because residential development of the site would involve excavation and grading, which would mix surface and subsurface soil. Relevant pathways for soil exposure include incidental ingestion, dermal contact, and inhalation of VOC vapors and dust. For evaluating inhalation exposure to dust, it is assumed that 80 percent of the surface is covered with pavement or vegetation. Inhalation of VOCs released from subsurface soil and entrapped in indoor air is also evaluated. In the future, the resident may be exposed to groundwater developed as a source of potable water. Scenarios and pathways for exposure to groundwater will be developed in the sitewide HHRA when groundwater data become available.

Airborne concentrations of VOCs from soil are not evaluated separately from levels generated by the wind erosion model because it is assumed that the topmost layer of soil, from which volatilization would be most significant, will remain relatively undisturbed and that most VOCs would have dissipated by the time construction is finished and occupation is established.

The resident could have access to the ponds and could be exposed to surface water and sediment. It was assumed that the resident would visit the ponds for 8 hours per day, 2 days per week during the warmer half of the year (i.e., 52 days per year), during which time he would be in contact with sediment. The resident was assumed to wade for 3 hours per day on 52 days per year, exposing his feet, lower legs, hands and forearms, or approximately 30 percent of his body SA to surface water

(EPA, 1997a). Plausible exposure pathways include dermal contact with surface water, inhalation of VOC vapors released from surface water, and incidental ingestion and dermal contact with sediment. Incidental ingestion of surface water in a wading scenario was assumed to be negligible.

Inhalation of VOC emissions from surface water is also possible, but the large volumes of outdoor air and natural air currents are expected to dilute airborne concentrations so that this pathway is expected to less significant than dermal contact, which is quantified. For these reasons, inhalation of VOC emissions from surface water is not quantified separately from dermal contact.

The on-site residential scenario was evaluated using both adults and children. Cancer risk was estimated as the sum of the risks calculated for the adult and the child. The child was used for the noncancer evaluation. This approach captures the greater conservatism of the larger incidental soil and sediment ingestion rates for the child, when normalized for BW.

The adult resident was assumed to be a 70-kg person with an incidental soil/sediment ingestion rate of 100 mg/day and an inhalation rate of 20 cubic meters per day (m^3/day) (0.83 m^3/hour) (EPA, 1991). Approximately 30 percent of his total body SA, or 5,450 cm^2, was assumed to be exposed to surface water while wading (EPA, 1992b). Body SA exposed to soil or sediment was assumed to be 25 percent of total SA, or approximately 4,550 cm^2 (EPA, 1992b). The adult resident was assumed to be exposed to soil 350 days per year for 24 years (EPA, 1991, 1999).

The resident child was assumed to be a 1- through 6 year-old with an average BW of 15 kg, a soil/sediment ingestion rate of 200 mg/day, and an inhalation rate of 10 m^3/day (0.42 m^3/hour) (EPA, 1999). Approximately 30 percent of total body SA or 2,100 cm^2 was assumed to be exposed to surface water while wading (EPA, 1992b). Body SA exposed to soil or sediment was assumed to be 25 percent of total SA, or approximately 1,750 cm^2 (EPA, 1992b). The child receptor was assumed to be exposed to soil for 350 days per year for 6 years.

EPA (1989a) permits the development of a fraction to reflect the proportion of total daily exposure that a receptor obtains from potentially contaminated medium. In this scenario, the FI was used to apportion the resident's time of exposure between site soil and sediment. It was assumed that the resident spends 16 hours per day awake and potentially exposed to soil or sediment. As previously noted, 350 days per year are available for contact with soil; 52 of those days are also available for

contact with sediment. It was assumed that contact with soil and sediment does not occur simultaneously; i.e., on those days when the resident spends time at the brook, 8 hours would be spent in contact with surface soil and 8 hours would be spent in contact with sediment. The fraction of exposure to soil, therefore, is 16 hours/16 hours = 1 on the 298 days without time spent at the brook, and 8 hours/16 hours = 0.5 on the 52 days with some time spent at the brook. An overall weighted fraction of 0.93 (rounded to 0.9) is estimated for exposure to soil. An overall weighted fraction of 0.07 (rounded to 0.1) is estimated for exposure to sediment.

The inhalation rate of the adult resident, 20 m^3/day, is multiplied by 16.4 hours per 24 hours per day to estimate a daily indoor inhalation rate of 13.7 m^3/day. An indoor inhalation rate of 6.8 m^3/day is estimated in the same manner for the child resident.

An average soil and sediment AF of 0.2 mg/cm^2 (EPA, 1992b) was used in this evaluation.

5.3.1.3.4 Indoor Worker

This receptor scenario is created to evaluate exposure to indoor airborne VOCs entrapped in a building. VOCs released from subsurface soil or shallow groundwater may enter a building through joints or cracks in the foundation or slab. The indoor worker is also potentially exposed to surface soil via incidental ingestion. Dermal exposure, although plausible, is expected to be far less significant than incidental ingestion and is not quantified separately. In the future, the indoor worker may be exposed to groundwater developed as a source of potable water. Scenarios and pathways for exposure to groundwater will be developed in the sitewide HHRA when groundwater data become available.

The indoor worker is assumed to be a 70-kg adult who works 8 hours per day, approximately 5 days per week year-round on the site, for a total of 250 days per year for 25 years (EPA, 1991). His soil incidental ingestion rate is assumed to be 50 mg/day, and his inhalation rate is assumed to be 20 m^3/8-hour workday.

5.3.1.3.5 Other Receptors Not Considered

Other plausible site workers include office workers and delivery personnel. These workers, however, would be less intensively exposed to soil than the groundskeeper; therefore, their exposures are not evaluated. The Red Water Ponds Areas could become part of the area used for National Guard training activities. National Guard trainees, however, would be less exposed to any of the potentially

contaminated media than the previously described receptors; their exposures are not evaluated. Parts of PBOW are used for fishing and hunting. The Red Water Ponds, however, are not used for fishing, and the Red Water Ponds Areas are too small to provide a significant amount of browse for deer or food for other game animals that would make a significant contribution to the diet. Furthermore, experience has shown that the game ingestion pathway generally is insignificant for contaminants other than the polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDD/PCDF), and the previously described receptors would represent the upper-bound for exposure to soil, surface water, and sediment. For these reasons, a hunting scenario is not evaluated. Much of the land around PBOW is used for agriculture, and it is possible that areas of PBOW could be farmed in the future. The areas around the Red Water Ponds, however, are not suited for agriculture. Also, experience has shown that ingestion of home-grown grains, fruits, meat, poultry, eggs, or milk is generally insignificant compared with direct exposure pathways, except for PCDDs/PCDFs; therefore, indirect food-chain exposures are not evaluated.

The last receptor considered is a trespasser or site visitor who would use the site for recreational purposes. This scenario, however, is not plausible under the current site-use scenario, because the facility is fenced and patrolled. The site visitor scenario is plausible under the future site-use scenario (the fence and patrols may be removed in the future), but the resident would represent the upper-bound on exposure, and evaluation of a site visitor is not necessary.

5.3.2 Quantification of Exposure-Point Concentrations

The exposure-point concentrations of COPC for direct exposure pathways for soil, surface water, and sediment were the source-term concentrations estimated as described in Section 2.2.

Chemical-specific physical property values used in the transport models described below are presented in Table 5-18 and documented in the toxicity profiles compiled in Appendix H.3.

5.3.2.1 Exposure-Point Concentrations in Air

No VOCs were identified as COPC in soil. Therefore, calculations of COPC concentrations in outdoor air were confined to estimating airborne dust concentrations. As previously noted, there is concern for inhalation exposure to VOCs that volatilize from subsurface soil and become entrapped in a building. This is a plausible exposure scenario for the indoor worker and the on-site resident.

5.3.2.1.1 COPC Concentrations from Dust

Inhalation exposure to particulate (dust) emissions from soils for the groundskeeper and construction worker evaluations arise from activities that raise dust. Therefore, the most appropriate approach to estimating chemical concentrations in ambient air is the use of an activity-based dust loading equation (U.S. Department of Energy [DOE], 1989):

$$C_a = (D)(C_{so})(CF2) \qquad \text{Eq. 5.5}$$

where:

C_a = contaminant concentration in air (mg/m^3, calculated)
D = dust loading factor (grams of soil/m^3 of air)
C_{so} = contaminant concentration in soil (mg/kg)
CF2 = conversion factor (1E-3 kg/g).

Plausible values for D include 2E-4 grams per cubic meter (g/m^3) for agricultural activity (DOE, 1989), 6E-4 g/m^3 for construction work (DOE, 1983), and 1E-4 g/m^3 for other activity (National Council on Radiation Protection and Measurements, 1984). The value for D of 1E-4 g/m^3 for other activity was used for the groundskeeper. It was assumed that construction activities requiring intimate contact with soil, for which D = 6E-4 g/m^3 is appropriate, would last for one-half of a construction period. The remaining one-half of the time is more realistically characterized by D = 1E-4 g/m^3; therefore, a time-weighted average dust loading factor for construction work of 3.5E-4 g/m^3 was estimated for the construction worker.

The resident is more likely to be exposed to dust arising from wind erosion rather than from dust-raising activities on the site. EPA (1996a) derived a model for estimating a dust particulate emission factor based on an "unlimited reservoir" model and the assumption that the source area is square:

$$PEF = Q/C \cdot \frac{3600}{0.036 \cdot (1 - V) \cdot (U_m/U_t)^3 \cdot F(x)} \qquad \text{Eq. 5.6}$$

where:

PEF = particulate emission factor (m^3/kg, calculated)

Q/C = inverse of the mean concentration at center of square source (43.08 g/m^2-second per kg/m^3, site-specific value from Table 3 in EPA, 1996a [Zone 7, Cleveland, 30-acre site])
3600 = seconds/hour
V = fraction of surface covered with vegetation (0.8, unitless, assumed)
U_m = mean annual wind speed (default, 4.69 m/second)
U_t = equivalent threshold value of wind speed at 7 m (default, 11.32 m/second)
F(x) = function dependent on U_m/U_t (default, 0.194).

The WARWP and PRRWP are each approximately 22 to 23 acres in size; the Q/C value based on approximately 30 acres (EPA, 1996a) is selected as most appropriate for these sites.

The concentration of COPC in air is calculated as follows:

$$C_a = \frac{C_{so}}{PEF} \qquad \text{Eq. 5.7}$$

where:

C_a = contaminant concentration in air (mg/m^3)
C_{so} = contaminant concentration in soil (mg/kg)
PEF = particulate emission factor (m^3/kg).

5.3.2.1.2 COPC Concentrations in Indoor Air

The RBSCs applied to subsurface soil for COPC selection do not address this pathway; therefore, an EPA (1997b) modification of the Johnson and Ettinger model is used to estimate airborne concentrations in indoor air.

Estimating indoor airborne concentrations from subsurface soil can be considered to consist of three separate steps:

- Estimating VOC concentration in soil gas at source of contamination (C_{source})
- Estimating an attenuation coefficient that captures the decline in VOC concentration between soil gas at the source and indoor air (")

- Combining C_{source} and " to estimate VOC concentration in indoor air in the building ($C_{building}$).

An "infinite source" assumption is selected to maintain consistency with the EPA (1996a) methodology for particulate emission factor, and to impart a conservative bias to the evaluation. It is assumed that both the source of VOC contamination in subsurface soil and the foundation of the building are located above the groundwater saturation zone. It is also assumed that VOC contamination in soil does not exist in a nonaqueous phase. Because of the strongly conservative bias imparted by the infinite source assumption, average values are selected for model variables, when possible, if site-specific data are not available. Default values are taken preferentially from 1996 EPA guidance (1996a) to maintain consistency with the other models described in Section 5.3.2, then from 1997 EPA guidelines (1997b).

The first step in estimating indoor VOC concentrations in air is to relate the concentration of VOC in soil gas at the source of contamination to the concentration of VOC in soil, as follows:

$$C_{source} = \frac{(H')(C_s)(D_b)(CF_1)}{(D_w) + (K_d)(D_b) + (H')(D_a)} \qquad \text{Eq. 5.8}$$

where:

C_{source}	=	VOC concentration in soil gas at source of contamination (g/cm^3)
H'	=	dimensionless Henry's law constant (chemical-specific, may be estimated as H @ 41 [EPA, 1996a])
H	=	Henry's law constant (atmosphere-m^3/mole, chemical-specific)
C_s	=	contaminant concentration in soil (mg/kg)
D_b	=	dry soil bulk density (1.5 g/cm^3, default [EPA, 1996a], or site-specific)
CF_1	=	conversion factor (10^{-6} kg/mg)
2_w	=	water-filled soil porosity (0.15 L_{water}/L_{soil}, default [EPA, 1996a], or site-specific)
K_d	=	soil-water partition coefficient (cm^3/g, chemical-specific, may be estimated as K_{oc} @ f_{oc})
K_{oc}	=	soil organic carbon-water partition coefficient (cm^3/g, chemical-specific)
f_{oc}	=	organic carbon content of soil (0.006 g/g, default [EPA, 1996a], or site-specific)
2_a	=	air-filled soil porosity (0.28 unitless, default [EPA, 1996a], or site-specific estimated as n-2_w)

n	=	total soil porosity (0.43 unitless, default [EPA, 1996a], or site-specific estimated as 1-[D_b/D_s]).

The next step in estimating indoor VOC concentrations in air is the estimation of an attenuation coefficient that reflects the phenomena that reduce concentration in air between the source and the interior of the building. Because of the many phenomena involved, it is helpful to break this step into several smaller segments.

Diffusion is probably the most important phenomenon involved in the transport of VOC vapors from source to building. The EPA (1997b) modification of the Johnson and Ettinger model provides for multiple layers, i.e., different soil types, each of which would have its own physical properties that affect diffusion, between the contaminant source and the foundation of the building. For the purposes of this evaluation, it is simplistically assumed that only one soil type – the predominant soil type in the area – intervenes between source and building foundation. The equation for effective diffusivity through the soil between the source and the building foundation is given as:

$$D^{eff} = D_a(\theta_a^{3.33} / n^2) + (D_w / H')(\theta_w^{3.33} / n^2) \qquad \text{Eq. 5.9}$$

where:

D^{eff}	=	effective diffusion coefficient across soil (cm^2/second, calculated)
D_a	=	diffusivity in air (cm^2/second, chemical specific)
2_a	=	air-filled soil porosity (0.28 unitless, default [EPA, 1996a], or site-specific estimated as n-2_w)
n	=	total soil porosity (0.43 unitless, default [EPA, 1996a], or site-specific estimated as 1-[D_b/D_s])
D_w	=	diffusivity in water (cm^2/second, chemical specific)
H'	=	dimensionless Henry's law constant (chemical-specific, may be estimated as H @ 41 [EPA, 1996a])
2_w	=	water-filled soil porosity (0.15 L_{water}/L_{soil}, default [EPA, 1996a], or site-specific).

The equation for the attenuation coefficient is given as:

$$\alpha = \frac{\left(\left(\frac{D^{eff} A_B}{Q_{building} L_T}\right) \times \exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right)\right)}{\left(\exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right) + \left(\frac{D^{eff} A_B}{Q_{building} L_T}\right) + \left(\frac{D^{eff} A_B}{Q_{soil} L_T}\right)\left(\exp\left(\frac{Q_{soil} L_{crack}}{D^{crack} A_{crack}}\right) - 1\right)\right)} \qquad \text{Eq. 5.10}$$

where:

"	=	attenuation coefficient (unitless, calculated)
D^{eff}	=	effective diffusion coefficient across soil (cm^2/second)
A_B	=	area of enclosed space below grade (1.51E+6 cm^2, see following)
$Q_{building}$	=	building ventilation rate (4.61E+4 cm^3/second, see following)
L_T	=	distance from source to building (150 cm, approximately 5 feet [the midpoint of the depth of the soil column of interest])
Q_{soil}	=	flow rate of soil gas into enclosed space (cm^2/second, see following)
L_{crack}	=	foundation or slab thickness (15 cm, default [EPA, 1997b])
D^{crack}	=	effective diffusion coefficient through cracks (cm^2/second, assumed to be equivalent to D^{eff} [EPA, 1997b])
A_{crack}	=	area of total cracks (492 cm^2, see following).

No buildings are currently present on site from which to estimate several of the parameters required for Equation 5-10. However, some of the building characteristics can be estimated from data provided for the potable-water-to-air volatilization model. EPA (1997a) reviewed several studies of the volumes of houses and recommends 369 m^3 as a central estimate of the volume of a house. Assuming the house has 8-foot (2.44 meters) ceilings and exists on one level, an area of 151.3 square meters, equivalent to 1.51E+6 cm^2, can be estimated as an upper-bound on the area below grade.

An average building ventilation rate of 3,984 m^3/day was estimated for a home (EPA, 1997b), which is equivalent to 4.61E+4 cm^3/second.

EPA (1997b) assumes that the only crack available for the entry of soil gas is a 0.1-centimeters-wide gap at the interface of the floor and foundation. As previously noted, it is assumed that the area of the basement floor is 151.3 square meters. Assuming that the house is square, the length of one side would be 12.3 meters, and the total length of the wall would be 49.2 meters (4,920 centimeters). Therefore, the area of the crack would be 492 square meters.

The equation for the flow rate of soil gas into enclosed space is:

$$Q_{soil} = \frac{2 \pi \Delta P k_v X_{crack}}{\mu \ln(2 Z_{crack} / r_{crack})} \qquad \text{Eq. 5.11}$$

where:

Q_{soil}	=	flow rate of soil gas into enclosed space (cm^2/second, calculated)
) P	=	pressure differential between soil surface and enclosed space (20 g/cm-second^2)
k_v	=	soil vapor permeability (cm^2, see following)
X_{crack}	=	floor-wall seam perimeter (4,920 cm, see previous text)
:	=	viscosity of air (1.83E+5 g/cm-second [EPA, 1992e])
Z_{crack}	=	crack depth below grade (108 cm, see following)
r_{crack}	=	equivalent crack radius (0.1 cm, see following).

Data were not located from which to estimate the crack depth below grade. Presumably, however, houses or other buildings may be built on slabs or on full foundations. EPA (1997b) provides default depths of 15 centimeters for buildings on slabs and 200 centimeters for buildings on foundations. The average, 108 centimeters, is chosen for this evaluation.

Equation 5-11 assumes that vapor transport occurs solely by pressure-driven air flow to an idealized cylinder buried some distance (Z_{crack}) below grade. The length of the cylinder is assumed to be equal to X_{crack}. Therefore, the equivalent crack radius can be estimated as follows:

$$r_{crack} = \eta \left(\frac{A_B}{X_{crack}} \right) \qquad \text{Eq. 5.12}$$

where:

r_{crack}	=	equivalent crack radius (cm, calculated)
0	=	A_{crack}/A_B
A_{crack}	=	area of total cracks (492 cm^2, see previous text)
A_B	=	area of enclosed space below grade (1.51E+6 cm^2, see previous text)
X_{crack}	=	floor-wall seam perimeter (4,920 cm, see previous text).

From the foregoing, a value of 0.1 centimeter is estimated for r_{crack}.

Soil vapor permeability is a very sensitive parameter associated with convective transport of vapors within the zone of influence of a building (EPA, 1997b). It can be estimated as the product of soil intrinsic permeability and the relative air permeability at the estimated water-filled soil porosity (2_w). Soil intrinsic permeability is estimated as follows:

$$k_i = \frac{K_s \mu_w}{\rho_w g} \qquad \text{Eq. 5.13}$$

where:

k_i	=	soil intrinsic permeability (cm^2, calculated)
K_s	=	soil saturation hydraulic conductivity (4.05E-3 cm/second, see below)
$:_w$	=	dynamic viscosity of water (0.01307 g/cm-second [EPA, 1997b])
D_w	=	density of water (0.999 g/cm^2, [EPA, 1997b])
g	=	acceleration due to gravity (980.665 $cm/second^2$ [EPA, 1997b]).

Soil saturation hydraulic conductivity is related to soil texture. Section 6.2.1.1 states that the soils in the Red Water Ponds Areas consists predominately of loamy fine sand and fine sand, or sandy loam, underlain by silt or clay. Table 4 of EPA (1997b) provides approximate values for K_s ranging from 0.20 to 0.25 centimeters per hour (cm/hr) for silt or clay, to 4.42 cm/hr for sandy loam, to 14.59 cm/hr for loamy sand, to 29.70 cm/hr for sand. The value of 14.59 cm/hr for loamy sand, equivalent to 4.05E-3 centimeters per second, is chosen for this evaluation.

Relative air permeability is estimated as follows:

$$k_{rg} = \left(1 - S_{te}\right)^{0.5}\left(1 - S_{te}^{1/M}\right)^{2M} \qquad \text{Eq. 5.14}$$

where:

k_{rg}	=	relative air permeability (positive unitless value, calculated)

S_{te}	=	effective total fluid saturation (unitless, see below)
M	=	van Genuchten shape parameter (0.561 unitless, see following).

Section 6.2.1.1 states that the soils in the Red Water Ponds Areas consists predominately of loamy fine sand and fine sand, or sandy loam, underlain by silt or clay. Table 2 of EPA (1997b) provides an approximate values for M ranging from 0.083 to 0.270 for silty clay or silt, to 0.471 for sandy loam, to 0.561 for loamy sand, to 0.627 for sand. The value of 0.561 for loamy sand is chosen for this evaluation. S_{te} is calculated as follows:

$$S_{te} = \frac{\theta_w - \theta_r}{n - \theta_r} \qquad \text{Eq. 5.15}$$

where:

S_{te}	=	effective total fluid saturation (unitless, calculated)
2_w	=	water-filled soil porosity (0.15 L_{water}/L_{soil}, default [EPA, 1996a], or site-specific)
2_r	=	soil water content (0.057 cm^3/cm^3, see following taken from Table 2 of EPA [1997b])
n	=	total soil porosity (0.43 unitless, default [EPA, 1996a], or site-specific estimated as 1-[D_b/D_s]).

The soil water content (2_r) of 0.057 cm^3/cm^3 was the valued provided by EPA (1997b) for loamy sand.

Soil vapor permeability is estimated as follows:

$$k_v = (k_i)(k_{rg}) \qquad \text{Eq. 5.16}$$

where:

k_v	=	soil vapor permeability (cm^2, calculated)
k_i	=	soil intrinsic permeability (cm^2)
k_{rg}	=	relative air permeability (unitless).

The foregoing permit calculation of the attenuation coefficient, which, in turn permits calculation of the concentration of the VOC in indoor air in the building, as follows:

$$C_{building} = \alpha \, CF_2 \, C_{source} \qquad \text{Eq. 5.17}$$

where:

$C_{building}$	=	VOC concentration in indoor air in the building (mg/m^3, calculated)
"	=	attenuation coefficient (unitless)
CF_2	=	conversion factor (1E+9 mg-cm^3/g-m^3)
C_{source}	=	VOC concentration in soil gas at source of contamination (g/cm^3).

5.3.3 Quantification of Chemical Intake

This section describes the models used to quantify doses or intakes of the COPC by the identified exposure pathways. Models were taken or modified from EPA (1989a) unless otherwise indicated.

5.3.3.1 Inhalation of COPC in Air

The following equation was used to estimate the inhaled dose of COPC in air. The equation was applied to exposures of the groundskeeper, construction worker, and residents by inhalation of dust dust from soil.

$$I_a = \frac{(C_a)(FI_a)(IR_a)(EF)(ED)}{(BW)(AT)} \qquad \text{Eq. 5.18}$$

where:

I_a	=	inhaled dose of COPC (mg/kg-day, calculated)
C_a	=	concentration of COPC in air (mg/m^3)
FI_a	=	fraction of exposure attributed to site media (unitless)
IR_a	=	inhalation rate (m^3/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days).

5.3.3.2 Incidental Ingestion of COPC in Soil

The ingested dose of COPC in soil (groundskeeper, construction worker, resident adult and child) is estimated from the equation:

$$I_{so} = \frac{(C_{so})(FI_{so})(IR_{so})(EF)(ED)(CF4)}{(BW)(AT)} \qquad \text{Eq. 5.19}$$

where:

I_{so} = ingested dose of COPC in soil (mg/kg-day, calculated)
C_{so} = concentration of COPC in soil (mg/kg)
FI_{so} = fraction of exposure attributed to site soil (unitless)
IR_{so} = ingestion rate of soil (mg/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
CF4 = conversion factor (1E-6 kg/mg)
BW = body weight (kg)
AT = averaging time (days).

5.3.3.3 Incidental Ingestion of COPC in Sediment

The ingested dose of COPC in sediment (construction worker, adult and child resident) is estimated from the equation:

$$I_{sd} = \frac{(C_{sd})(FI_{sd})(IR_{sd})(EF)(ED)(CF4)}{(BW)(AT)} \qquad \text{Eq. 5.20}$$

where:

I_{sd} = ingested dose of COPC in sediment (mg/kg-day, calculated)
C_{sd} = concentration of COPC in sediment (mg/kg)
FI_{sd} = fraction of exposure attributed to site sediment (unitless)
IR_{sd} = ingestion rate of sediment (mg/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
CF4 = conversion factor (1E-6 kg/mg)
BW = body weight (kg)
AT = averaging time (days).

5.3.3.4 Dermal Contact with COPC in Soil, Sediment, or Water

Unlike the methodologies for estimating inhaled or ingested dose of COPC, which quantify the dose presented to the barrier membrane (the pulmonary or gastrointestinal mucosa, respectively), dermal dose is estimated as the dose that crosses the skin and is systemically absorbed. For this reason, dermal toxicity values are also based on absorbed dose. The absorbed dose of COPC is estimated from the equation (EPA, 1992b):

$$DAD = \frac{(DA)(SA)(EF)(ED)}{(BW)(AT)} \qquad \text{Eq. 5.21}$$

where:

DAD = average dermally absorbed dose of COPC (mg/kg-day, calculated)
DA = dose absorbed per unit body surface area per day (mg/cm^2-day)
SA = SA_{so} for soil, SA_{sd} for sediment, SA_{sw} for surface water, SA_{gw} for ground-water, = surface area of the skin exposed (cm^2)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (days).

Dose absorbed (DA) is calculated differently for dermal uptake from soil or sediment and from water. Dermal uptake of COPC from soil (groundskeeper, construction worker, resident) or sediment (construction worker, resident) assumes that absorption is a function of the fraction of a dermally applied dose that is absorbed. It is calculated from the equation (EPA, 1992b):

$$DA = (C)(FI)(CF4)(AF)(ABS) \qquad \text{Eq. 5.22}$$

where:

DA = dose absorbed per unit body surface area per day (mg/cm^2-day, calculated)
C = C_{so} for soil, C_{sd} for sediment, = concentration of COPC in medium (mg/kg)
FI = FI_{so} for soil, FI_{sd} for sediment, = fraction of exposure attributed to site medium (unitless)
CF4 = conversion factor (1E-6 kg/mg)
AF = AF_{so} for soil, AF_{sd} for sediment, = soil- or sediment-to-skin adherence factor (mg/cm^2-day)

ABS = absorption fraction (unitless, chemical-specific).

ABS values have been empirically determined for very few chemicals. EPA (1992b) discussed the available empirical data, as well as several predictive approaches for estimating ABS, but refrains from recommending any single approach. OEPA (1998) offers ABS default values of 10 percent (0.1) for organic chemicals and 1 percent (0.01) for inorganic chemicals, consistent with EPA (1999). These default values are used when empirical data are not available. The ABS values for soil are used also for sediment. ABS values are presented in Table 5-18.

Quantification of dermal uptake of COPC from surface water (construction worker, resident) and groundwater (groundskeeper, construction worker, resident) depends on a PC, which describes the rate of movement of a constituent from water across the dermal barrier to the systemic circulation (EPA, 1992b). The equation for dermal uptake of chemicals from water is the same as the equation for dermal uptake of chemicals from soil. DA for dermal uptake from water is calculated from the following equation:

$$DA = (C)(FI)(PC)(ET)(CF5) \qquad \text{Eq. 5.23}$$

where:

DA = dose absorbed per unit body surface area per day (mg/cm^2-day, calculated)
C = C_{sw} for surface water, C_{gw} for groundwater, = concentration of COPC in water (mg/L)
FI = FI_{sw} for surface water, FI_{gw} for groundwater, = fraction of exposure attributed to site medium (unitless)
PC = permeability coefficient (cm/hr)
ET = ET_{sw} for surface water, ET_{gw} for groundwater, = time of exposure (hours/day)
CF5 = conversion factor (1E-3 L/cm^3).

PC has been determined for very few inorganic compounds. For those inorganic compounds for which empirical data are not available, EPA (1992b) recommends a default of 1E-3 cm/hr.

PC for organic chemicals varies by several orders of magnitude. PC for organic chemicals is highly dependent on lipophilicity, expressed as a function of the octanol/water partition coefficient (K_{ow}).

Documentation for PC values is provided in the toxicity profiles compiled in Appendix H.3. The values are summarized in Table 5-18.

The end of the exposure assessment is an estimation of lifetime average COPC intake or contact rates for quantifying cancer risk and chronic COPC intake or contact rates for quantifying noncancer hazard. These estimations, performed as part of the chain of computations that calculate risk and hazard, are presented in the risk characterization table (Section 5.5.).

5.4 Toxicity Evaluation

Toxicity is defined as the ability of a chemical to induce adverse effects in biological systems. The purpose of the toxicity assessment is two-fold:

- Identify the cancer and noncancer effects that may arise from exposure of humans to the COPC (hazard assessment).
- Estimate the quantitative relationship between the magnitude and duration of exposure and the probability or severity of adverse effects (dose-response assessment).

The latter is accomplished by the derivation of cancer and noncancer toxicity values, as described in the following sections.

5.4.1 Cancer Evaluation

A few chemicals are known, and many more are suspected, to be human carcinogens. The evaluation of the potential carcinogenicity of a chemical includes both a qualitative and a quantitative aspect (EPA, 1986b). The qualitative aspect is a weight-of-evidence evaluation of the likelihood that a chemical might induce cancer in humans. The EPA recognizes six weight-of-evidence group classifications for carcinogenicity:

- Group A - Human Carcinogen: human data are sufficient to identify the chemical as a human carcinogen.
- Group B1 - Probable Human Carcinogen: human data indicate that a causal association is credible, but alternative explanations cannot be dismissed.
- Group B2 - Probable Human Carcinogen: human data are insufficient to support a causal association, but testing data in animals support a causal association.

- Group C - Possible Human Carcinogen: human data are inadequate or lacking, but animal data suggest a causal association, although the studies have deficiencies that limit interpretation.

- Group D - Not Classifiable as to Human Carcinogenicity: human and animal data are lacking or inadequate.

- Group E - Evidence of Noncarcinogenicity to Humans: human data are negative or lacking, and adequate animal data indicate no association with cancer.

Weight-of-evidence group classifications for the site COPC are provided on Table 5-19.

The toxicity value for carcinogenicity, called a cancer slope factor (SF), is an estimate of potency. Potency estimates are developed only for chemicals in Groups A, B1, B2 and C, and only if the data are sufficient. The potency estimates are statistically derived from the dose-response curve from the best human or animal study or studies of the chemical. Although human data are often considered to be more reliable than animal data because there is no need to extrapolate the results obtained in one species to another, most human studies have one or more of the following limitations:

- The duration of exposure is usually considerably less than lifetime.

- The concentration or dose of chemical to which the humans were exposed can be approximated only crudely, usually from historical data.

- Concurrent exposure to other chemicals frequently confounds interpretation.

- Data regarding other factors (tobacco, alcohol, illicit or medicinal drug use, nutritional factors and dietary habits, heredity) are usually insufficient to eliminate confounding or quantify its effect on the results.

- Most epidemiologic studies are occupational investigations of workers, which may not accurately reflect the range of sensitivities of the general population.

- Most epidemiologic studies lack the statistical power (i.e., sample size) to detect a low, but chemical-related increased incidence of tumors.

Most potency estimates are derived from animal data, which present different limitations:

- It is necessary to extrapolate from results in animals to predict results in humans, usually done by estimating an equivalent human dose from the animal dose.

- The range of sensitivities arising from genotypic and phenotypic diversity in the human population is not reflected in the animal models ordinarily used in cancer studies.

- Usually very high doses of chemical are used, which may alter normal biology, creating a physiologically artificial state and introducing substantial uncertainty regarding the extrapolation to the low-dose range expected with environmental exposure.

- Individual studies vary in quality (e.g., duration of exposure, group size, scope of evaluation, adequacy of control groups, appropriateness of dose range, absence of concurrent disease, sufficient long-term survival to detect tumors with long induction or latency periods).

The SF is usually expressed as "extra risk" per unit dose; that is, the additional risk above background in a population corrected for background incidence. It is calculated by the expression:

$$(p_{(d)} - p_{(0)}) / (1 - p_{(0)})$$

where:

$p_{(d)}$ = the probability of cancer associated with dose = 1 mg/kg-day
$p_{(0)}$ = the background probability of developing cancer at dose = 0 mg/kg-day.

The SF is expressed as risk per mg/kg per day (mg/kg-day). In order to be appropriately conservative, the SF is usually the 95 percent upper-bound on the slope of the dose-response curve extrapolated from high (experimental) doses to the low-dose range expected in environmental exposure scenarios. EPA (1986b) assumes that there are no thresholds for carcinogenic expression; therefore, any exposure represents some quantifiable risk.

The oral SF is usually derived directly from the experimental dose data, because oral dose is usually expressed as mg/kg-day. When the test chemical was administered in the diet or drinking water, oral dose first must be estimated from data for the concentration of the test chemical in the food or water, food or water intake data, and BW data.

The EPA (2000) Integrated Risk Information System (IRIS) expresses inhalation cancer potency as a unit risk factor (URF) based on concentration, or risk per microgram (: g) of chemical/m^3 of ambient

air. Because cancer risk characterization requires a potency expressed as risk per mg/kg-day, the URF must be converted to the mathematical equivalent of an inhalation cancer SF, or risk per unit dose. Since the inhalation unit risk is based on continuous lifetime exposure of an adult human (assumed to inhale 20 m^3 of air per day and to weigh 70 kg) the mathematical conversion consists of multiplying the unit risk (per ：g/m^3) by 70 kg and by 1,000 ：g/mg, and dividing the result by 20 m^3/day. Oral and inhalation cancer SFs for the site COPC are presented in Table 5-19.

5.4.2 Evaluation of Noncancer Effects

Many chemicals, whether or not associated with carcinogenicity, are associated with noncarcinogenic effects. The evaluation of noncancer effects (EPA, 1989c) involves:

- Qualitative identification of the adverse effect(s) associated with the chemical; these may differ depending on the duration (e.g., acute or chronic) or route (e.g., oral or inhalation) of exposure

- Identification of the critical effect for each duration of exposure (i.e., the first adverse effect that occurs as dose is increased)

- Estimation of the threshold dose for the critical effect for each duration of exposure

- Development of an uncertainty factor; i.e., quantification of the uncertainty associated with interspecies extrapolation, intraspecies variation in sensitivity, severity of the critical effect, slope of the dose-response curve, and deficiencies in the data base, in regard to developing a reference dose (RfD) for human exposure

- Identification of the target organ for the critical effect for each route of exposure.

These information points are used to derive an exposure route- and duration-specific toxicity value called an RfD, expressed as mg/kg-day, which is considered to be the dose for humans, with uncertainty of an order of magnitude or greater, at which adverse effects are not expected to occur. Mathematically, it is estimated as the ratio of the threshold dose to the uncertainty factor.

IRIS (EPA, 2000) and the Health Effects Assessment Summary Tables (HEAST) (EPA, 1997c) express the inhalation noncancer reference value as a reference concentration (RfC) in units of mg/m^3. Because noncancer risk characterization requires a reference value expressed as mg/kg-day, the RfC must be converted to an inhalation RfD. Since the inhalation RfC is based on continuous exposure of an adult human (assumed to inhale 20 m^3 of air/day and to weigh 70 kg), the mathematical conversion

consists of multiplying the RfC (mg/m^3) by 20 m^3/day and dividing the result by 70 kg. Oral and inhalation RfDs for the site COPC are presented in Table 5-19.

5.4.3 Target Organ Toxicity

As a matter of science policy, EPA (1989a) assumes dose- and effect-additivity for cancer effects. This assumption provides the justification for adding the hazard quotients (HQ) or HIs in the risk characterization for noncancer effects resulting from exposure to multiple chemicals, pathways or media. EPA, however, acknowledges that adding all HQ or HI values may overestimate hazard, because the assumption of additivity is probably appropriate only for those chemicals that exert their toxicity by the same mechanism.

Mechanism of toxicity data sufficient for predicting additivity with a high level of confidence are available for very few chemicals. In the absence of such data, EPA (1989a) assumes that chemicals that act on the same target organ may do so by the same mechanism of toxicity, unless the data clearly indicate otherwise. That is, the target organ serves as a surrogate for mechanism of toxicity. When total HI for all media for a receptor exceeds 1.0 due to the contributions of several chemicals, it is appropriate to segregate the chemicals by route of exposure and mechanism of toxicity (i.e., target organ) and estimate separate HI values for each.

As a practical matter, since human environmental exposures are likely to involve near- or sub-threshold doses, the target organ chosen for a given chemical is the one associated with the critical effect. If more than one organ is affected at the threshold, the more severely affected is chosen. Target organ is also selected on the basis of duration of exposure (i.e., the target organ for chronic or subchronic exposure to low or moderate doses is selected rather than the target organ for acute exposure to high doses) and route of exposure. Because dermal RfD values are derived from oral RfD values, the oral target organ is adopted as the dermal target organ. For some chemicals, no target organ is identified. This occurs when no adverse effects are observed or when adverse effects such as reduced longevity or growth rate are not accompanied by recognized organ- or system-specific functional or morphologic alteration. Target organs for the site COPC that have noncancer endpoints are presented in Table 5-19.

5.4.4 Dermal Toxicity Values

Dermal RfDs and SFs are derived from the corresponding oral values, provided there is no evidence to suggest that dermal exposure induces exposure route-specific effects that are not appropriately

modeled by oral exposure data. In the derivation of a dermal RfD, the oral RfD is multiplied by the gastrointestinal absorption factor (GAF), expressed as a decimal fraction. The resulting dermal RfD, therefore, is based on absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than exposure doses. The dermal SF is derived by dividing the oral SF by the GAF. The oral SF is divided, rather than multiplied, by the GAF because SFs are expressed as reciprocal doses.

5.4.5 Sources of Toxicity Information Used in the Human Health Risk Assessment

Toxicity values are chosen using the following hierarchy:

- EPA's on-line IRIS database (EPA, 2000) containing toxicity values that have undergone the most rigorous Agency review
- The latest version of the annual HEAST, including all supplements (EPA, 1997c)
- Other EPA documents, memoranda, former Environmental Criteria and Assessment Office, or National Center for Environmental Assessment (NCEA) derivations for the Superfund Technical Support Center.

All toxicity values, regardless of their source, have been evaluated for appropriateness for use in this HHRA. Documentation for the toxicity values is presented in the toxicity profiles in Appendix H.3.

GAFs (used to derive dermal RfDs and SFs from the corresponding oral toxicity values) presented in Table 5-19 are documented in the toxicity profiles in Appendix H.3.

GAFs obtained from reviews were compared to empirical (especially more recent) data, when possible, and were evaluated for suitability for use for deriving dermal toxicity values from oral toxicity values. The suitability of the GAF increases when the following similarities are present in the oral toxicokinetic study from which the GAF is derived and in the key toxicity study from which the oral toxicity value is derived:

- The same strain, sex, age, and species of test animal was used.
- The same chemical form (e.g., the same salt or complex of an inorganic element or organic compound) was used.

- The same mode of administration (e.g., diet, drinking water or gavage vehicle) was used.
- Similar dose rates were used.

The most defensible GAF for each chemical is used in the HHRA.

When quantitative data were insufficient, a default GAF was used.

5.5 Risk Characterization

Risk characterization is the combination of the results of the exposure assessment and toxicity assessment to yield a quantitative expression of cancer risk or noncancer hazard for the exposed receptors. This quantitative expression is the probability of developing cancer, or a non-probabilistic comparison of estimated dose with a RfD for noncancer effects. Quantitative estimates are developed for individual chemicals, exposure pathways, and exposure media for each receptor. The risk characterization is used to guide risk management decisions.

Generally, the risk characterization follows the methodology prescribed by EPA (1989a), as modified by more recent information and guidance. EPA methods are, appropriately, designed to be health-protective, and tend to overestimate, rather than underestimate, risk. The risk results, however, are generally overly conservative, because risk characterization involves multiplication of the conservatisms built into the estimation of source-term and exposure-point concentrations, the exposure (intake) estimates and the toxicity dose-response assessments.

Risk characterization is limited to those chemicals selected as COPC, i.e., present at concentrations that exceed RBSCs (Section 5.2.1.4). OEPA requires characterizing risk for all chemicals whose concentrations exceed their RBSCs, regardless of whether their concentrations are comparable to background. This approach, although consistent with EPA (1989a), obscures the risk associated with background chemicals, and may leave the misimpression that the entire risk estimate is due to site-related activity. This potential misimpression is avoided by providing three separate risk estimates: total site risk, which includes all COPC identified; background risk, which includes the inorganic and organic COPC identified as natural or anthropogenic background; and site-related risk, which is limited to COPC not identified as background and presumed to be present as a result of former PBOW

activity. Segregating risk estimates in this manner provides maximum useful information for site management.

5.5.1 Carcinogenic Effects of Chemicals

The risk from exposure to potential chemical carcinogens is estimated as the probability of an individual developing cancer over a lifetime, and is called the ILCR. In the low-dose range, which would be expected for most environmental exposures, cancer risk is estimated from the following linear equation (EPA, 1989a):

$$ILCR = (CDI)(SF) \qquad \text{Eq. 5.24}$$

where:

ILCR = incremental lifetime cancer risk, a unitless expression of the probability of developing cancer, adjusted for background incidence, calculated
CDI = chronic daily intake, averaged over 70 years (mg/kg-day)
SF = cancer slope factor (per mg/kg-day).

The chronic daily intake (CDI) term in Equation 5.24 is equivalent to the "I" or "DAD" terms (intake or dose) in Equations 5.18 through 5.23, when these equations are evaluated for cancer intakes.

The use of Equation 5.24 assumes that chemical carcinogenesis does not exhibit a threshold, and that the dose-response relationship is linear in the low dose range. Because this equation could generate theoretical cancer risks greater than 1 for high dose levels, it is considered to be inaccurate at cancer risks greater than 1E-2. In these cases, cancer risk is estimated by the one-hit model:

$$ILCR = 1 - e^{[(CDI)(SF)]} \qquad \text{Eq. 5.25}$$

where:

ILCR = incremental lifetime cancer risk, a unitless expression of the probability of developing cancer, adjusted for background incidence, calculated
$-e^{(CDI)(SF)}$ = the exponential of the negative of the risk calculated using Equation 5.24.

As a matter of policy, EPA (1986b) considers the carcinogenic potency of simultaneous exposure to low doses of carcinogenic chemicals to be additive, regardless of the chemical's mechanisms of toxicity or sites (organs of the body) of action. Cancer risk arising from simultaneous exposure by a given pathway to multiple chemicals is estimated from the following equation:

$$Risk_p = ILCR_{(chem1)} + ILCR_{(chem2)} + \ldots ILCR_{(chemi)} \qquad \text{Eq. 5.26}$$

where:

$Risk_p$ = total pathway risk of cancer incidence, calculated
$ILCR(chem_i)$ = individual chemical cancer risk.

Cancer risk for a given receptor across pathways and across media is summed in the same manner.

5.5.2 Noncancer Effects of Chemicals

The hazards associated with noncancer effects of chemicals are evaluated by comparing an exposure level or intake with an RfD. The HQ, defined as the ratio of intake to RfD, is estimated as (EPA, 1989a):

$$HQ = I/RfD \qquad \text{Eq. 5.27}$$

where:

HQ = hazard quotient (unitless, calculated)
I = intake of chemical averaged over subchronic or chronic exposure period (mg/kg-day)
RfD = reference dose (mg/kg-day).

The I term in Equation 5.27 is equivalent to the "I" or "DAD" terms (intake or dose) in Equations 5.18 through 5.23, when these equations are evaluated for noncancer intakes.

Chemical noncancer hazards are evaluated using chronic RfD values. This approach is different from the probabilistic approach used to evaluate cancer risks. An HQ of 0.01 does not imply a 1 in 100 chance of an adverse effect, but indicates that the estimated intake is 100 times lower than the RfD. An

HQ of unity indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be concern for potential adverse health effects.

In the case of simultaneous exposure of a receptor to several chemicals, an HI is calculated as the sum of the HQs by:

$$HI = I_1/RfD_1 + I_2/RfD_2 + \ldots I_i/RfD_i \qquad \text{Eq. 5.28}$$

where:

HI = hazard index (unitless, calculated)
I_i = intake for the ith toxicant
RfD_i = reference dose for the ith toxicant.

If HI for a given pathway exceeds 1, individual HI values may be calculated for each target organ.

5.5.3 Risk Characterization Results and Discussion

ILCR, HQ, and HI estimates are surrounded by considerable uncertainty; therefore, EPA (1989a) recommends that they be rounded to one significant figure for presentation in a risk assessment. However, in order to facilitate review and to more accurately estimate the contribution of individual chemicals and exposure pathways to the totals, these estimates are presented in the risk tables in scientific notation rounded to two places to the right of the decimal.

For this discussion, a significant contribution to cancer risk is defined for an individual chemical as an ILCR summed across all exposure pathways for a given source medium exceeding 1E-6; a significant contribution to hazard is defined as an HI across all pathways for a source medium exceeding 0.1. The COC were selected because of their cancer risk (cancer COC) or noncancer hazard (noncancer COC). The results and discussion of the risk characterization for soil, surface water, and sediment are described in the following subsections.

5.5.3.1 West Area Red Water Ponds

5.5.3.1.1 Groundskeeper

ILCR and HI values for potential exposures of the groundskeeper to surface soil at the WARWP are shown in Table 5-20. The ILCR summed across all exposure pathways falls within the 1E-6 to 1E-4 risk management range requiring further evaluation. The greatest contributor to cancer risk is chromium, which is carcinogenic only by the inhalation route. The ILCR for chromium, therefore, arises solely from inhalation of dust. Chromium is considered to be a site-related COPC because its concentration slightly exceeds background levels in surface soil. Benzo(a)pyrene is the only other site-related COPC that contributes significantly to cancer risk

The total HI from all exposure pathways, when rounded to one significant figure, does not exceed the threshold value of 1 (Table 5-20). Comparison of total HI values calculated for total risk, background risk and site-related risk indicates that background is the predominant contributor to the total HI and that aluminum and manganese are significant contributors. No site-related chemicals contribute significantly to noncancer hazard.

5.5.3.1.2 Indoor Worker

ILCR and HI values for potential exposures of the indoor worker to surface soil via incidental ingestion are shown in Table 5-21. The ILCR summed across all exposure pathways falls below the 1E-6 to 1E-4 risk management range requiring further evaluation. The total HI from all exposure pathways is well under the threshold value of 1 (Table 5-21).

5.5.3.1.3 Construction Worker

ILCR and HI values for potential construction worker exposures to total soil are shown in Table 5-22. The total ILCR from all exposure pathways is below the 1E-6 to 1E-4 risk management range requiring further evaluation. The total HI from all exposure pathways exceeds the threshold value of 1. The major contributor is manganese. A significant contribution is also provided by aluminum. The site-related HI summed across chemicals and exposure pathways is below the threshold value of 1. No site-related COPC in total soil at the WARWP contribute significantly to cancer risk or noncancer hazard to the construction worker.

ILCR and HI values for potential exposures of the construction worker to surface water are shown in Table 5-23. All ILCR values are below the 1E-6 to 1E-4 risk management range, and all HI values are below the threshold of 1. No site-related COPC in surface water at the WARWP contribute significantly to cancer risk or noncancer hazard to the construction worker.

ILCR and HI values for potential exposures of the construction worker to sediment are shown in Table 5-24. All ILCR values are below the 1E-6 to 1E-4 risk management range, and all HI values are below the threshold of 1. No site-related COPC in sediment at the WARWP contribute significantly to cancer risk or noncancer hazard to the construction worker.

5.5.3.1.4 On-Site Resident

ILCR and HI values for potential exposures of future on-site residents to total soil are shown in Tables 5-25 and 5-26. The total ILCR for potential exposures of a future on-site resident to total surface and subsurface soil from all exposure pathways falls within the 1E-6 to 1E-4 risk management range (Table 5-25). Comparison of total ILCR values calculated for total risk, background risk, and site-related risk shows that the predominant calculated risk is associated with arsenic present at background levels. 2,4-DNT, 2,6-DNT, and benzo(a)pyrene are significant contributors to site-related risk in total soil.

Ingestion and dermal contact rates for children are greater than adults; therefore, noncancer hazards to future residents were calculated only for potential exposures to children. The resulting HI calculations are expected to overestimate the HI for exposures to adults, and thus are conservative. The total HI calculated for potential exposures of children from all exposure pathways exceeds the threshold value of 1 (Table 5-26). However, neither the background risk nor the site-related total HI exceeds the threshold value. Significant contributors to background HI include the metals aluminum, antimony, arsenic and manganese. The site-related COPC that contribute significantly to site-related noncancer hazard include 2-amino-4,6-DNT, 4-amino, 2-6-DNT, and 1,3-dinitrobenzene.

ILCR and HI values for potential exposures of future on-site residents to surface water are shown in Tables 5-27 and 5-28, respectively. All ILCR values calculated for potential exposures of adults and children are below the risk management range. All HI values calculated for potential exposures of children are below the threshold of 1.

ILCR and HI values calculated for residential exposures to sediment are shown in Tables 5-29 and 5-30, respectively. All ILCR values calculated for potential exposures of adults and children are below the risk management range. All HI values calculated for potential exposures of children are below the threshold HI value of 1.

5.5.3.1.5 Summary for West Area Red Water Ponds

Site-related ILCR and HI values calculated for potential exposures of groundskeepers, indoor workers, construction workers, and future residents to COPC in soil, surface water and sediment at the West Area Red Water Ponds are summarized in Table 5-31. All site-related ILCR values summed across COPC and media are within or below the risk management range of 1E-6 to 1E-4. All site-related HI values are below the threshold value of 1.

As mentioned in Section 5.2.2.1, the exposure unit concept may be used to develop data sets and source-term concentrations for site-related COPC in total soil, because it could be inappropriate to use data from an entire site for some receptors, such as the construction worker and on-site resident that may be exposed to relatively small areas. Generally, data from the entire site are used in the first iteration of the HHRA, the results of which were previously presented. Alternative assessments are performed only if necessary. Necessity is defined in this context as the occurrence of MDCs significantly higher than source-term concentrations, so that the first iteration estimates fail to capture the risk associated with exposure to areas smaller than the entire site on which the data set was based.

Table 5-7 identifies the site-related COPC selected for total soil, and provides source-term concentrations and MDCs in surface and/or subsurface soil. The MDC of chromium in surface soil exceeds the source-term concentration by a factor of approximately 2, indicating the potential for higher risk estimates than those previously presented. However, chromium's contribution to cancer risk for the construction worker (Table 5-22) and the on-site resident (Table 5-25) is insignificant. Chromium's contribution to noncancer hazard for the construction worker (Table 5-22 and on-site resident (Table 5-26) is also insignificant. Substituting the MDC for chromium for the source-term concentration would not elevate cancer risk or noncancer hazard estimates significantly. Therefore, it is concluded that it is not necessary to identify exposure units based on the spatial distribution of chromium.

A similar analysis can be performed for the PAHs. The source-term concentrations of the PAHs are equal to their MDCs in surface soil, and exceed their MDCs in subsurface soil (Table 5-7). Therefore, the risk estimates previously summarized capture the maximum risk associated with the PAHs. Of the PAHs, only benzo(a)pyrene contributes significantly to cancer risk for the on-site resident (Table 5-25). It should be noted, however, that PAHs were detected only at sample location DP13 (Appendix E). Therefore, inclusion of the PAHs may slightly overestimate risks for the construction worker or on-site resident located someplace other than at DP13. (Please see Figure 4-1 for the location of DP13).

The MDCs of several nitroaromatic compounds in surface or subsurface soil (1,3-dinitrobenzene, 2,4-DNT, 4-amino-2,6-DNT) exceed their source-term concentrations by factors of approximately 2 or less (Table 5-7), suggesting that slightly higher risk estimates could be calculated for smaller exposure units. Figure 5-2 ranks the detected concentrations of these compounds from highest to lowest, and identifies the concentrations and the corresponding sample locations that exceed the source-term concentrations. For example, 2-4-DNT, with a source-term concentration of 3.09 mg/kg, was identified at 6.3 mg/kg in subsurface soil at sample location DP13. DP13 is located approximately 80 feet northwest of monitoring well MW-02 in the north central part of the site (Figure 4-1). Other sample locations of interest include S6, S10, and S17. These locations come from previous investigations and are presented in Figure 5-3. The four sample locations of interest are scattered over the site and do not appear to reflect a pattern of contamination.

Each of the four sample locations of interest is evaluated as a separate exposure unit. Source-term concentrations of site-related COPC in soil are developed separately for each sample location. The source-term concentration is the highest detected value in surface or subsurface soil. One-half the reporting limit is used as a surrogate concentration for COPC that were not detected at the particular sample location.

Source-term concentrations for site-related COPC at sample location DP13 are presented in Table 5-32. It is noted that the source-term concentration of chromium is below the BSC of 29 mg/kg (Table 5-1); therefore, chromium could be considered a background COPC and deleted from the analysis of DP13. Cancer risk estimates for the construction worker (Table 5-33) are below the 1E-6 to 1E-4 risk management range, as was observed for the WARWP as a whole (Table 5-22). Noncancer HI estimates for the construction worker are below the threshold of 1 (Table 5-33), as was observed for the WARWP as a whole (Table 5-22). No COPC are selected as contributing significantly to cancer risk or noncancer hazard.

Cancer risk estimates for the on-site resident at DP13 (Table 5-34) are within the 1E-6 to 1E-5 risk management range and are similar to those observed for the WARWP as a whole (Table 5-25). 2,4-DNT and benzo(a)pyrene contribute significantly to cancer risk. Noncancer HI estimates for the on-site resident are below the threshold of 1 (Table 5-35), as was observed for the WARWP as a whole (Table 5-26). 4-Amino-2,6-DNT contributes significantly to noncancer hazard.

Similar evaluations were performed for sample locations S6 (Tables 5-36 through 5-39), S10 (Tables 5-40 through 5-43), and S17 (Tables 5-44 through 5-47). The spatial distribution of the nitroaromatic compounds and benzo(a)pyrene results in risk and hazard estimates for both the construction worker and on-site resident being very similar to those noted for the WARWP as a whole. It is concluded that the exposure unit analysis had no effect on the summary observations previously presented, and it is deemed unnecessary to re-summarize the total hazard and risk estimates presented in Table 5-31.

5.5.3.2 Pentolite Road Red Water Ponds

5.5.3.2.1 Groundskeeper

ILCR and HI values for potential exposures of the groundskeeper to surface soil are shown in Table 5-48. The total risk and background ILCR summed across all exposure pathways falls within the 1E-6 to 1E-4 risk management range requiring further evaluation. The greatest contributor to cancer risk is arsenic, which is present at concentrations comparable to background. No other COPC contribute significantly to cancer risk. The site-related ILCR summed across all exposure pathways falls below the risk management range. No site-related COPC contribute significantly to cancer risk.

The total HI from all exposure pathways falls below the threshold value of 1 (Table 5-48). The only significant contribution to HI is provided by aluminum and manganese, both of which are present at concentrations comparable to background.

5.5.3.2.2 Indoor Worker

ILCR and HI values for potential exposures of the indoor worker to surface soil by incidental ingestion are shown in Table 5-49. The total risk and background ILCR summed across all exposure pathways falls within the 1E-6 to 1E-4 risk management range requiring further evaluation. The greatest contributor to cancer risk is arsenic, which is present at concentrations comparable to background. No other COPC contribute significantly to cancer risk. The site-related ILCR summed across all exposure pathways falls below the risk management range.

The total HI from incidental ingestion is under the threshold value of 1 (Table 5-49). No COPC contribute significantly to noncancer HI.

5.5.3.2.3 Construction Worker

ILCR and HI values for potential construction worker exposures to total soil are shown in Table 5-50. The total site and site-related ILCR from all exposure pathways is within the 1E-6 to 1E-4 risk management range requiring further evaluation. The total ILCR for background metals is below the risk management range. The total HI from all exposure pathways exceeds the threshold value of 1, due almost entirely to TNT, which is a site-related chemical (Table 5-50). 4-Amino-2,6-DNT also provides a slight but significant contribution to noncancer hazard. The total HI for background metals also exceeds the threshold of 1 due primarily to manganese, with a slight but significant contribution from aluminum.

ILCR and HI values for potential exposures of the construction worker to surface water are not estimated because no chemicals were selected as COPC in surface water.

ILCR and HI values for potential exposures of the construction worker to sediment are shown in Table 5-51. All ILCR values are below the 1E-6 to 1E-4 risk management range, and all HI values are below the threshold of 1. Arsenic, the only COPC identified in sediment, is present at concentrations comparable to background.

5.5.3.2.4 On-Site Resident

ILCR and HI values for potential exposures of future on-site residents to total soil are shown in Tables 5-52 and 5-53. The total ILCR for potential exposures of a future on-site resident to total surface and subsurface soil from all exposure pathways exceeds the 1E-6 to 1E-4 risk management range (Table 5-52), due almost entirely to TNT, which is a site-related chemical. Significant contributions to site-related risk are also made by 2,4- and 2,6-DNT. The total ILCR associated with background metals falls within the risk management range, due almost entirely to arsenic.

Ingestion and dermal contact rates for children are greater than adults; therefore, noncancer hazards to future residents were calculated only for potential exposures to children. The resulting HI calculations are expected to overestimate the HI for exposures to adults, and thus are conservative. The total HI calculated for potential exposures of children from all exposure pathways exceeds the threshold value of 1 (Table 5-53) due almost entirely to TNT, with slight but significant contributions from 4-amino-2,6-DNT and 1,3-dinitrobenzene. The total HI for background metals does not exceed the threshold of 1, but significant contributions are provided by aluminum, antimony, arsenic, and manganese.

ILCR and HI values for potential exposures of future on-site residents to surface water are not calculated because no chemicals were selected as COPC in surface water.

ILCR and HI values calculated for residential exposures to sediment are shown in Tables 5-54 and 5-55, respectively. All site-related ILCR values calculated for potential exposures of adults and children are below the 1E-6 to 1E-4 risk management range. All HI values calculated for potential exposures of children are well below the threshold HI value of 1.

5.5.3.2.5 Summary for Pentolite Road Red Water Ponds

Site-related ILCR and HI values calculated for potential exposures of groundskeepers, indoor workers, construction workers, and on-site residents to COPC in soil, surface water, and sediment at the PRRWP are summarized in Table 5-56. Site-related ILCR values summed across COPC and source media are within or below the risk management range of 1E-6 to 1E-4 for all receptors except the on-site resident. The ILCR for the on-site resident is substantially above the risk management range. Site-related HI values for the groundskeeper and indoor worker are below the threshold value of 1. Site-related HI values for the construction worker and on-site resident are substantially above the threshold value of 1.

TNT in total soil accounts for almost all of the site-related cancer risk and noncancer hazard estimates for the construction worker and on-site resident, although other nitroaromatics contribute slightly to cancer risk (2,4- and 2,6-DNT) and noncancer HI (4-amino-2,6-DNT, 1,3-dinitrobenzene). Examination of Table 5-13 reveals that the MDCs exceed the source-term concentrations for these site-related COPC, except for TNT, for which the MDC was adopted as the source-term concentration. Figure 5-4 ranks the detected concentrations of these compounds from highest to lowest and identifies the concentrations and the corresponding sample locations that exceed the source-term concentrations. Sample locations of interest include DP03, DP10, and DP11 from the present investigation (Figure 4-4), and S4, S6, S10, S13, S14, S15, and S16 from previous investigations (Figure 5-5). Figure 5-4 identifies sample location S14 as a potential hot spot for TNT. Therefore, the evaluation that follows is called an exposure unit/hot spot analysis.

Examination of Tables 5-50, 5-52 and 5-53 reveals that higher ILCR and HI estimates are computed for the on-site resident than for the construction worker. Therefore, the PRRWP exposure unit/hot spot analysis will be performed only for the on-site resident.

Three tables are prepared for each of the ten sample locations of interest; Table 5-57 presents the source-term concentrations, Table 5-58 presents the on-site resident ILCR estimates, and Table 5-59 presents the on-site resident HI estimates for DP-03. Tables 5-60 through 5-86 present these estimates for the other nine sample locations of interest previously identified.

ILCR estimates for the on-site resident fall within the 1E-6 to 1E-4 risk management range at all sample locations of interest except for S14, where the ILCR rounded to one figure is 9E-4. The risk is due almost entirely to TNT, which was identified at high levels at two different sampling depths at S14. Other significant contributors to risk, at this and the other sampling locations, include 2,4-DNT and, at some sampling locations, 2,6-DNT as well.

HI estimates for the on-site resident fall below the threshold value of 1 for all sample locations of interest except for DP03, DP10, DP11, S14, and S15. 1,3-Dinitrobenzene is the greatest contributor to HI at all of these sample locations except S14. The greatest contributor to HI at S14 is TNT. A substantial contribution to HI at S14 is provided by 4-amino-2,6-DNT; lesser but significant contributions are provided by 1,3-dinitrobenzene and 2,4-DNT.

In summary, the exposure unit/hot spot evaluation identifies DP03, DP10, DP11, S14, and S15 as sample locations with HI estimates above the threshold value of 1. A casual examination of the data (Figure 5-4) would have easily reveal sample location S14 as a hot spot associated with unusually high levels of TNT. However, the significance of 1,3-dinitrobenzene as a contributor to HI at the other four sample locations would not have been as easily seen.

5.5.4 Risk-Based Remediation Criteria Development

RBRC development performed as part of the HHRA provides key risk information to risk managers. RBRC are site-specific risk-based concentrations that reflect the exposure and toxicity assumptions applied in the BHHRA. Consequently, the RBRC are source medium-, receptor-, and chemical-specific.

The first step in RBRC development is selection of COC. Either of two conditions result in designation of a COPC as a COC:

- The concentration of the COPC exceeds its medium-specific ARAR.

- The COPC contributes significantly to cancer risk or hazard, as described in the following text.

COC based on cancer are selected for any medium for which the total ILCR (summed across chemicals and exposure pathways) exceeds 1E-6. An individual COPC in that medium must have an ILCR (summed across exposure pathways) exceeding 1E-6 to be selected as a cancer-based COC. Generally, COC based on noncancer are selected for any receptor whose HI summed across all source media exceeds 1, then for any medium for which the total HI (summed across chemicals and exposure pathways) exceeds 0.1. An individual COPC in that medium must have an HI (summed across exposure pathways) exceeding 0.1 to be selected as a noncancer-based COC.

As previously noted, exposure to shallow or deep groundwater is plausible for all receptors evaluated herein. Groundwater data, however, are not yet available. Risk for exposure to groundwater will be estimated when the data become available, and the risk estimates from this evaluation (soil, surface water, sediment) will be combined with those for groundwater to yield total risk for each receptor summed across all relevant media. Since total receptor HI estimates across media are not available at this time, it is assumed for the purpose of noncancer COC selection that the total HI exceeds the threshold of 1. Therefore, all COPC in a given medium that yield an HI (summed across all exposure pathways) greater than 0.1 are selected as noncancer-based COC.

There are no ARARs for soil, surface water, or sediment; therefore, only the risk-based conditions are evaluated in COC selection.

RBRC are risk-or hazard-specific concentrations of chemicals developed only for the COC in media selected by the criteria described above. In this HHRA, COC were selected for exposure to surface soil (groundskeeper) and total soil (construction worker and on-site resident).

RBRC for cancer COC are estimated for soil from the following equation:

$$RBRC_{coc} = \frac{ST_{coc}\,TR}{ILCR_{COC}} \qquad \text{Eq. 5.29}$$

where:

$RBRC_{coc}$	=	remedial goal option for a given COC, receptor and source medium (calculated)
ST_{coc}	=	source-term concentration of the COC in the given medium
TR	=	target risk level (1E-6, 1E-5)
$ILCR_{coc}$	=	total incremental lifetime cancer risk for a given COC, receptor and source medium.

RBRC for noncancer COC are estimated as follows:

$$RBRC_{coc} = \frac{ST_{coc}\ THI}{HI_{COC}} \qquad \text{Eq. 5.30}$$

where:

$RBRC_{coc}$	=	remedial goal option for a given COC, receptor, and source medium (calculated)
ST_{coc}	=	source-term concentration of the COC in the given medium
THI	=	target hazard index (0.1, 1)
HI_{coc}	=	total hazard index for a given COC, receptor, and source medium.

Concentration units are not provided in Equations 5.29 or 5.30; the RBRC units are the same as the concentration units of the source-term concentration (e.g., mg/kg for soil).

5.5.5 Conclusions

COC were identified and RBSCs were developed for groundskeeper exposure to surface soil (Table 5-87), construction worker exposure to total soil (Table 5-88) and on-site resident exposure to total soil (Table 5-89).

5.6 Uncertainty Analysis

This section explores the uncertainties inherent in the HHRA process. Uncertainty is a factor in each step of the data evaluation and exposure and toxicity assessments presented in the preceding sections. Uncertainties associated with earlier stages of the HHRA become magnified when they are concatenated with other uncertainties in the latter stages. It is not possible to eliminate all uncertainty; however, a recognition of the uncertainties is fundamental to the understanding and reasonable use of the HHRA results.

Generally, BHHRAs carry two types of uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements, e.g., instrument uncertainty (accuracy and precision) associated with contaminant concentrations. The results of the HHRA reflect the accumulated variances of the individual measured values. A different kind of uncertainty stems from data gaps, i.e., additional information needed to complete the database for the assessment (EPA, 1992c). Often, the data gap is significant, such as imprecision regarding the number of days that a construction worker might work at the Red Water Ponds Areas, or the absence of information on the effects of human exposure to the aminodinitrotoluenes.

EPA (1992c) guidance urges risk assessors to address or provide descriptions of individual risk to include the "high end" portions and "central tendency" (CT) of the risk distribution. One way of fulfilling this request, if either cancer or noncancer risk exceed generally acceptable limits (cancer risk greater than 1E-5 or target organ-specific HI greater than 1), is to re-compute the ILCRs or HIs using CT values for as many intake model variables as possible. In contrast to the RME evaluation, which prevails in HHRA and uses upper-end values for intake or contact rates, EF, and ED, the CT evaluation chooses average or mid-range values for these variables (EPA, 1991, 1993b). The intent is to present a quantified risk/hazard estimate more typical for the receptor of interest.

The CT exposure evaluation, however, falls short of its stated intent for several reasons. First, the same source-term concentration is usually used for the CT evaluation as is used for the RME evaluation. EPA (1993b) considers that the UCL or MDC selected as a conservative estimate of average for the RME is appropriate for the CT estimates. Second, there is little information available as to what constitutes a reliable CT estimate for most exposure variables, with the possible exception of a simple on-site residential scenario. For these reasons, RME values are still used. In addition, no CT toxicity values are available, so the uncertainty about the toxicity assessment is not included. A CT evaluation, therefore, usually provides little relief compared with the RME, particularly for exposure scenarios such as a groundskeeper or construction worker, for which no reliable estimation of most exposure variable values can be made. It should be stated that management decisions are generally based on RME rather than CT evaluations. The CT evaluation, within the described limitations, simply adds limited perspective regarding the magnitude of uncertainty about the RME estimates.

Another method of quantifying uncertainty, called Monte Carlo simulation, provides a more graphic illustration of the uncertainty about a risk/hazard estimate, because it presents the risk as a range with

probability densities. To be meaningful, however, Monte Carlo simulation requires that the nature of the distributions of the variables that drive the HHRA should be well characterized. However, well characterized distributions are available for few exposure or toxicological variables, in which case the Monte Carlo simulation provides an incomplete illustration of the magnitude or the distribution of the uncertainty.

5.7 Summary and Conclusions

The WARWP and PRRWP areas were individually evaluated in a HHRA. Potentially contaminated media include surface soil, subsurface soil, surface water, sediment, shallow groundwater and deep groundwater. Analytical data were available for soil, surface water, and sediment. Data for shallow and deep groundwater will be evaluated at a later date. Hence, it is acknowledged that this HHRA, which evaluates a set of plausible receptors for exposure to soil, surface water, and sediment, is incomplete because total cancer risk and noncancer hazard estimates across all media, including groundwater, are not evaluated.

Chemicals in a given source medium were chosen as COPC largely on the basis of their potential to contribute significantly to risk. The COPC were designated as background if they are metals present at concentrations comparable to those observed in uncontaminated areas, or as site-related if their concentrations exceed background or if they were organic chemicals likely to have been released as a result of former DOD activities. This approach permitted estimation of total site risk, background risk, and site-related risk. Only site-related risk is considered in this summary.

The receptors chosen include a groundskeeper, an indoor worker, a construction worker, and an on-site resident. The groundskeeper represents the upper-bound for long-term exposure to soil under a nonresidential site-use assumption. The indoor worker represents the upper-bound for exposure to vapors from subsurface soil trapped in indoor air in a nonresidential setting. The construction worker represents the upper-bound for short-term exposure to soil, surface water, and sediment for nonresidential site use. The on-site receptor represents the upper-bound for exposure to soil, indoor vapors from subsurface soil, surface water, and sediment for residential use. Generally, residential site use represents more intense exposure to all media than nonresidential site use and is considered the most conservative evaluation.

It is plausible that a groundskeeper would be exposed randomly over the entire site; therefore, the surface soil data from the entire site was used to create a single data set for use in the HHRA. The construction worker and on-site resident, on the other hand, are more likely to be exposed to a much smaller area, e.g., the site of a construction project, or a resident's own back yard. The first iteration of the HHRA used data from the entire site to develop a single total soil data set. Smaller exposure units were also evaluated to assess the possibility that higher chemical concentrations could yield higher risk estimates.

Site-related COPC selected for soil at the WARWP area include one metal, one PAH, and several nitroaromatic compounds. The groundskeeper evaluation revealed that contaminant concentrations in surface soil yield cancer risk estimates near the middle of the 1E-6 to 1E-4 risk management range. It is unlikely, however, that adverse noncancer effects would be experienced from exposure to surface soil in a nonresidential setting. The construction worker and on-site resident scenarios evaluated exposure to total soil. The construction worker evaluation suggests that short-term exposure to soil in a nonresidential setting is unlikely to be associated with unacceptable cancer risks. The on-site resident evaluations yielded cancer risk estimates near the middle of the risk management range. Both receptor evaluations, however, showed that adverse noncancer effects are unlikely from exposure to soil in a short-term or long-term setting. The construction worker and on-site resident evaluations were carried further to demonstrate that significantly higher risk estimates would not be calculated for smaller exposure units.

The construction worker and resident exposure evaluations demonstrated that contaminant concentrations in surface water and sediment at the WARWP area are unlikely to pose unacceptable risk under any plausible exposure scenario.

Site-related COPC selected for soil at the PRRWP area are limited to several nitroaromatic compounds. The groundskeeper evaluation revealed that contaminant concentrations in surface soil are unlikely to pose unacceptable cancer risk or induce noncancer effects for long-term nonresidential exposure. The construction worker and on-site resident scenarios evaluated exposure to total soil. The construction worker evaluation revealed that contaminant concentrations in total soil yield cancer risk estimates near the middle of the 1E-6 to 1E-4 risk management range. The noncancer HI exceeded the threshold of 1, raising concern for the occurrence of adverse noncancer effects for short-term exposure to soil in a nonresidential setting. The on-site resident evaluations yielded cancer risk

estimates substantially above the 1E-6 to 1E-4 risk management range. The HI for on-site resident exposure to soil exceeded the threshold of 1 by more than two orders of magnitude, raising concern for the occurrence of adverse noncancer effects. TNT contributed nearly all the cancer risk and the large majority of the noncancer hazard.

Exposure unit/hot spot analysis of the PRRWP revealed that TNT levels at sampling location S14 were responsible for the high cancer risk. Cancer risk at other sampling locations within the PRRWP area fall within the risk management range. Exposure unit/hot spot analysis revealed concern for adverse noncancer effects at sampling locations DP03, DP10, DP11, S14, and S15. Noncancer HI estimates were below the threshold of 1 at the other sampling locations. The sampling locations occur in no discernable array that would suggest a pattern of contamination.

The construction worker and resident exposure evaluations at the PRRWP area demonstrated that contaminant concentrations in surface water and sediment are unlikely to pose unacceptable risk under any plausible exposure scenario.

In summary, soils at the WARWP and PRRWP areas are clearly contaminated with TNT and other nitroaromatic compounds as a result of former DOD activities. The foregoing evaluation demonstrates that contaminant levels in soil raise concern regarding cancer risk (WARWP and PRRWP) and adverse noncancer effects (PRRWP). Although certain sampling locations in the PRRWP are more heavily contaminated than others, no pattern of contamination is discernable. Surface water and sediment are unlikely to pose unacceptable risk.

6.0 Ecological Risk Assessment

6.1 Introduction

A baseline ecological risk assessment (BERA) has been performed to provide an estimate of current and future ecological risk associated with potential hazardous substance releases within the Red Water Ponds Areas. Ecological risks have been assessed separately for logically distinct source areas within the facility. The results of the BERA contribute to the overall characterization of the sites and serve as part of the baseline used to develop, evaluate, and select appropriate remedial alternatives, as needed. The BERA has been performed following the general guidelines of the *Tri-Service Procedural Guidelines for Ecological Risk Assessments* (Wentsel, et al., 1996), with secondary guidance from EPA (1997d) and EPA (1996b).

The primary objective of the BERA is to determine whether unacceptable adverse risks are posed to ecological receptors as a result of potential hazardous substance releases from the Red Water Ponds Areas. This objective is accomplished through:

- Characterizing the ecological communities in the vicinity of the subsites
- Determining the particular hazardous substances being released from the subsites
- Identifying pathways for receptor exposure
- Estimating the magnitude and likelihood of potential risk to identified receptors. The BERA addresses the potential for adverse effects to the vegetation, wildlife, aquatic life (including both fish and aquatic macro-invertebrates), endangered and threatened species, and wetlands or other sensitive habitats associated with the subsites.

Concentrations of chemicals have been measured in relevant environmental media, including soil, surface water, and sediment. It is anticipated that potential impacts from groundwater will be completed in a sitewide groundwater evaluation in the future. Using available concentration data, the BERA consists of:

- Problem formulation section (6.2)
- An exposure characterization section (6.3)

- An ecological effects characterization section (6.4)
- A risk characterization section (6.5)
- A risk summary and identification of preliminary remedial action objectives section (6.6)
- A conclusions and recommendations section (6.7).

IT has evaluated the chemicals of potential ecological concern (COPEC), the ecosystems and receptors at risk, the ecotoxicity of the contaminants (known or suspected), and observed or anticipated ecological effects. This evaluation has been conducted in two steps: (1) a screening assessment step, and (2) a predictive assessment step. Ecological endpoints to be addressed in both steps have been identified. The results and conclusions of the screening assessment determine whether a predictive assessment is required. The criteria by which a predictive assessment is needed have been formalized as null hypotheses. If the null hypotheses are accepted, then a predictive assessment is not needed. If they are rejected, then a predictive assessment is needed.

6.2 Problem Formulation

The screening assessment null hypotheses are:

- The potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of **viable habitat** for potential ecological receptors.
- The potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of **potential ecological receptors**.
- The potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of **potential exposure pathways**.
- The no potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of **potential chemical stressors**.

All four null hypotheses must be rejected for a predictive assessment to be triggered. The first three null hypotheses are tested against the results of the ecological site description (Section 6.2.1). The fourth null hypothesis is tested against the results of the COPEC selection (Sections 6.2.2 and 6.2.3).

If a predictive assessment is triggered, terrestrial and aquatic ecological conceptual site models are developed, as appropriate, and the additional problem formulation tasks described in Sections 6.2.4 to 6.2.6 will be performed.

6.2.1 Ecological Site Description

This ecological site description section includes a general discussion of site background and areas of concern (AOC), surface water resources, wetlands, vegetative communities, a species inventory, and a discussion on threatened and endangered species.

6.2.1.1 General Site Background

PBS, approximately 6,453 acres in size, is located within the Eastern Lake Plains physiographic region of the Eastern Huron/Erie Lake Plain Ecoregion (Lafferty, 1979; Omernik, 1986). This region is generally characterized as containing flat plains as the predominant land-surface form and as having a dominant natural vegetation of elm and ash in undisturbed areas. Approximately two-thirds of Erie County was once covered by a glacial lake that produced features such as beach ridges and wave-cut cliffs. Much of the region is poorly drained due to the flat topography and low stream gradients. Many of the wetlands adjacent to Lake Erie in this region have been preserved by various federal, state, and private organizations (Peterjohn and Rice, 1991), thereby providing important wetland habitat for wildlife.

Across PBS, the land slopes gently to the north-northeast towards Lake Erie. Elevations range from 675 feet above msl at the southwest edge of the site to 625 feet msl in the northern portion of the property at Bogart Road, resulting in an average slope of approximately 0.3 percent. The Lake Plains region itself is over 69 percent cropland, 2.7 percent pasture land, and 10.5 percent forest (Ohio Department of Natural Resources [ODNR], 1985). However, since the prior owner, Trojan Powder Company, acquired the site in the early 1940s and removed the land from agricultural production, undeveloped portions of the station have become second generation forest and open fields. This has resulted in PBS becoming an island of forest and open fields within a sea of agricultural land in north central Ohio.

Site soils associated with the Red Water Ponds include the Arkport-Galen soil association (USCS, 1971). Arkport soils are characterized as deep, nearly level to moderately sloping, well-drained to moderately-well-drained, and having a subsoil of loamy fine sand and fine sand. Galen soils are mostly

level and moderately well-drained, with find sand or sandy loam surface layers, and a subsurface of fine sand, which is underlain by silt or clay. The thickness of soils at PBS ranges from approximately 5 feet or less for most of the site to approximately 20 feet for the extreme northern portion of the site (Erie Planning Commission Report on Land Capability, 1967 in D&M [1997b]). The Arkport-Galen association is comprised of approximately 40 percent Arkport soils, 30 percent Galen soils, and 30 percent minor soils. Permeability of Arkport and Galen soils is estimated to be 12 and 6 to 12 inches per hour, respectively. Bedrock at PBS includes Ohio (Huron) shale, Prout limestone, Plum Brook shale, and Delaware limestone (Erie Planning Commission Report on Land Capability, 1967 in D&M [1997b]) The Red Water Ponds are underlain primarily by Plum Brook shale, and to a lesser extent by Delaware limestone.

AOC at the site include the WARWP, PRRWP, other surface water bodies such as an Pipe Creek and Plum Brook, and area wetlands. These AOC are discussed in more detail in Sections 6.2.1.2 through 6.2.1.5 in the following subsections. Based on a site reconnaissance performed by IT on June 15 and 16, 1998, a photographic record of the site was prepared and is presented in Figures 6-1 through 6-8. The site reconnaissance was performed by two IT ecologists. Prior to arrival at the site, IT personnel obtained relevant information on the site, including topographic maps; township, county, or other appropriate maps; and determined the location of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the sites. Additionally, the *Biological Inventory of Plum Brook Station, 1994* (NASA, 1995), which identifies and shows the locations of threatened and endangered species at PBOW, was reviewed. IT personnel completed a checklist similar to EPA's "Checklist for Ecological Assessment/Sampling" (EPA, 1997d); and information from this checklist was used to complete Section 6.2 herein. The locations were identified of known or potential contaminant sources affecting the sites and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment. IT personnel used the reconnaissance to evaluate the sites for more subtle clues of potential effects from contaminant release.

6.2.1.2 West Area Red Water Ponds

The WARWP area being investigated as part of the current study is approximately 23 acres in size. Present at the site are the "east" and "west" ponds, with the west pond normally being full of water. The two ponds are not hydraulically connected. NASA drained the east pond in the late 1970s and it is usually dry, except for small areas of standing water that accumulate during periods of wet weather.

During the site reconnaissance, approximately 50 percent of the west pond surface was covered with duckweed, and a white-tailed deer was observed drinking out of the red-orange-tinted surface water. Fish were also observed in the west pond, along with great blue heron, American robin, and quail in the surrounding area. Aquatic macrophytes were observed growing within the shallow borders of the west pond. The area surrounding the ponds was primarily wooded, except for the northeast side of the west pond, which was open field. Trees adjacent to the ponds were approximately 30 to 40 feet in height, with diameters at breast height of 6 to 8 inches. A variety of grasses were observed growing within the interior area of the east pond that was not inundated with rain water, and the surface water that did exist was almost entirely covered with duckweed. Pipe Creek flows along the eastern and southern boundaries of the east pond; deer tracks and bull frogs were observed along the creek during site reconnaissance.

6.2.1.3 Pentolite Road Red Water Ponds

The PRRWP area being investigated as part of the current study is approximately 22 acres in size. Ponded water is seasonally present and the area of open water, when it is present, is quite small, estimated to be less than approximately 0.5 acres. Historically, two ponds were present, totaling approximately 2.5 acres in size (D&M, 1997b). According to information provided by D&M (1997b), the water table in this area rises seasonally to a depth of 3 to 5 feet bgs. Ponded water generally occurs in bare areas of the site. An approximately 10-foot-deep southwest-northeast ditch traverses the eastern edge of the site. Based on a site reconnaissance performed by IT ecologists on June 15 to 16, 1998, the seasonally ponded areas of the site exhibited thick stands of reed canary grass and cattails, while common plant species in this and other areas included red maple, dogbane, fox sedge, Canada thistle, grass-leaved goldenrod, tall fescue, and fescue (see Section 6.2.1.7 for a more complete species list).

6.2.1.4 Surface Water

All surface waters present at the sites that are likely to support forage fish throughout the year (the WARWP and Pipe Creek) are most properly designated “warm water habitat.” For the WARWP area, the water depths in the center of west pond range from 1.0 to 1.5 feet, a maximum depth of 2.4 feet occurs in the southwest corner of the water body, and the pond has an average depth of 0.8 feet (D&M, 1997b). The volume of water within the west pond has been estimated to be approximately 114,000 cubic feet, with a surface area of 3.3 acres and an average sediment thickness of approximately 1 foot (November 1994 field study; D&M, 1997b). Sediments of the west pond are

soft to very soft dark gray to black organic silty clay with decayed organic material and fine to medium sand. Below the sediments, natural soils consist of gray to brown silty clay with varying amounts of fine sand and organic material (D&M, 1997b). The smaller east pond is estimated to be between 0.5 and 1.0 acre in size. According to D&M (1997b), the water in both ponds is perched and not directly connected to the underlying groundwater.

Pipe Creek is located south and east of both West Area ponds and is part of the Pickerel Creek-Pipe Creek drainage basin. Pipe Creek flows north to northeasterly into Sandusky Bay approximately 4.5 miles away. According to information from an August 1990 NASA Environmental Resources Document cited in D&M (1997b), the drainage area of Pipe Creek as it passes the WARWP is approximately 12,000 acres. Pipe Creek was observed to be approximately 12 feet wide and 1 foot deep during the site reconnaissance, shaded by overhanging bank vegetation, and with a silt/clay substrate. Water flow in the creek was estimated to be approximately 0.8 feet per second. The water was turbid and the banks of the creek had well-established vegetation and relatively little erosion. A northwest-southeast trending ditch is located to the northeast of the east pond; this ditch flows in a southeasterly direction and discharges into Pipe Creek. The ditch does not drain either of the ponds.

The PRRWP area contains seasonal ponded water. The area of open water, when it is present, is quite small, estimated to be less than half an acre. As mentioned previously, an approximately 10-foot-deep southwest-northeast ditch traverses the eastern edge of the site, and located approximately 1/3-mile further to the east is Plum Brook. According to information from an August 1990 NASA Environmental Resources Document cited in D&M (1997b), the drainage area of Plum Brook as it passes the PRRWP is approximately 500 acres. It is unlikely that any runoff from the site drains to Plum Brook due to the presence of the ditch along the eastern edge of the site. The ditch carries water to the northeast into another ditch that flows parallel to Pentolite Road. According to information in D&M (1997b), an underground clay pipe ("drainage tile") drains the Red Water Ponds and discharges into the ditch that parallels Pentolite Road; however, the outfall of this clay pipe could not be located during the site reconnaissance. During the site visit the 10-foot-deep ditch was observed to have flowing water, with the creek at the bottom approximately 3 feet wide, covered with algae, and 3 to 4 inches deep. Vegetation in and along the flowage included cattails and other emergent macrophytes, and dragon flies, water striders, and crayfish were also observed. The 10-foot banks of the ditch were steep, vegetated with grasses, shaded by overhanging bushes, and were observed to have little erosion.

6.2.1.5 Wetlands

According to the National Wetland Inventory (NWI) Maps for the area (U.S. Fish and Wildlife Service [USFWS], 1977), the open water within the PRRWP area is classified as a palustrine wetland, with both broad-leaved deciduous shrub/scrub and emergent wetland species present. Within the WARWP there are two different wetland classification types: a palustrine open water wetland category for the west pond and a riverine open water category for Pipe Creek. It should be noted that the accuracy of NWI maps are limited, especially in relatively flat landscapes (such as PBS) because minor depressions often contain isolated wetlands not easily identified through air photo interpretation (the process used by the USFWS in preparing NWI maps). As discussed in the following section, additional small seasonal wetlands exist in both study areas.

6.2.1.6 Vegetative Communities

Vegetative communities at the site were classified during site reconnaissance using the 15 potential community types (presented in Table 6-1). The three largest community types observed at the WARWP were moderate forest (FRM), late forest (FRL), and palustrine open water (POW), as shown in Figure 6-9. The three largest community types observed at PRRWP were early old field (OFE), FRM, and palustrine scrub/scrub and emergent wetlands, as shown in Figure 6-10. These general habitat figures presents the type and extent of biological communities present within the immediate vicinity of each AOC. Each of these habitat types can be expected to support different wildlife species assemblages; however, given the close proximity of the habitats to each other, many of the species (discussed in the following text) would be expected to spend some amount of time within each community type for foraging, resting, and loafing activities, depending on the season.

During site reconnaissance, the study areas were examined for vegetative stress, including the identification of plants displaying stunted growth, poor foliage growth, tissue discoloration, and a loss of leaf coverage. Possible vegetative stress was observed at the PRRWP, and to a lesser extent at the WARWP, as evidenced by large areas devoid of vegetation (bare areas; Figure 6-1 [Photo No. 1]; Figure 6-2 [Photo No. 4]; Figure 6-5 [Photo No. 9]). Some of these bare areas have red-tinted ponded water, suggesting chemical inhibition of plant growth. Potential adverse impacts of chemical stressors on plant growth are discussed further in Section 6.5.1.

6.2.1.7 Species Inventory

Based on information from ODNR (1995) and information collected during the site reconnaissance, species lists were prepared for plants, mammals, birds, reptiles, amphibians, and fish (Tables 6-2 through 6-7). Of the plant 365 species documented at the 6,453 acre station by the ODNR (Appendix I, Table I-1), 56 of the common and frequently observed species at the two sites are listed in Table 6-2. As shown at the bottom of Table 6-2, the PRRWP area had slightly more plant species than the WARWP area (85 versus 72 species). In addition, the PRRWP area had more common and/or frequent occurring plant species than the WARWP (46 versus 31, respectively; Table 6-2).

Of the 43 species of mammals that may be found in the region based on species range maps, 4 species were observed on site during site reconnaissance (Table 6-3), including woodchuck, short-tailed shrew, masked shrew, and white-tailed deer. Numerous deer tracks were observed during the site reconnaissance, especially within the bare soil areas of the PRRWP, and the ground cover and understory of the forested areas of both sites showed significant overbrowsing by area wildlife, most likely deer.

Of the 129 species of birds that may be found in the region based on species range maps, 105 species (81 percent) have been recorded at the station by the ODNR during their multiyear studies (Table 6-4). Thirteen bird species were documented at the sites currently under study during the site reconnaissance performed June 15 to 16, 1998 by IT. Of the species recorded by the ODNR, 49 were neotropical migrants and would not be expected to nest at the station. ODNR (1995) notes that of the top 50 bird species recorded at the station, only 6 were ground nesters and 3 others occasionally nest on the ground, suggesting that ground nesters are having problems at the station. Burning practices used by NASA at the station, as well as the large deer population that feeds on much of the ground cover, limits the ground cover available for nesting birds, and results in increased predation for these species (ODNR, 1995). It should be noted that NASA has recently altered its burning practices, burning approximately one-third of the station lands every year, rather than one-half of the lands as was performed in the past (Peecook, 1998). The 15 most abundant bird species recorded at the station by the ODNR included American robin; red-winged blackbird; European starling; song sparrow; common grackle; field sparrow; American goldfinch; indigo bunting; blue jay; common yellow throat; brown-headed cowbird; house wren; gray catbird; northern cardinal; and cedar waxwing.

Of the 14 species of reptile that may be found in the region based on species range maps, 10 species (71 percent) have been observed on site, including turtles and snakes (ODNR, 1995; Table 6-5). During the site reconnaissance snapping and painted turtles were observed.

Of the ten species of amphibians that may be found in the region based on species range maps, nine species (90 percent) have been observed at the site (ODNR, 1995; Table 6-6), including salamanders, toads, and frogs. During the site reconnaissance, American toad, spring peeper, bullfrog, and green frog were observed.

Fourteen species of fish have been observed at Plum Brook, including suckers, sunfish, minnows, sticklebacks, and bullheads (Table 6-7).

6.2.1.8 Threatened and Endangered Species Information

According to an Ohio Division of Natural Areas & Preserves (DNAP) review of their Natural Heritage maps and files (ODNR, 1998), there are records of legal status threatened and endangered (T&E) species within a 1-mile radius of the WARWP and the PRRWP. These species include the following:

- Sedge wren (*Cistothorus platensis*) - endangered
- Dwarf bulrush (*Lipocarpha micrantha*) - threatened
- Twisted yellow-eye-grass (*Xyris torta*) - threatened
- Field sedge (*Carex conoidea*) - threatened
- Least St. John's-wort (*Hypericum gymnanthum*) - endangered
- Flat-leaved rush (*Juncus platyphyllus*) - endangered
- Bushy aster (*Aster dumosus*) - threatened.

In addition, based on information contained in ODNR (1995), there are several species of threatened or endangered plants, potentially threatened plants, and threatened or endangered birds that have been recorded at PBS, as follows:

- Grove sandwort (*Arenaria lateriflora*) - threatened
- Thin-leaved sedge (*C. cephaloidea*) - endangered
- Ashy sunflower (*Helianthus mollis*) - threatened
- Prairie false indigo (*Baptisia lactea*) - potentially threatened
- Broad-winged sedge (*C. alata*) - potentially threatened
- Round-fruited hedge-hyssop (*Gratiola virginiana*) - potentially threatened
- Tall St. John's wort (*H. majus*) - potentially threatened
- Virginia meadow beauty (*Rhexia virginica*) - potentially threatened

- Tall nut rush (*Scleria triglomerata*) - potentially threatened
- Lance-leaved violet (*Viola lanceolata*) - potentially threatened
- Winter wren (*Trogoldytes troglodytes*) - endangered
- Cattle egret (*Bublucus ibis*) - endangered
- Black-crowned night heron (*Nycticorax nycticorax*) - threatened
- Trumpeter swan (*Cygnus buccinator*) - endangered
- Upland sandpiper (plover) (*Bartramia longicauda*) - threatened
- Indiana bat (*Mytolis sodalis*) - endangered

In addition, wild white lettuce was recently found on site outside the study area. This species is considered extinct in Ohio, but common in prairie states (Peecook, 1998). A detailed listing of these T&E species is included in Appendix I, Table I-2, along with the estimated distance, if known, from the location of the sighting of each of the species to the two sites under study. Also included in the table is a general description of the habitat type preferred by the species and data on general identification characteristics that were used during the site reconnaissance in an attempt to document sightings of T&E species at the two Red Water Ponds Areas. Based on the results of the site reconnaissance, no threatened or endangered species of plants, birds, or mammals were found. The site reconnaissance also included detailed searches performed by a highly qualified botanist subcontractor during both the June 1998 site visit and a subsequent September 1998 site visit. The botanist collected numerous specimens from the genus *Carex* (sedges) for definitive identification by Dr. Stanley Stine of Kent, Ohio, a local authority on this difficult group of plants. After a careful evaluation, IT's subcontractor botanist and Dr. Stine determined that none of the sedge specimens collected were threatened or endangered species (Appendix I.3). It should be noted that the September site visit was performed specifically to search for threatened and endangered plant species that flower in the late summer (e.g., the bushy aster).

None of the threatened or endangered bird species, with the possible exception of the sedge wren (also called the short-billed marsh wren) and the black-crowned night heron, would typically be expected to be found at either of the sites. The winter wren, cattle egret, trumpeter swan, and upland sandpiper are all considered rare visitors or migrants at the station (ODNR, 1995), and have not been documented nesting within a 1-mile radius of either site (ODNR, 1998).

Six sedge wren nesting sites were documented in the ODNR DNAP's database for an area near the PRRWP area in old grassy field habitat during 1994, with the closest nesting site being approximately one-third of a mile to the southwest of the site (ODNR, 1998). In the June 1994 sighting, eight sedge

wrens were observed near the PRRWP and two were observed near the WARWP, with 24 territorial birds and several fledglings identified at the PBS (ODNR, 1995). Sedge wrens, an Ohio endangered species, have a preferred breeding habitat that consists of wet meadows, grassy marshes, and old grassy fields (Peterson, 1947) and moist grasses and sedge marshes or wet meadows with scattered low bushes (Bent, 1948). These habitat types are found at the PRRWP, and to a more limited extent, at the WARWP. A possible sedge wren nest (a globular nest hidden at the base of tall grassy vegetation) was found at the PRRWP site during reconnaissance (Figure 6-4; Photo No. 7), however, a definitive identification was not possible because the nest was abandoned and no sedge wrens were observed in the area. Sedge wrens are very sporadic nesters, and birds may not arrive at a breeding colony until July or August and nesting continues into September (Trautman and Trautman, 1968). Draining of marshes has eliminated considerable breeding habitat in Ohio and many recent colonies have been located in wet meadows and hayfields and have disappeared after these fields have been mowed (ODNR DNAP information) (ODNR, 1998).

The black-crowned night heron, an Ohio threatened species, is a regular visitor at ponds, streams, and ditches within the station, however, it does not nest at the station (ODNR, 1995, 1998). The species is typically found near water and wetlands, and since the early 1980s there has been a nesting colony of approximately 100 pairs located on an island in Sandusky Bay approximately 8½ miles north northwest of the study area (Peterjohn and Rice, 1991).

The Indiana bat has not been documented at the site, and is generally not expected in the area based on the fact that its preferred habitat (e.g., caves along streams or trees with exfoliated bark) is not present at either of the two sites. Trees with exfoliated bark, such as shagbark or shellbark hickory, are rare or only occasionally present at the sites, thereby providing little bat roosting habitat (Appendix I, Table I-1).

With the exception of the Erie Sand Barrens State Nature Preserve (ESBSNP), there are no existing or proposed state nature preserves or scenic rivers within 1 mile of the study area, and ODNR is unaware of any unique ecological sites, geological features, breeding or nonbreeding animal concentrations, champion trees, or state parks, forests or wildlife areas within a 1-mile radius of the site (ODNR, 1998). The ESBSNP is located approximately 1 mile south of the WARWP and 2 miles southwest of the PRRWP. The 32-acre preserve is a remnant sand beach of Lake Warren, the fifth ancestral Lake Erie, that supports many species of T&E plant species, such as field sedge, Least St.

John's wort, dwarf bullrush, twisted yellow-eyed-grass, flat-leaved rush, bushy aster, and Virginia meadow beauty. Many of the preserve's rare plant species thrive in open wind-swept conditions such as those found on the sand barrens. The DNAP actively manages the preserve to ensure that the open wind-swept areas remain and do not become overgrown with woody vegetation.

6.2.2 Selection of Preliminary Chemicals of Potential Ecological Concern

IT has identified a subset of chemicals detected at the site that have good quality data and are not naturally occurring, or the result of nonsite sources. These chemicals are also present in sufficient frequency, concentration, and location to pose a potential risk to ecological receptors. Examples of screening criteria that have been used include the following: analytical detection limit; frequency of detection less than 5 percent; comparability with background (Table 6-8); and role as an ecologically essential nutrient at site concentrations. This selection process is described in more detail in the following subsections.

6.2.2.1 Data Organization

The data for each chemical have been sorted by medium. For ecological impacts, soil from 0 to 6 feet have been considered. Chemicals not detected at least once in a medium have not been included in the risk assessment. Available background data have been determined for each medium. Sources of background information include data from previous and current investigations.

The analytical data may have qualifiers from the analytical laboratory QC or from the data validation process that reflect the level of confidence in the data. Some of the more common qualifiers and their meanings are (EPA, 1989a):

- U - Chemical was analyzed for but not detected; the associated value is the sample quantitation limit.
- J - Value is estimated, probably below the contract-required quantitation limit.
- R - QC indicates that the data are unusable (chemical may or may not be present).
- B - Concentration of chemical in sample is not sufficiently higher than concentration in the blank (using five-times, ten-times rule).

"J" qualified data are used in the risk assessment; "R" and "B" qualified data are not. The handling of "U" qualified data (nondetects) is described in Section 6.2.2.2.

6.2.2.2 Descriptive Statistical Calculations

Because of the uncertainty associated with characterizing contamination in environmental media, both the mean and the 95 percent UCL of the mean have been usually estimated for each chemical in each medium of interest (Tables 6-9 through 6-16) . In general, “outliers” are included in the calculation of the UCL because high values in environmental data are seldom true statistical outliers. Inclusion of outliers increases the overall conservatism of the risk estimate, and the likelihood of rejecting the null hypothesis (i.e., there are no chemical stressors at the site).

Data sets have been tested for normality and lognormality based on the Shapiro-Wilks test (EPA, 1992a). Statistical analysis has been performed on all detected chemicals. If statistical tests support the assumption that the data set is normally distributed, the UCL for a normal distribution is calculated. If the statistical analysis shows the data to be lognormally distributed, the UCL is calculated for a lognormal distribution.

The UCL is calculated for a normal distribution as follows (EPA, 1992b):

$$UCL = \bar{x} + t_{1-\alpha, n-1} \times (s/\sqrt{n}) \qquad \text{Eq. 6.1}$$

where:

- $\bar{x}$ = sample arithmetic mean
- t_1 = critical value for student's plus distribution
- α = 0.05 (95 percent confidence limit for a one-tailed test)
- n = number of samples in the set
- s = sample standard deviation.

The UCL is calculated for a lognormal distribution as follows (Gilbert, 1987):

$$UCL = e^{\left(\bar{y} + (0.5 \cdot s_y^2) + \left[H_{0.95} \cdot \frac{s_y}{(n-1)^{0.5}}\right]\right)} \qquad \text{Eq. 6.2}$$

where:

$\bar{y}$ = $\sum y/n$=sample arithmetic mean of the log-transformed data, y = ln x
s_y = sample standard deviation of the log-transformed data
n = number of samples in the data set
$H_{0.95}$ = value for computing the one-sided 95 percent UCL on a lognormal mean from standard statistical tables (Land, 1975).

A nonparametric confidence limit is used when the data set fits neither a normal or a lognormal distribution. The nonparametric UCL is estimated as the 95 percent UCL rank order on the arithmetic mean of the data set. It is estimated by ranking the data observations from smallest to largest. The arithmetic mean is converted to a percentile by interpolation. The rank order of the observation selected as the UCL is estimated from the following equation (Gilbert, 1987):

$$u = p(n + 1) + Z_{1-\alpha}\sqrt{np(1 - p)} \qquad \text{Eq. 6.3}$$

where:

u = upper confidence limit
p = percentile corresponding to the arithmetic mean (0.5)
n = number of samples in the set
α = confidence limit; 95 percent
$Z_{1-\alpha}$ = normal deviate variable.

Analytical results are presented as "nondetects" ("U" qualifier) whenever chemical concentrations in samples do not exceed the detection or quantitation limits for the analytical procedures for those samples. Generally, the detection limit is the lowest concentration of a chemical that can be "seen" above the normal, random noise of an analytical instrument or analytical method. To apply the previously mentioned statistical procedures to a data set with nondetects, a concentration value must be assigned to nondetects. Nondetects are assumed to be present at one-half the SQL, although judgement is used in those cases where matrix interference or other phenomena drive the SQL unusually high. The UCL or MDC, whichever is smaller, is selected as the source-term concentration, and is understood to represent a conservative estimate of average for use in the risk assessment or in various transport models used to estimate exposure-point concentrations.

6.2.2.3 Frequency of Detection

Chemicals that are detected infrequently may be artifacts in the data that may not reflect site-related activity or disposal practices. These chemicals have not been included in the risk evaluation. Generally, chemicals that are detected only at low concentrations in less than 5 percent of the samples from a given medium are dropped from further consideration, unless their presence is expected based on historical information about the site. For the current assessment, nitroaromatics have not been dropped as COPEC as this group of constituents is site-related. Chemicals detected infrequently at high concentrations may identify the existence of "hot spots" and have been retained in the evaluation, unless other information exists to suggest that their presence is unlikely to be related to site activities.

6.2.2.4 Natural Site Constituents (Background and Essential Nutrients)

Chemical concentrations have been compared to background concentrations as an indication of whether a chemical is present from site-related activity or as natural background. This comparison is generally valid for inorganic chemicals, but not for organic chemicals, because inorganic chemicals are naturally occurring and most organic chemicals, besides PAHs, are not. Statistical techniques are used as tools to aid the exercise of professional judgement in resolving site-related issues for metals, since metals are naturally present in most environmental media. The statistical techniques generally involve comparing the site data with background data.

The first statistical technique is the development of an UTL for background, and comparing the MDC with the UTL. Chemicals with MDCs less than the background UTL are eliminated from further consideration. If the MDC exceeds the UTL, the chemical is retained as a COPEC, or a more rigorous statistical analysis may be performed. The statistical analysis consists of comparing the site and background data sets to determine if both are drawn from the same population. The Wilcoxon Rank Sum test is used for this purpose. For the current BERA, the more rigorous statistical analysis was not performed.

The UTL was calculated as follows:

$$UTL = \bar{X} + k(\alpha) \qquad \text{Eq. 6.4}$$

where:

UTL = upper tolerance limit (confidence factor of 0.95 and coverage of 95 percent)

$\bar{x}$ = arithmetic mean
a = standard deviation
k = tolerance factor (Table 5, OEPA [1991], *Final How Clean is Clean Policy*, 26 July.

For background data that were determined to have a nonparametric distribution, based on use of the Shapiro-Wilk Test (EPA, 1992d), and for data sets with greater than 15 percent nondetects, the 95th percentile (rather than the UTL) was used, as discussed for soil in IT (1998b). Results are presented in Table 6-8. Background surface water and sediment results were obtained from upstream samples collected at both Red Water Pond sites, and are presented in Tables 6-13 through 6-16.

It must be understood that statistical analysis is only a tool to aid the exercise of professional judgement. Site data from uncontaminated areas with concentrations at the high end of background may "fail" statistical testing because of the limitations of sample size, i.e., the full range of actual background and site variation was not captured. Statistical testing is based on absolute values, but the approximately 20 metals generally analyzed together constitute only approximately 4 to 5 percent of a given sample. Apparently high values of one or more metals may arise from a diminished amount of other constituents in soil, e.g., silica or organic matter, that may be more abundant in background areas. Therefore, it may be necessary to normalize the metal concentrations in site and background data before performing comparisons. However, for the current BERA, this additional analysis was not performed.

Essential nutrients such as calcium, chloride, iodine, magnesium, phosphorus, potassium and sodium may be eliminated as COPEC, provided that their presence in a particular medium is judged to be unlikely to cause adverse effects on wildlife. However, since there are no screening criteria that are readily available for nutrients, they have been retained as COPEC unless shown to be below the background UTL or 95th percentile.

6.2.2.5 Summary of Preliminary COPEC Selection

Tables 6-9 through 6-16 have been prepared for each medium, by site, with the following information:

- Chemical name
- Frequency of detection
- Arithmetic mean of site concentrations
- Range of detected concentrations
- Range of detection limits

- Statistical distribution
- UCL on the arithmetic mean
- Background screening criterion, if available
- Exclusion rationale for selection as COPEC
- COPEC selection conclusion: YES or NO
- Source-term exposure concentration that may be used in the BERA.

Footnotes in the tables provide the rationale for selecting or rejecting a chemical as a preliminary COPEC. An evaluation of all of the constituents that were eliminated for further consideration was performed to determine whether any should be reinstated as COPEC due to other considerations. Examples of these exceptions include: potential breakdown products and chemicals known to have been used on site historically. Based on this evaluation, no additional preliminary COPEC are recommended. Chemicals not eliminated using the screening procedures previously presented are considered preliminary COPEC and have been further evaluated in Section 6.2.3.

6.2.3 Comparison to Risk-Based Screening Ecotoxicity Values

A final comparison has been made between MDCs of chemicals in sampled media, excluding groundwater, and risk-based screening ecotoxicity values (RBSEV) for ecological endpoints following recommendations in EPA Region 5 Biological Technical Assistance Group (BTAG) Bulletin No. 1 (EPA, 1996b). This comparison used the subset of preliminary COPEC identified in Section 6.2.2.5. Chemicals that exceed the RBSEVs have been retained as final COPEC. The following RBSEV have been used for the final ecological screening assessment:

- ***Soil.*** Soil screening values from EPA Region 3 BTAG screening levels (EPA, 1995), and other available guidance documents, as appropriate, have been used.

- ***Groundwater.*** If groundwater is known to impact surface water at the site, EPA Ecotox Threshold screening values for freshwater (EPA, 1996c) and OEPA Water Quality Criteria will be used when the groundwater evaluation is completed at a future date.

- ***Surface Water.*** EPA Ecotox Threshold screening values for freshwater (EPA, 1996c) and OEPA Water Quality Criteria have been used.

- ***Sediment.*** EPA Ecotox Threshold values for freshwater sediment and sediment criteria from the Ontario Ministry of the Environment and Energy (OME) (OME, 1993) have been used, as recommended in EPA Region 5 guidance (EPA, 1996b).

The results of the final screening of the selected COPEC with RBSEV for ecological endpoints of concern are presented in Table 6-17. COPEC are only selected for further consideration in the BERA if the MDC exceeded the available RBSEV. If no RBSEV was available, the constituent was carried forward for consideration in the BERA. Based on this final screening, 20 COPEC have been selected for surface soil, 22 have been selected for subsurface soil, 14 have been chosen for surface water, and 23 have been chosen for sediment. Based on this selection of potential chemical stressors, and on the finding that viable habitat, potential receptors, and potential exposure pathways exist at both of the Red Water Pond sites, a predictive assessment is triggered, as discussed at the beginning of Section 6.2.

An evaluation of all of the constituents that were eliminated for further consideration was performed to determine whether any should be reinstated as COPEC due to other considerations. Examples of these exceptions include: chemicals with detection limits greater than the RBSEV and chemicals with high bioconcentration and/or bioaccumulation factors. Based on this evaluation, no additional COPEC are recommended. Chemicals not eliminated using the screening procedures previously presented are considered final COPEC and have been quantitatively evaluated in the predictive BERA. The relevant and important physical, chemical, and toxicological properties of the identified COPEC risk drivers (Section 6.5) have been reviewed from the scientific literature and are presented as COPEC profiles in Appendix J.

6.2.4 Selection of Assessment Receptors

IT has selected assessment receptors for evaluation during the predictive BERA. In order to focus the exposure characterization portion of the BERA on species or components that are the most likely to be affected and on those that, if affected, are most likely to produce greater effects in the on-site ecosystem, IT has focused the selection process on species, groups of species, or functional groups, rather than higher organization levels such as communities or ecosystems. Site biota are organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds. For aquatic and/or wetland communities, the major groups are flora and fauna, including vertebrates (water fowl and fish), aquatic invertebrates, and wetland/terrestrial mammals. Species presence at the sites was determined during a literature review and during the site reconnaissance (Section 6.2.1.7 and 6.2.1.8) prior to identification of target receptor species.

Primary criteria for selecting appropriate assessment receptors included, but were not limited to, the following.

- The assessment receptor will have a relatively high likelihood of contacting chemicals via direct or indirect exposure.
- The assessment receptor will exhibit marked sensitivity to chemicals.
- The assessment receptor will be a key component of ecosystem structure or function (e.g., importance in the food web, ecological relevance).
- The assessment receptor's position in the food chain make it vulnerable to a particular class of chemicals (e.g., top predators vulnerable to COPEC that bioaccumulate readily).
- The assessment receptor may be listed as rare, threatened, or endangered (RTE) by a governmental organization; or the receptor will consist of critical habitat for RTE species. Based on the availability of species-specific data, a RTE surrogate species may be selected (Section 6.2.4.1).

Additional criteria for selection of assessment receptors was used to identify species that offer the most favorable combination of characteristics for determining the implications of on-site contaminants. These criteria included: (1) limited home range; (2) role in local nonhuman food chains; (3) potential high abundance and wide distribution at the site; (4) sufficient toxicological information available in the literature for comparative and interpretive purposes; (5) sensitivity to COPEC; (6) relatively high likelihood of occurrence on site following remediation (if required); (7) suitability for long-term monitoring; (8) importance to the stability of the ecological food chain or biotic community of concern; and (9) relatively high likelihood that they will be present at the sites or that habitats present at the sites could support the species.

It is important that sufficient toxicological information is available in the literature on the receptor species, or that a closely related species may be selected. While the ecological communities at the individual sites have species with many desirable characteristics for use as receptor species, not all of these species have been used extensively for toxicological testing.

6.2.4.1 Terrestrial

Seven representative receptor species that are expected or possible in the area of the Red Water Ponds (Section 6.2.1.7) were selected as indicator species for the potential effects of COPEC. These

indicator species represent two classes of vertebrate wildlife (mammals and birds) and a range of both body size and food habits, including herbivory, omnivory, and carnivory. (Potential impacts to terrestrial plants are considered in Section 6.5.1.) The seven species selected include the deer mouse (*Peromyscus maniculatus*) (small, omnivorous mammal), short-tailed shrew (*Blarina brevicauda*) (small, insectivorous mammal), Eastern cottontail rabbit (*Sylvilagus floridanus*) (medium-sized herbivorous mammal), marsh wren (*Cistothorus palustris*) (small insectivorous bird), white-tailed deer (*Odocoileus virginianus*) (large herbivorous mammal), raccoon (*Procyon lotor*) (medium-sized omnivorous mammal), and red-tailed hawk (*Buteo jamaicensis*) (large, carnivorous bird). The marsh wren was selected as a surrogate for the sedge wren, an Ohio endangered species that has been documented within one-half mile of both Red Water Pond Areas and a species that would be expected on site given the availability of preferred nesting habitat.

The deer mouse, shrew, Eastern cottontail, and wren represent the prey base for the larger predators of the area (represented by the red-tailed hawk). A terrestrial food web is presented in Figure 6-11. Many of these species have limited home ranges, particularly the deer mouse, cottontail, shrew, and marsh wren, which makes them particularly vulnerable to exposure to site contaminants. All of the selected terrestrial receptor species have a potential high abundance and wide distribution at the site and sufficient toxicological information (with the exception of some bird species) is available in the literature for comparative and interpretive purposes. In addition, all of the selected species are likely to occur after site remediation (if risk management decisions require it), and all are important to the stability of the local ecological food chain and biotic community. Finally, all the selected species have readily-available exposure data, as summarized in the *Wildlife Exposure Factors Handbook* (EPA, 1993c).

Larger mammal species were generally not selected as sensitive receptors due to their large home ranges; however, the far-ranging red-tailed hawk was retained due to its unique role as a top predator in the food chain and the white-tailed deer was retained due to its high abundance at the sites. Smaller birds were generally not included because most are migratory. The potential risk to species with larger home ranges and migratory avian species will be included within the predicted risks to the selected terrestrial indicator receptors. Foraging factors were conservatively set to 100 percent for the mouse, shrew, rabbit, wren, and raccoon, due to their relatively small home ranges (Section 6.3.1). However, for the deer and hawk, the foraging factor was set at 0.01 (or one percent), based on these two

species' relatively large home ranges (518 and 842 hectares, or 1,280 and 2,081 acres, respectively), compared with the size of the two sites (23 and 22 acres, Sections 6.2.1.2 and 6.2.1.3).

Results of the assessment receptor selection process are presented in detailed biological and ecological descriptions called assessment receptor profiles (ARP). Additionally, the biologically relevant criteria used to select the seven terrestrial assessment receptors are discussed and summarized in the ARP (Appendix K).

6.2.4.2 Aquatic

The major aquatic habitats at or adjacent to the sites include the west pond and Pipe Creek (and its associated riverine wetland) at the WARWP area, and the palustrine shrub/scrub emergent wetland and 10-foot-deep ditch at the PRRWP area (Section 6.2.1; Figure 6-4 [Photo No. 8]; Figure 6-5 [Photo No. 10]; Figure 6-6 [Photo No. 11]; Figure 6-7 [Photo No. 13]; Figure 6-8 [Photo No. 16]). Exposure to aquatic organisms within the water bodies is assumed to occur via direct exposure to contaminants in the water column and via ingestion of benthic invertebrates and littoral and pelagic prey exposed to contaminants in surface water and sediment. Potential effects to fish, macroinvertebrates, and phytoplankton (algae) have been assessed using available surface water and sediment quality criteria for the protection of aquatic life (Section 6.5.2). Potential uptake through the food chain is evaluated for two representative receptors, including the raccoon (also considered as a terrestrial receptor) and the great blue heron (*Ardea herodias*) (large-sized aquatic piscivore). It should be noted that the great blue heron is a surrogate for the black-crowned night heron, as this threatened species is a common visitor to ponds and streams within PBS. A great blue heron rookery is located within 8 miles of the site.

Fish and other aquatic organisms represent the prey base for aquatic predators (represented by the great blue heron and raccoon). An aquatic food web is presented in Figure 6-12. The selected receptor species have relatively small home ranges, which makes them particularly vulnerable to exposure to site contaminants. Foraging factors were conservatively set to 100 percent for both of the aquatic receptors evaluated in this BERA. Both of the selected aquatic receptor species have been documented on site (Section 6.2.1), have a potential high abundance and wide distribution at the site, and sufficient toxicological information (with the exception of the heron bird species) is available in the literature for comparative and interpretive purposes. In addition, both of the selected species are likely to occur after site remediation (if risk management decisions require it), and both are important to the

stability of the local ecological food chain and biotic community. Finally, the selected species have readily available exposure data, as summarized in the *Wildlife Exposure Factors Handbook* (EPA, 1993c).

Other water fowl were not included as representative receptors because they are migratory, although it should be noted that the great blue heron is a migratory species, but has been assumed to be nonmigratory for the BERA. The potential risk to migratory avian species will be included within the predicted risks to the selected aquatic indicator receptors.

Results of the assessment receptor selection process are presented in detailed biological and ecological descriptions (ARP). The biological relevant criteria used to select the aquatic assessment receptors are discussed and summarized in the ARPs (Appendix K).

6.2.5 Ecological Endpoint (Assessment and Measurement) Identification

The protection of ecological resources, such as habitats and species of plants and animals, is a principal motivation for conducting the BERA. Key aspects of ecological protection are presented as policy goals. These are general goals established by legislation or agency policy that are based on societal concern for the protection of certain environmental resources. For example, environmental protection is mandated by a variety of legislation and government agency policies (e.g., Comprehensive Environmental Response, Compensation, and Liability Act, National Environmental Policy Act). Other legislation includes the Endangered Species Act 16 U.S.C. 1531-1544 (1993, as amended) and the Migratory Bird Treaty Act 16 U.S.C. 703-711 (1993, as amended). To determine whether these protection goals are met at the site, assessment and measurement endpoints have been formulated to define the specific ecological values to be protected and to define the degree to which each may be protected.

Unlike the human health risk assessment process, which focuses on individual receptors, the BERA focuses on populations or groups of interbreeding nonhuman, nondomesticated receptors. In the BERA process, the risks to individuals are assessed only if they are protected under the Endangered Species Act, are species that are candidates for protection, or are species that are considered rare.

Given the diversity of the biological world and the multiple values placed on it by society, there is no universally applicable list of assessment endpoints. Suggested criteria that may be considered in

selecting assessment endpoints suitable for a specific ERA are: (1) ecological relevance, (2) susceptibility to the contaminant(s), (3) accessibility to prediction and/or measurement, and (4) definable in clear, operational terms (Suter, 1993). Selected assessment endpoints should reflect environmental values that are protected by law, are critical resources, or have relevance to ecological functions that may be impaired. Both the entity and attribute are identified for each assessment endpoint.

Assessment endpoints are inferred from effects to one or more measurement endpoints. The measurement endpoint is a measurable response to a stressor that is related to the valued attribute of the chosen assessment endpoint. It serves as a surrogate attribute of the ecological entity of interest (or of a closely related ecological entity) that can be used to draw a predictive conclusion about the potential for effects to the assessment endpoint. Information gained during the site reconnaissance was used to assist in the selection of assessment and measurement endpoints. These endpoints, formal expressions of the environmental values to be protected (Suter, 1993), have been used to focus the goals of the BERA (Table 6-18).

Measurement endpoints for this BERA are based on toxicity values from the available literature and not statistical or arithmetic summaries of actual field or laboratory observations or measurements. When possible, receptors and endpoints have been concurrently selected by identifying those that are known to be adversely affected by chemicals at the site based on published literature. COPEC for those receptors and endpoints have been identified by drawing on the scientific literature to obtain information regarding potential toxic effects of site chemicals to site species (Section 6.2.3). This process ensures that a conservative approach is taken in selecting endpoints and evaluating receptors that are likely to be adversely affected by the potentially most toxic chemicals at the sites.

6.2.5.1 Assessment Endpoints

The assessment endpoints for the Red Water Ponds are stated as “the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, aquatic vertebrates (fin fish), omnivorous aquatic mammals, and piscivorous aquatic birds.” The corresponding null hypothesis (H_o) for each of the assessment endpoints is stated as: “the presence of site contaminants within soil, surface water, sediment, vegetation, and prey will have no effect on the survival or reproductive capabilities of terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and

birds, carnivorous birds, benthic invertebrates, aquatic vertebrates (fin fish), omnivorous aquatic mammals, and piscivorous aquatic birds."

Assessment receptor species were selected based on the likelihood of finding the species at the Red Water Ponds. Historical information, the site reconnaissance (performed June 15 to 16, 1998 and September 2, 1998), and the availability of toxicological data were used to select terrestrial and aquatic receptor species. These receptors species are depicted in food web models (Figures 6-11 and 6-12). Food web models are simplified versions of the possible movement of contaminants through the food chain present or potentially present at the site. Due to lack of data for all possible species, key species have been selected to represent broad classes, or guilds.

The food web conceptual site models were developed to illustrate how the selected terrestrial and aquatic species are ecologically linked within food webs. One species was used to represent each of the major trophic levels and habitats at the site. The decision was made not to complicate the food web models with detailed species selection at the base of the food web (i.e., specific terrestrial/benthic invertebrates or aquatic vertebrates). Thus, generic terrestrial invertebrates, benthic invertebrates, and aquatic vertebrates were used to represent the bottom of the food chain. For terrestrial invertebrates and plants, partitioning coefficients and simple empirical uptake models were employed to estimate COPEC concentrations within tissues (Section 6.3). These tissue concentrations were then used as input values for exposure to higher trophic level receptors through the dietary ingestion route. Brief life-history descriptions for the selected area receptor species are provided in Appendix K.

All trophic levels may be exposed to COPEC, either by direct exposure to contaminated abiotic media or through ingestion of lower trophic level food items. Primary producers (plants) absorb COPEC (as well as nutrients) from soil and/or water. Through abiotic processes, COPEC can adsorb to the sediment and detritus particles. When these particles settle and become part of the benthic substrate they may also become a source of COPEC to benthic communities. Various species of fin fish fulfill the role of aquatic herbivorous (feeding on aquatic plants and suspended detritus) and predatory vertebrates (feeding on benthic invertebrate species). The combination of COPEC bioconcentration from water, ingestion of contaminated prey, and generally restricted ranges for aquatic organisms provides ideal conditions for significant bioconcentration of COPEC. For this reason the great blue heron was included in the aquatic food web as a top trophic-level piscivore capable of bioaccumulating

COPEC. In terrestrial species bioconcentration occurs in plants and invertebrates, and higher food chain receptors bioaccumulate COPEC through the ingestion of food items.

6.2.5.2 Measurement Endpoints

Measurement endpoints are frequently numerical expressions of observations (e.g., toxicity test results or community diversity indices) that can be compared statistically to detect adverse responses to a site contaminant. Examples of typical measurement endpoints include mortality, growth, or reproduction in toxicity tests; individual abundance; species diversity; and the presence or absence of indicator data in field surveys of existing impacts (EPA, 1994).

For assessments, measurable responses to stressors may include lowest-observed-adverse-effect levels (LOAEL), no-observed-adverse-effect levels (NOAEL), LC_{50}s (lethal concentration to 50 percent of the test population), LD_{50}s (lethal dose to 50 percent of the test population), or EC_{20}s (effective concentration for 20 percent of the test population), collectively termed "toxicity endpoint values." In addition, critical effect values for surface water, sediment, and soil were selected as measurement endpoints (Table 6-18). The most appropriate measurement endpoint(s) were chosen based on exposure pathways as well as ecotoxicity of the contaminant.

6.2.6 Ecological Site Conceptual Model

IT has prepared pictorial representations of potential exposure. These food web pictorials (Figures 6-11 and 6-12) and accompanying text presented in Section 6.3.1 clarify the representations that are the ecological site conceptual models (ESCM). The ESCMs trace the contaminant pathways through both abiotic components and biotic food web components of the environment. The ESCMs present all potentially complete exposure pathways. The ESCMs have been used as a tool for judging the appropriateness and usefulness of the selected measurement endpoints in evaluating the assessment endpoints, and for identifying sources of uncertainty in the exposure characterization.

6.3 Exposure Characterization

IT has developed an estimate of the nature, extent, and magnitude of potential exposure of assessment receptors to COPEC that are present at or migrating from the site, considering both current and reasonably plausible future use of the site. Exposure characterization is critical in further evaluating the risk of compounds identified as COPEC during the selection process (Section 6.2.3). The exposure assessment has been conducted by linking the magnitude (concentration) and distribution (locations) of

the contaminants detected in the media sampled during the investigation, evaluating pathways by which chemicals may be transported through the environment, and determining the points at which organisms found in the study areas may contact contaminants.

6.3.1 Exposure Analysis

IT has performed an exposure analysis, which combines the spatial and temporal distribution of the ecological receptors with those of the COPEC to evaluate exposure. The exposure analysis focuses on the chemical amounts that are assumed to be bioavailable, and the means by which the ecological receptors are exposed (e.g., exposure pathways). The focus of the analysis is dependent on the assessment receptors being evaluated, as well as the assessment and measurement endpoints.

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Examples of direct exposure include animals incidentally ingesting contaminated soil or sediment (e.g., during burrowing or dust-bathing activities); animals ingesting surface water; plants absorbing contaminants by uptake from contaminated sediment or soil; and the dermal contact of aquatic organisms with contaminated surface water or sediment.

Food web exposure can occur when terrestrial or aquatic fauna consume contaminated biota. Examples of food web exposure include animals at higher trophic levels consuming plants or animals that bioaccumulate contaminants. The concepts of bioconcentration, bioaccumulation, and biomagnification are used throughout this document. Definitions describing their application are presented in the Glossary of Terms (Appendix L).

Contamination of biota could result from exposure to one or more COPEC. Bioavailability is an important contaminant characteristic that influences the degree of chemical-receptor interaction. Bioavailable compounds are those that a receptor can take in from the environment. Bioavailability of a chemical is a function of several physical and chemical factors.

Exposure pathways consist of four primary components: source and mechanism of contaminant release, transport medium, potential receptors, and exposure route. A chemical may also be transferred between several intermediate media before reaching the potential receptor. All of these components have been addressed within this BERA. If any of these components are not complete,

then contaminants in those media do not constitute an environmental risk at that specific site. As discussed in Section 6.2.3, however, these four components are complete for all sampled site media, except groundwater. The major fate and transport properties associated with typical site contaminants are presented in subsequent sections. These properties directly affect a contaminant's behavior in each of the exposure pathway components.

For terrestrial faunal receptors, calculation of exposure rates relies upon determination of an organism's exposure to COPEC found in surface water, surface soil, and on transfer factors used for food-chain exposure. Exposure rates for terrestrial wildlife receptors are based solely upon ingestion of contaminants from these media and from consumption of other organisms. Given the scarcity of data available for wildlife dermal and/or inhalation exposure pathways, potential risk from these pathways has not been estimated. In addition, dermal and inhalation pathways are generally considered to be incidental for most species, with the possible exception of burrowing animals and dust-bathing birds.

The first step in estimating exposure rates for terrestrial wildlife involves the calculation of feeding and watering rates for site receptors. EPA (1993c) includes a variety of exposure information for a number of avian and mammalian species. Information regarding feeding and watering rates, and dietary composition are available for many species, or may be estimated using allometric equations (Nagy, 1987). Data have also been gathered on incidental ingestion of soil, and are incorporated for the receptor species. This information is summarized in Table 6-19.

Algorithms have been evaluated for calculating exposure for terrestrial vertebrates that account for exposure via ingestion of contaminated water, incidental ingestion of contaminated soil, ingestion of plants grown in contaminated soil, and prey items. Singular algorithms have been developed for soil to plant uptake and for animal bioaccumulation (transfer factors).

The basic equation for estimating dose through the dietary pathway is:

$$D_p = \sum_{k=1}^{m} (C_k \cdot F_k \cdot I_k)/W \qquad \text{Eq. 6.5}$$

where:

D_p = the potential average daily dose (mg/kg-day),
C_k = the average COPEC concentration in the kth food type (mg/kg dry weight)
F_k = the fraction of the kth food type that is contaminated
I_k = the ingestion rate of the kth food type (kg dry weight/day)
W = the body weight of the receptor (kg wet weight).

For aquatic faunal receptors, the calculation of exposure rates depends on the determination of the contaminant concentration in water and sediment, and on food-chain multipliers, bioconcentration factors (BCF), and bioaccumulation factors (BAF). If appropriate, an evaluation can be made of the time each organism spends associated with surface water or sediment pore water in order to modify exposure rates; however, this refined approach was not used in the current BERA.

Literature values for animal-specific sediment ingestion have been used if available. However, such values generally are not available in the literature. Where sediment ingestion rates could not be found, the animal-specific incidental soil ingestion rate is used for sediment ingestion as well, if the receptor's life history profile suggests a significant aquatic component (e.g., raccoons' use of surface water in foraging activities).

For species exposed to organic contaminants found in sediment, calculations have been performed to quantify interstitial (pore) water contaminant concentrations given a known sediment concentration. Suter's (1993) algorithm to calculate pore water concentrations for nonionic organic chemicals was used, as follows:

$$\text{Pore water concentration (milligrams per liter)} = (SC)/[(F_{oc})\,(K_{oc})] \qquad \text{Eq. 6.6}$$

where:

SC = sediment concentration (mg/kg)
F_{oc} = fraction organic carbon in sediment (kg organic carbon/kg sediment)
K_{oc} = chemical-specific organic carbon partition coefficient (L/kg).

For sediment, K_{ow} values (Table 6-20) have been converted to chemical-specific organic carbon/water partition coefficient (K_{oc}) values (EPA, 1996b) as follows:

$$\log K_{oc} = 0.00028 + (0.983 \times \log K_{ow}) \qquad \text{Eq. 6.7}$$

where:

K_{oc} = the partition constant relative to organic carbon.

This equation was chosen because it is the best fit for important site-related compounds, such as semivolatile nonionizing organic compounds.

F_{oc} values for sediment have been set at 0.067 and 0.011, based on sediment samples collected from the WARWP west pond and the RPRWP creek that flows in the 10-foot-deep ravine (Tables 6-15 and 6-16, respectively).

To estimate inorganic partitioning from sediment to pore water, K_d values (Table 6-21; with units of L/kg) were used instead of F_{oc} and K_{oc}. It should be noted that estimates of inorganic COPEC concentrations in sediment pore water were set at the calculated value using the appropriate K_d or were set at the metal's published solubility in water, whichever was lower. This approach was necessary as some of the common nutrients' estimated pore-water concentrations exceeded typical solubility values because inorganic partitioning using K_d values is inaccurate for nutrients with elevated concentrations. Nutrient solubilities were assumed to be best represented by the common environmental compounds MgO, CaO, Al_2O_3, and $FeCO_3$.

Adjustments have been made for potential biomagnification of contaminants through aquatic trophic levels. Food chain multipliers (FCM), derived by EPA (1995), have been used to assess the possibility of contaminant magnification through site receptors. The FCMs are multiplied by chemical-specific BCFs to obtain BAFs. The BERA uses either laboratory-measured BCF values obtained from the scientific literature or fish BCFs calculated for organic compounds using the following equation (EPA, 1995):

$$BCF = K_{oc} \qquad \text{Eq. 6.8}$$

where:

K_{ow} = chemical-specific octanol/water partition coefficient.

When possible, K_{ow} values for appropriate COPEC have been obtained from the literature or from databases, and are presented in Table 6-20.

The BCF is dependent upon a chemical-specific K_{ow} that relates to a chemical's tendency to partition to a polar versus nonpolar solution. EPA has established a relationship between the K_{ow} and the FCM such that as the K_{ow} increases, the FCM increases correspondingly.

Per EPA (1995) guidance, aquatic BAFs have been estimated by one of four methods (in order of preference):

- A measured BAF for an inorganic or organic chemical derived from a field study
- A predicted BAF for an organic chemical derived from a field-measured biota-sediment accumulation factor
- A predicted BAF for an inorganic or organic chemical derived from a laboratory-measured BCF and an FCM
- A predicted BAF for an organic chemical derived from a K_{ow} and an FCM.

The EPA guidance notes, however, that for chemicals for which no K_{ow} is available, and for which no BCF is calculable, a default FCM of 1.0 should be used. Thus, for inorganics not thought to biomagnify and/or which no literature value is available, this value of 1.0 has been used at each trophic level.

In addition to the aquatic food web, FCMs are also related to an organism's trophic status as predator/prey, producer/consumer, etc in the terrestrial food web. Although exposures of terrestrial floral and faunal receptors are significant considerations for many hazardous waste sites, well accepted models for predicting the fate of many contaminants in terrestrial systems are less developed. Trophic level compartments and transfer between compartments based on uptake, storage, and loss processes are not as well defined in terrestrial systems as in aquatic systems. In addition, the relationship between K_{ow} and bioconcentration is less well delineated by trophic level in terrestrial ecosystems. For the

current BERA, soil-to-plant and food-to-muscle BAFs (or transfer factors [TF]) have been estimated for organic constituents using the log K_{ow} relationships developed by Travis and Arms (1988), as presented in the following, with calculated transfer factors presented in Appendix M.

$$\log TF_{soil\text{-}to\text{-}plant} = 1.588 - 0.578(\log K_{ow}) \qquad \text{Eq. 6.9}$$

$$\log TF_{food\text{-}to\text{-}muscle} = -7.735 + 1.033(\log K_{ow}) \qquad \text{Eq. 6.10}$$

Soil-to-insect BAFs are based on log K_{ow} relationships developed by Connell and Markwell (1990). For organic COPEC in soil invertebrates, the transfer factor was derived from the following equation developed by Connell and Markwell (1990) for bioaccumulation in earthworms:

$$BAF = \frac{y_L \cdot K_{ow}^{b-a}}{x \cdot f_{oc}} \qquad \text{Eq. 6.11}$$

where:

BAF	=	the bioaccumulation factor (unitless)
y_L	=	the fractional lipid content of the organism
K_{ow}	=	the octanol/water partition coefficient
(b-a)	=	a nonlinearity constant
x	=	a proportionality constant
f_{oc}	=	the fractional organic carbon content in the soil.

Although derived from earthworm data, the values for the nonlinearity constant (0.05) and proportionality constant (0.66) were applied to modeling uptake in soil invertebrates. Because of differences in integument, it is expected that the uptake by earthworms will generally be greater than that of invertebrates such as insects. Therefore, these factors are expected to yield conservative estimates of invertebrate uptake. The lipid content in insects was estimated at 3.1 percent fresh weight (Taylor, 1975), which is 7.9 percent of dry weight, using a value of 61 percent water content in beetles (EPA, 1993c), calculated as follows:

$$\frac{0.031}{(1-0.61)} = 0.079 \text{ or } 7.9 \text{ percent} \qquad \text{Eq. 6.12}$$

The fraction of organic carbon in the soil was estimated to be 0.01, or 1 percent, as site-specific soil f_{oc} data were not available. This default value was based on information related to fate and transport data for organic constituents, as presented in *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA, 1998). Except where literature-derived values are available, the soil-to-invertebrate transfer factors for inorganics were assumed to be 1. Table 6-21 presents the soil-to-plant and soil-to-invertebrate transfer factors estimated for the inorganic COPEC. The COPEC in this table are limited to those that were not dropped during the screening assessment (Section 6.2.3). Transfer factors for organic COPEC are presented in the risk characterization spreadsheets presented in Appendix M.

Tissue concentrations in vertebrate prey species were estimated from the daily intake of the COPEC through the use of transfer factors for beef. The regression equation developed by Travis and Arms (1988) was used to derive food-to-beef transfer factors for the organic COPEC based on the log K_{ow} value of the chemical of concern. Transfer factors for the inorganic COPEC were taken from International Atomic Energy Agency (1994), National Council on Radiation Protection and Measurements (1989), Ma (1982), and Baes, et al. (1984), as shown in Table 6-21. A weighted total of the concentrations of COPEC intakes (including ingested soil and surface water) was then used in the calculation of tissue concentrations in prey species and the dietary exposure rate in all selected receptor assessment species, as follows:

$$\frac{\text{Total intake of soil, water, plants, and/or invertebrates (in mg COPEC/day)} \times \text{Food-to-Tissue TF}}{0.32 \times \text{Total food and soil intake (in kg mass/day)}} \quad \text{Eq.6.13}$$

A conversion factor of 0.32 was used to convert wet weight tissue concentrations to dry weight values, given that the water content of mammals, passerine birds, and fish is reported to be 68 percent (Table 4-1 in EPA, 1993c).

Media-Specific Exposure Pathways. Exposure to four categories of environmental media are addressed in this BERA, as discussed in the following subsections.

Soil Exposure Pathway. Soil exposure pathways are potentially important for terrestrial plants and animals at the site. For nonburrowing animal exposure, soil samples obtained from a depth of 0 to 3 feet have been considered, as this would be the point of exposure. Note: The agency-approved work plan defined surface soil as 0 to 1 foot; however, due to depth compositing of 0 to 2 feet and 0 to

3 feet in the historic data set, all soils from the 0- to 3-foot-depth interval were considered as surface soil for this BERA. For burrowing animals such as the shrew, soil samples obtained from a depth of 0 to 6 feet have been considered.

For deep-rooted plant exposure, soil samples taken from 0 to 6 feet have been considered because most feeder roots are located within this depth. Thus, the white-tailed deer is assumed to ingest leaves of trees translocating COPEC from subsoils (Figure 6-11).

Environmental conditions such as soil moisture, soil pH, and cation exchange capacities significantly influence whether potential soil contaminants remain chemically bound in the soil matrix or whether they can be chemically mobilized (in a bioavailable form) and released for plant absorption. Generally, neutral to alkaline soils (soil pH of 6.5 or greater) restrict the absorption of toxic metals, making pathway completion to plants difficult. Literature values for soil-to-plant transfer rates for inorganic soil contaminants have been used (Table 6-21).

Sediment Exposure Pathway. Sediment consists of materials precipitated or settled out of suspension in surface water. Potential contaminant sources for sediment include buried or stored waste, and contaminated surface water, groundwater, and soil. The release mechanisms include surface water runoff, groundwater discharge, and airborne deposition. Potential receptors of chemicals in contaminated sediment include aquatic flora and fauna. Direct exposure routes for contaminated sediment include uptake by aquatic flora and ingestion by aquatic fauna. Indirect exposure pathways from sediment include consumption of bioaccumulated contaminants by consumers in the food chain. Chemical bioavailability of many nonpolar organic compounds (e.g., PCBs and pesticides) decreases with increasing concentrations of TOC in the sediment; however, these compounds can still bioaccumulate up the food chain (Landrum and Robbins, 1990).

Surface Water Exposure Pathway. Surface water represents a potential transport medium for COPEC. Potential sources for contaminated surface water include: buried or stored waste, stored or spilled fuel, contaminated soil and groundwater, and deposition of airborne contaminants. The release mechanisms include surface runoff, leaching, and groundwater seepage. Potential receptors of contaminated surface water include terrestrial and aquatic fauna and aquatic flora. Exposure routes for contaminated surface water include ingestion by terrestrial fauna, and uptake and absorption by aquatic flora and fauna. Consumption of bioaccumulated contaminants constitutes a potential indirect exposure

pathway for faunal receptors. Chemical bioavailability of some metals and other chemicals is controlled by water hardness, pH, and total suspended solids.

Groundwater Exposure Pathway. Groundwater represents a potential transport medium for COPEC. Potential contaminant sources for groundwater include contaminated soil, and buried or stored waste. The release mechanism for contaminants into groundwater is direct transfer of contaminants from waste materials to water as water passes through the materials.

Groundwater itself is not an exposure point. However, contaminant transport along the shallow groundwater pathway would be considered an exposure route to aquatic life, wetlands, and some wildlife where the groundwater discharges to surface water. This pathway is of importance to aquatic and wetland receptors if groundwater is found to be discharging to surface water. As noted in Section 6.1, a groundwater assessment is not included in this BERA because a sitewide GWI, including samples from the bedrock aquifer, is planned for a future date. In addition, groundwater discharge to surface water within either of the Red Water Pond Areas is not suspected, based on existing data.

6.3.2 Exposure Characterization Summary

The estimated chemical intakes for each exposed receptor group under each exposure pathway and scenario are presented in the risk characterization spreadsheets in Appendix M. These intake estimates are combined with the COPEC toxicity values, discussed in the following section, to derive estimates and characterize potential ecological risk. The uncertainties associated with the estimation of chemical intake are discussed in Section 6.5.4). The basis for each uncertainty has been identified, with the degree of uncertainty estimated qualitatively (low, medium, or high) or quantitatively, and the impact of the uncertainty estimated qualitatively (overestimate or underestimate, as appropriate).

6.4 Ecological Effects Characterization

The ecological effects characterization includes the selection of literature benchmark values and the development of reference toxicity values.

6.4.1 Selection of Literature Benchmark Values

IT has consulted appropriate sources for literature benchmark values. The level of effort has been limited to documents that summarize the available ecotoxicological information and does not consist of a

review of the primary toxicological literature (i.e., IT has not reviewed details of toxicity test conditions to determine validity of the tests performed).

6.4.2 Development of Reference Toxicity Values

IT has developed or determined reference toxicity values (RTV) for the site. These RTVs focus on the growth, survival, and reproduction of species and/or populations. Empirical data are available for the specific receptor-endpoint combinations in some instances. However, for some COPEC, data on surrogate species and/or on endpoints other than the NOAEL and LOAEL had to be used. The NOAEL is a dose of each COPEC that will produce no known adverse effects in the test species. The NOAEL was judged to be an appropriate toxicological endpoint since it would provide the greatest degree of protection to the receptor species. In addition, the LOAEL may be used as a point of comparison for decision-making for risk management purposes. In addition, in instances where data are unavailable for a site-associated COPEC, toxicological information for surrogate chemicals had to be used. Safety factors are used to adjust for these differences and extrapolate risks to the sites' receptors at the NOAEL and/or LOAEL endpoint. This process is described in the following paragraphs.

Toxicity information pertinent to identified receptors has been gathered for those analytes identified as COPEC. Because the measurement endpoint ranges from the NOAEL to the LOAEL, preference has been given to chronic studies noting concentrations at which no adverse effects were observed and ones for which the lowest concentrations associated with adverse effects were observed. As previously noted, where data are unavailable for the exposure of a receptor to a COPEC, data for a surrogate chemical (e.g., benzo[a]pyrene for other PAHs) have been gathered for use in the BERA.

Using the relevant toxicity information, RTVs have been calculated for each of the COPEC. RTVs represent NOAELs and LOAELs with safety factors incorporated for toxicity information derived from studies other than no-effects or lowest-effects studies. For studies on species other than the receptors selected for this risk assessment, additional uncertainty factors have been used. RTVs have been calculated using safety factors specified in Wentsel, et al. (1996) and shown in Figure 6-13 and Table 6-22. Interclass toxicity extrapolations were not performed because physiological differences between classes are too great to be addressed with the use of simplistic safety factors. Separate factors are used to account for extrapolation to the no-effects or lowest-effects endpoints, for study duration (Table 6-22), and for extrapolation across taxonomic groups (e.g., species, genus, family, order), as

shown in Table 6-23 for the receptors used in this BERA. Although additional safety factors may be employed for endangered species, no endangered species were selected as representative receptors and these additional safety factors were not required. Because NOAELs for the selected wildlife receptor species are based on NOAELs from test species, the latter are converted to NOAELs specific to the selected wildlife receptors using a power function of the ratio of BWs, as described by Sample, et al. (1996) and shown below. A BW scaling factor of 0.25 was used for mammals, whereas a body weight scaling factor of 0 was used for birds.

$$NOAEL_W = NOAEL_T \left(\frac{BW_T}{BW_W} \right)^s \qquad \text{Eq. 6.14}$$

where:

$NOAEL_W$	=	the No Observed Adverse Effect Level for the wildlife indicator species (mg/kg-day)
$NOAEL_T$	=	the No Observed Adverse Effect Level for the test species (mg/kg-day)
BW_T	=	the body weight of the test species (kg)
BW_W	=	the body weight of the wildlife indicator species (kg)
s	=	a body weight scaling factor (s = 1/4 for mammals and s = 0 for birds).

Test species body weights (BW_T) used for COPEC RTVs are contained in the risk characterization spreadsheets presented in Appendix M.

These factors were used together to derive a final adjusted RTV, as shown in the risk characterization spreadsheets (Appendix M). Reference toxicity threshold value uncertainties are discussed in Section 6.5.4. RTVs for essential nutrients are derived as shown in Appendix N.

Exposure rate RTVs provide a reference point for the comparison of toxicological effects upon exposure to a contaminant. To complete this comparison, receptor exposure to site contaminants are calculated, or as in the case of plant receptors, exposure is simply calculated as the soil concentration (Section 6.5.1).

6.5 Risk Characterization

The risk characterization phase integrates information on exposure, exposure-effects relationships, and defined or presumed target populations to arrive at conclusions for the site. The result is a determination of the likelihood, severity, and characteristics of adverse effects to ecological receptors at the site. Qualitative and semiquantitative approaches were used to estimate the likelihood of adverse effects occurring as a result of exposure of the selected site receptors to COPEC. Potential adverse affects to terrestrial plants have been qualitatively assessed by comparing plant toxicity benchmarks with COPEC concentrations. Potential adverse impacts to aquatic biota were qualitatively assessed by comparing surface water and sediment quality criteria (for the protection of aquatic life) with surface water and sediment COPEC concentrations.

In addition, RTVs and exposure rates were calculated for the semiquantitative predictive assessment and used to generate HQs (Wentsel, et al., 1996). HQs are used to estimate potential for adverse effects to organisms at a contaminated site, and to assess the potential for adverse toxicological effects upon site receptors.

6.5.1 Terrestrial Plant Impact Assessment

To assess the potential impact of COPEC concentrations in surface soil on terrestrial plant species, the source-term concentrations from both Red Water Ponds were compared with available benchmark concentrations developed for the protection of terrestrial plants. As shown in Table 6-24, no benchmarks were exceeded by the COPEC source-term concentrations. It should be noted, however, that only one benchmark, beryllium, was readily available for the COPEC retained for the predictive BERA. Although some bare soil areas were noted during the site reconnaissance (Section 6.2.1.6), these findings cannot be definitively attributed to chemical stressors in surface soils, as the bare soil areas were not linked to COPEC concentrations that were greater than other areas with vegetation. A possible explanation of the bare areas includes heavy deer activity, because many of the bare soil areas were completely covered with deer tracks. Finally, IT's subcontractor, a botanical expert, observed similar conditions (i.e., bare soil) in other areas of Northern Ohio that had not been impacted by chemical stressors.

6.5.2 Aquatic Biota Impact Assessment

To assess the potential impact of COPEC concentrations in surface water and sediment on aquatic biota, the source-term concentrations from both Red Water Ponds were compared with available benchmark concentrations developed for the protection of aquatic life. As shown in Table 6-25,

surface water COPEC concentrations for aluminum, iron, lead, manganese, and vanadium measured in the WARWP exceeded benchmarks for the protection of aquatic life. Because as many as four different benchmarks were used for in the surface water assessment, a weight-of-evidence approach was applied to this analysis. More significant impacts are predicted to occur where more surface water benchmarks are exceeded. Thus, for the WARWP, elevated concentrations of aluminum, iron, and lead are more of a concern than elevated levels of manganese or vanadium. Elevated levels of these metals, particularly iron, may account for the red-orange color noted previously (Section 6.2.1.2). It is important to note that the limited number of surface water samples collected at the WARWP resulted in the maximum measured concentration for each of these five inorganics being used as the source-term concentration (Table 6-13). It is possible that additional sampling would result in different conclusions for the impact assessment.

In addition, surface water COPEC concentrations for aluminum, iron, and manganese measured in the PRRWP exceeded some or all of the available benchmarks. Using a weight-of-evidence approach, elevated concentrations of iron are more of a concern than aluminum or manganese (Table 6-25). As discussed previously, it is important to note that the limited number of surface water samples collected at the PRRWP resulted in the maximum measured concentration for each of these three inorganics being used as the source-term concentration (Table 6-14). It is possible that additional sampling would result in different conclusions for the impact assessment.

As shown in Table 6-26, sediment COPEC concentrations for arsenic, copper, and iron measured in the WARWP exceeded some of the available benchmarks developed for the protection of aquatic biota. It is important to note that source-term concentrations for these three inorganics only exceeded sediment threshold effect levels (TEL) developed by the state of Florida or lowest effect levels developed by OME, and concentrations did not exceed probable effect levels (PEL) or severe effect levels (Table 6-26). These findings suggest COPEC concentrations in the WARWP sediments are not of concern. For the PRRWP, no benchmarks are exceeded. It should be noted that EPA Region 5 (1996b) BTAG recommends that NOAA ER-L and ER-M benchmarks (Table 6-26) only be used when freshwater benchmarks are unavailable, as NOAA benchmarks are primarily for marine environments. Thus, NOAA benchmarks are not applied in the final column in Table 6-26, when other benchmarks are available.

6.5.3 Predictive Risk Estimation for Terrestrial and Aquatic Wildlife

IT has estimated the risk associated with the two Red Water Ponds. The risk estimation has been performed through a series of quantitative HQ calculations that compare receptor-specific exposure values with RTVs. The HQs are compared to HQ guidelines for assessing the risk posed from contaminants. HQs less than or equal to 1 present no probable risk; HQs from 1 up to, but less than 10, present a low potential for environmental effects; HQs from 10 up to, but less than 100, present a significant potential that effects could result from exposure; and HQs greater than 100 present the highest potential for expected effects (Wentsel, et al., 1996).

The simple HQ ratios have been summed to provide conservative HI estimates for all chemicals and exposure pathways for a given receptor. In general, HQ summation is only appropriate and scientifically defensible for a given receptor when chemical HQs have similar modes of toxicological action. While individual contaminants may affect distinct target organs or systems within an organism, classes of chemicals may act in similar ways, thus being additive in effect. The summation of HQs into a HI was performed, in part, to determine whether or not individual COPEC HQs should be segregated based on dissimilar modes of toxicological action. If a risk driver resulted in an HQ greater than approximately 10 to 100, segregation of other COPEC by mode of toxicological action would not be necessary. All individual COPEC HQs are contained in Appendix M.

Conservative HIs (summed HQs) for terrestrial receptors at the WARWP are: 28 for the deer mouse; 9.1 for the cottontail rabbit; 96 for the shrew; 452 for the marsh wren; 38 for the raccoon; 8.3 for the white-tailed deer; and 0.0062 for the red-tailed hawk (Table 6-27). COPEC from soil were the risk drivers for the deer mouse, shrew, and marsh wren. While COPEC from water were the risk drivers for the cottontail and deer receptors, COPEC from water and soil contributed equal shares of estimated risk for the raccoon. Risk drivers, listed in decreasing order of concern, included 4-amino-2,6-dinitrotoluene and PAHs from soil, and aluminum from surface water. Important routes of exposure included invertebrate intake and direct surface water intake (Table 6-27). It should be noted that the elevated hazard predicted for the marsh wren for 4-amino-2,6-dinitrotoluene was based on an adjusted LD_{50} value for an unspecified bird species (Table 6-22) and is of elevated uncertainty. Use of a more realistic NOAEL would likely reduce the hazard. Also, PAH toxicity was assessed using benzo(a) pyrene as a surrogate, and this approach likely resulted in an overestimate of PAH hazards. It should also be noted that the maximum aluminum concentration measured in surface water was used as the source-term concentration due to the limited number of samples (Table 6-13) and an additional sampling effort could potentially reduce the hazard estimate.

Conservative HIs (summed HQs) for aquatic receptors at the WARWP are 724 for the great blue heron and 665 for the raccoon (Table 6-28). It should be noted that both terrestrial and aquatic hazards have been estimated for the raccoon, as it exhibits a combined terrestrial and aquatic lifestyle, and hazards may be summed for this receptor. COPEC from sediment were risk drivers for the raccoon, while COPEC from water were the risk drivers for the heron receptor. Risk drivers, listed in decreasing order of concern, included iron from water, aluminum from sediment, magnesium from water, aluminum from water, calcium from sediment, 2-amino-4,6-dinitrotoluene from sediment, phosphorus from sediment, lead from water, and iron from sediment. Important routes of exposure included fish intake, invertebrate intake, and direct surface water intake (Table 6-28). It should be noted that the maximum concentrations of many of the COPEC measured in surface water and sediment were used as source-term concentrations due to the limited number of samples, and an additional sampling effort could potentially reduce the hazard estimate. It should also be mentioned that there are significant uncertainties associated with estimating concentrations in macroinvertebrates and fish, especially for nutrients such as phosphorus, iron, calcium, and magnesium (Section 6.5.4). Performance of a lab bioassay with earthworms and fish would likely show reduced bioaccumulation from soil and water.

Conservative HIs (summed HQs) for terrestrial receptors at the PRRWP are 4.1 for the deer mouse, 2.7 for the cottontail rabbit, 15 for the shrew, 451 for the marsh wren, 6.1 for the raccoon, 1.8 for the white-tailed deer, and 0.0018 for the red-tailed hawk (Table 6-29). COPEC from soil were risk drivers for the deer mouse, shrew and marsh wren, while COPEC from water were the risk drivers for the cottontail, raccoon, and deer receptors. Risk drivers, listed in decreasing order of concern, included 4-amino-2,6-dinitrotoluene, antimony, and 1,3-dinitrobenzene in soil, and aluminum in surface water. Important routes of exposure included invertebrate intake, soil intake, and direct surface water intake (Table 6-29). It should be noted that the elevated hazard predicted for the marsh wren for 4-amino-2,6-dinitrotoluene was based on an adjusted LD_{50} value for an unspecified bird species (Table 6-22) and is of elevated uncertainty. Use of a more realistic NOAEL would likely reduce the predicted 4-amino-2,6-DNT hazard. It should also be noted that the maximum aluminum concentration measured in surface water was used as the source-term concentration due to the limited number of samples (Table 6-14) and an additional sampling effort could potentially reduce the hazard estimate.

Conservative HIs (summed HQs) for aquatic receptors at the PRRWP are 126 for the great blue heron and 38 for the raccoon (Table 6-30). COPEC from sediment were risk drivers for the raccoon, while

COPEC from water were the risk drivers for the heron receptor. As mentioned previously, both terrestrial and aquatic hazards have been estimated for the raccoon, as it exhibits a combined terrestrial and aquatic lifestyle, and hazards may be summed for this receptor. Risk drivers, listed in decreasing order of concern, included iron from water, aluminum from water, carbazole from sediment, potassium from sediment, and magnesium from sediment. Important routes of exposure included fish intake, invertebrate intake, and direct surface water intake (Table 6-30). It should be noted that the maximum concentrations of many of the COPEC measured in surface water and sediment were used as source-term concentrations due to the limited number of samples, and an additional sampling effort could potentially reduce the hazard estimate. It should also be mentioned that there are significant uncertainties associated with estimating concentrations in macroinvertebrates and fish, especially for nutrients such as potassium, iron, and magnesium (Section 6.5.4). Performance of a lab bioassay with earthworms and fish would likely show reduced bioaccumulation from soil and water.

6.5.4 Uncertainty Analysis

The results of the BERA are influenced to some degree by variability and uncertainty. In theory, investigators might reduce variability by increasing sample size of the media or species sampled. Alternatively, uncertainty within the risk analysis can be reduced by using species-specific and site-specific data (i.e., to better quantify contamination of media, vegetation, and prey through: direct field measurements, toxicity testing of site-specific media, and field studies using site-specific receptor species). Detailed media, prey, and receptor field studies are relatively costly; thus, the preliminary predictive analyses of risk has been conducted to limit the potential use of these resource-intensive techniques to only those COPEC that continue to show a relatively high potential for ecological risk. Since assessment criteria were developed based on conservative assumptions, the results of the screening and predictive assessments err on the side of conservatism. This has the effect of maximizing the likelihood of accepting a false positive (Type I error: the rejection of a true null hypothesis) and simultaneously minimizing the likelihood of accepting a true negative (Type II error: the acceptance of a false null hypothesis).

A number of factors contribute to the overall variability and uncertainty inherent in ERAs. Variability is due primarily to measurement error; laboratory media analyses and receptor study design are the major sources of this kind of error. Uncertainty, on the other hand, is associated primarily with deficiency or irrelevancy of effects, exposure, or habitat data to actual ecological conditions at the site. Species physiology, feeding patterns, and nesting behavior are poorly predictable; therefore, all toxicity

information derived from toxicity testing, field studies, or observation will have uncertainties associated with them. Laboratory studies conducted to obtain site-specific, measured information often suffer from poor relevance to the actual exposure and uptake conditions on site (i.e., bioavailability, exposure, assimilation, etc., are generally greater under laboratory conditions as compared to field conditions). Calculating an estimated value based on a large number of assumptions is often the only alternative to the accurate (but costly) method of direct field or laboratory observation, measurement, or testing. Finally, habitat- or site-specific species may be misidentified if, for example, the observational assessment results are based on only one brief site reconnaissance performed on a relatively large site.

The uncertainty analysis is presented in Table 6-31 and lists some of the major assumptions made for the BERA; the direction of bias caused by each assumption (i.e., if the uncertainty results in an overestimate or underestimate of risk); the likely magnitude of impact (quantitative [percent difference], or qualitative [high, medium, low, or unknown]); and, if possible, a description of recommendations for minimizing the identified uncertainties if the BERA progresses to higher level assessment phases (EPA, 1992b). The uncertainty analysis identifies and, if possible, quantifies the uncertainty in the individual preliminary scoping assessment, problem formulation, exposure and effects assessment, and risk characterization phases of this BERA. Based on this uncertainty analysis, the most important biases that may result in an overestimation of risk include the following:

- Assuming that COPEC are 100 percent bioavailable
- Using laboratory-derived or empirically-estimated partitioning and transfer factors to predict COPEC concentrations in plants, invertebrates, fish, prey, and sediment pore water
- Using K_{ow} values without adjustment to estimate fish BCFs for organic COPEC
- Assuming that surface-water-to-fish-tissue BCFs, and sediment-pore-water-to-benthic-invertebrate BCFs, are linear with respect to low level and high level media concentrations, and are appropriate for use with elevated nutrient concentrations (e.g., Fe, Mg) in surface water and sediment. As mentioned in Rand and Petrocelli (1985), greater accumulations of metals usually occurs in soft waters due to complexation and reduced bioavailability. Since site surface waters are not soft, significant accumulation is not expected.

6.5.5 Risk Description

As part of the risk description, IT has completed the following: (1) summarized the ecological risk associated with the site; and (2) interpreted the ecological significance, which describes the magnitude

of the identified risks and the accompanying uncertainty. The effect of additional data or analyses on uncertainty has also been discussed. A weight-of-evidence approach has been used to interpret the ecological significance of the findings.

Based on available data (Section 6.5.1), soil COPEC impacts to terrestrial plants are estimated to be insignificant. Surface water COPEC impacts to aquatic biota are of most concern for aluminum, iron, and lead at the WARWP and for iron at the PRRWP (Section 6.5.2). Considerations of limited sample size suggest these findings should be confirmed based on additional sampling before any remedial actions are considered. Sediment COPEC impacts on aquatic biota are of limited concern, as probable effect levels and/or severe effect levels are not exceeded at either Red Water Ponds (Section 6.5.2). In general, it should be noted that based on the quality of aquatic habitat available at the Red Water Ponds, potential impacts at the WARWP are more of a concern than at PRRWP. Thus, if any aquatic bioassays are performed, they should focus on the WARWP. Terrestrial receptors at the WARWP are predicted to incur elevated hazards from exposure to 4-amino-2,6-dinitrotoluene and PAHs in soil and from exposure to aluminum in surface water (Section 6.5.3). Based on uncertainties of toxicity and sample size, and on the fact that no RTE species have been confirmed at this Red Water Pond, with the possible exception of the black-crowned night heron, remedial actions are not warranted at this time. Aquatic receptors at the WARWP are predicted to have elevated hazards from exposure to iron, magnesium, aluminum, and lead in surface water, and from exposure to aluminum, calcium, 2-amino-4,6-DNT, phosphorus, and iron in sediment (Section 6.5.3). Based on uncertainties associated with toxicity, estimating concentrations in fish and aquatic insects, and limited sample size, a determination regarding remedial actions cannot be made until uncertainties are reduced. Terrestrial receptors at the PRRWP are predicted to have elevated hazards from exposure to 4-amino-2,6-DNT, antimony, and 1,3-DNB in soil and from exposure to aluminum in surface water. Based on uncertainties of toxicity and sample size, and on the fact that no RTE species have been confirmed at the PRRWP, with the possible exception of the black-crowned night heron, remedial actions are not warranted at this time. Aquatic receptors at the PRRWP are predicted to have elevated hazards from potential exposure to iron and aluminum in surface water and from exposure to carbazole, potassium, and magnesium in sediment (Section 6.5.3). Based on uncertainties of toxicity and sample size, and on the fact that no RTE species have been confirmed at the PRRWP, with the possible exception of the black-crowned night heron, remedial actions are not warranted at this time.

6.6 Risk Summary and Identification of Preliminary Remedial Action Objectives

IT has summarized ecological risk associated with releases from the site (Section 6.5.5). This summary is supported by tasks performed during the previous sections. Additionally, IT has made recommendations for further risk investigation in Section 6.7. IT has not developed site-specific remedial action objectives for the site at this time due to previously discussed uncertainties associated with the BERA (Section 6.5.4).

6.7 Conclusions and Recommendations

Only the data, results, and conclusions of the various preliminary scoping and predictive assessment phases are described herein. No recommendations concerning types of remedial actions to be conducted are given other than to present the specific remedial action objectives or additional activities to reduce uncertainty. Conclusions and recommendations are derived from the risk assessment and are based on the responses to the assessment hypotheses. The predictive assessment results have been summarized and presented in Tables 6-24 through 6-30. These tables, along the qualitative estimates of uncertainty bias (Table 6-31), may serve as the foci of discussions among risk managers and regulatory agencies concerning the potential need for additional assessment at PBOW to reduce the uncertainty in the estimate of ecological risk.

Relatively high HQs are predicted for certain receptors (greater than 100 for the marsh wren, great blue heron, and racoon). This is due to potential 4-amino-2,6-DNT uptake by invertebrates from surface soil and sediment, aluminum ingestion by the racoon at the WARWP, and iron uptake by fish from surface water. The following additional investigatory work is recommended to eliminate uncertainty regarding potential adverse ecological impacts from these sites.

- Collection of additional inorganic surface water and sediment data, including background, to supplement the database
- Performance of earthworm bioassay to estimate uptake and bioavailability of organics (particularly 4-amino-2,6-DNT) from surface soil
- Performance of a fish uptake study to estimate bioconcentration and bioavailability of metals (particularly iron, magnesium, and aluminum) from surface water
- Research the literature, including both primary and secondary sources, to obtain a more accurate avian NOAEL for 4-amino-2,6-DNT.

7.0 Conclusions and Recommendations

The purpose of this site investigation was to characterize potential contamination and associated risk to human and ecological receptors from the PBOW Red Water Ponds Sites. The investigation evaluated current and future risk from environmental media including soil, sediment, and surface water. Additional investigatory and risk assessment work may be warranted to characterize and assess potential risk from groundwater at these sites.

The detailed results and conclusions of this study are presented in the human health risk characterization section (5.5) of the HHRA, and the ecological risk characterization section (6.5) of the BERA. The human health risk characterization is organized into three sections: 5.5.1 Carcinogenic Effects of Chemicals; 5.5.2 Noncancer Effects of Chemicals; and 5.5.3 Risk Characterization Results and Discussion. The ecological risk characterization is also organized into three sections of results, plus the uncertainty analysis section. The ecological risk characterization includes: Section 6.5.1 Terrestrial Plant Impact Assessment; Section 6.5.2 Aquatic Biota Impact Assessment; and Section 6.5.3 Predictive Risk Estimation for Terrestrial and Aquatic Wildlife.

7.1 Human Health Risk Assessment Conclusions

Human health risk from potential chemical carcinogens at both the WARWP and the PRRWP are either at or below OEPA acceptable limits, for the residential, groundskeeper, and construction worker exposure scenarios. Similarly, human health risk from potential noncarcinogenic chemical hazards at both these sites are below the OEPA acceptable limit. Because none of the ILCRs or HIs exceeded OEPA limits, no COPC were identified as COC and the development of RBRC was not required.

Site-related cancer risk values for residential exposure to soil, surface water, and sediment at the WARWP are precipitously close to the OEPA acceptance limit. It is probable that cancer risk from groundwater in the Red Water Ponds Areas, when calculated in a future risk assessment previously discussed, will push these values over the edge into the unacceptable range. However, human health risk values metals in surface water at the site have been characterized highly conservatively, because existing data are insufficient to determine whether these metals in surface water are present at background levels or as site-related chemicals. If additional sampling and analysis work demonstrates that risks from metals in groundwater are not site-related, then overall site cancer risk levels could return to the OEPA acceptable range.

7.2 Ecological Risk Assessment Conclusions

To determine potential impacts upon terrestrial plants, source term concentrations calculated for soil at the Red Water Ponds Areas were compared with available benchmark concentrations. None of the benchmark concentration values were exceeded by source term concentrations at either area.

To determine potential impacts upon aquatic biota, surface water and sediment contamination concentrations at the Red Water Ponds Areas were compared with benchmarks designed to protect aquatic life. Concentrations of aluminum, iron, lead, manganese, and vanadium measured in surface water at the WARWP exceeded acceptable benchmarks to protect aquatic biota. Upon further analysis, aluminum, lead, and iron were found to be more significant contaminants of potential concern than manganese and vanadium. The contamination concentration data for sediments at the WARWP exceeded acceptable benchmarks for arsenic, copper, and iron designed to protect aquatic biota. These sediment contaminant concentrations only exceeded the strictest benchmarks for the protection of aquatic biota. They did not exceed less conservative probable or severe effect level benchmarks.

Surface water concentrations of aluminum, iron, and manganese at the PRRWP also exceeded some of the benchmark concentrations applied to the sites. At the latter sites, elevated iron concentrations appeared to be more significant than less elevated aluminum and manganese concentrations. No sediment benchmarks were exceeded at the PRRWP.

Potential risks to terrestrial and aquatic wildlife at the Red Water Pond Sites were evaluated through calculating HQs for all chemicals and exposure pathways for each receptors of concern. The HQ calculated for each receptor was compared with general guidelines. According to the guidelines, the higher the HQ the greater the risk posed by site related contaminants. If the HQ is less than 1, then there is no probable risk. If the HQ is between 1 and 10, then there is a very low potential for ecological effects. If the HQ is between 10 and 100, then significant potential for ecological effects exists. If the HQ is above 100, then very significant potential for ecological effects is present due to site contaminants.

For the WARWP, summed HQs for terrestrial receptors are: 28 for the deer mouse; 9.1 for the cottontail rabbit; 96 for the shrew; 452 for the marsh wren; 38 for the racoon; 8.3 for the white-tailed deer; and 0.0062 for the red-tailed hawk. Summed HQs for aquatic receptors at the WARWP are

724 for the great blue heron and 665 for the racoon. Since the racoon lives a combined terrestrial and aquatic life, HQs (that can be summed) are presented for both environments.

For the PRRWP, summed HQs for terrestrial receptors are: 4.1 for the deer mouse; 2.7 for the cottontail rabbit; 15 for the shrew; 412 for the marsh wren; 6.1 for the racoon; 1.8 for the white-tailed deer; and 0.0018 for the red-tailed hawk. Summed HQs for aquatic receptors at the PRRWP are 126 for the great blue heron and 38 for the racoon.

The presence of receptors with relatively high summed HQs, in the most significant cases greater than 100, was due to the high potential for 4-amino-2,6-DNT uptake by invertebrates, aluminum uptake by racoons in the WARWP, and iron uptake from surface water by fish. More work is needed to better ascertain the nature and extent of ecological risks at the Red Water Ponds, and what types of actions are needed to ameliorate these risks. This additional work should focus on resolving the many uncertainties regarding ecological risk at the Red Water Ponds discussed in Section 6.5.4. Section 6.5.5 presents a more comprehensive summary of ecological risks at the sites, and Section 6.7 of the BERA presents four distinct tasks that could be performed to reduce ecological risk assessment uncertainty associated with these sites.

7.3 Recommendations

The following recommendations are made as a result of the findings of both the HHRA and ERA:

- Background concentrations for metals should be established for site-specific surface water and sediment.
- Following completion of bedrock water quality characterization at the two Red Water Ponds Areas, human health risk from the bedrock groundwater should be evaluated at the two sites.
- Conduct earthworm bioassay to estimate uptake and bioavailability of organics from surface soil.
- Conduct fish uptake study to estimate bioconcentration and bioavailability of metals from surface water.
- Conduct literature search to obtain more accurate avian NOAEL for 4-amino-2,6-DNT.

8.0 References

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TABLES

Table 2-1

Summary of Primary Soil and Groundwater Samples Collected
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 4)

Area	Soil Sample Designation	Direct-Push Boring Designation	Sample Matrix	Sampling Depth Interval (feet, bgs)
West Area Red Water Ponds	PBOW-98-SO-WARP-DP01-8100-(0002)	DP01	Soil	0 - 2
	PBOW-98-SO-WARP-DP01-8110-(0406)			4 - 6
	PBOW-98-SO-WARP-DP01-8120-(0810)			8 - 10
	PBOW-98-GW-WARP-DP01-8130		Groundwater	NA
	PBOW-98-SO-WARP-DP02-8140-(0002)	DP02	Soil	0 - 2
	PBOW-98-SO-WARP-DP02-8150-(0406)			4 - 6
	PBOW-98-SO-WARP-DP02-8160--(0810)			8 - 10
	PBOW-98-GW-WARP-DP02-8170		Groundwater	NA
	PBOW-98-SO-WARP-DP03-8180-(0002)	DP03	Soil	0 - 2
	PBOW-98-SO-WARP-DP03-8190-(0406)			4 - 6
	PBOW-98-SO-WARP-DP03-8200-(0810)			8 - 10
	PBOW-98-GW-WARP-DP03-8210		Groundwater	NS
	PBOW-98-SO-WARP-DP04-8220-(0002)	DP04	Soil	0 - 2
	PBOW-98-SO-WARP-DP04-8230-(0406)			4 - 6
	PBOW-98-SO-WARP-DP04-8240-(0810)			8 - 10
	PBOW-98-GW-WARP-DP04-8250		Groundwater	NA
	PBOW-98-SO-WARP-DP05-8260-(0002)	DP05	Soil	0 - 2
	PBOW-98-SO-WARP-DP05-8270-(0406)			4 - 6
	PBOW-98-SO-WARP-DP05-8280-(0810)			8 - 10
	PBOW-98-GW-WARP-DP05-8290		Groundwater	NS
	PBOW-98-SO-WARP-DP06-8300-(0002)	DP06	Soil	0 - 2
	PBOW-98-SO-WARP-DP06-8310-(0406)			4 - 6
	PBOW-98-SO-WARP-DP06-8320-(0810)			8 - 10
	PBOW-98-GW-WARP-DP06-8330		Groundwater	NA
	PBOW-98-SO-WARP-DP07-8340-(0002)	DP07	Soil	0 - 2
	PBOW-98-SO-WARP-DP07-8350-(0406)			4 - 6
	PBOW-98-SO-WARP-DP07-8360-(0810)			8 - 10
	PBOW-98-GW-WARP-DP07-8370		Groundwater	NA
	PBOW-98-SO-WARP-DP08-8380-(0002)	DP08	Soil	0 - 2
	PBOW-98-SO-WARP-DP07-8390-(0406)			4 - 6
	PBOW-98-SO-WARP-DP07-8400-(0810)			8 - 10
	PBOW-98-GW-WARP-DP08-8410		Groundwater	NA
	PBOW-98-SO-WARP-DP09-8420-(0002)	DP09	Soil	0 - 2
	PBOW-98-SO-WARP-DP09-8430-(0406)			4 - 6
	PBOW-98-SO-WARP-DP09-8440-(0810)			8 - 10
	PBOW-98-GW-WARP-DP09-8450		Groundwater	NA
	PBOW-98-SO-WARP-DP10-8460-(0002)	DP10	Soil	0 - 2
	PBOW-98-SO-WARP-DP10-8470-(0406)			4 - 6
	PBOW-98-SO-WARP-DP10-8480-(0810)			NS
	PBOW-98-GW-WARP-DP10-8490		Groundwater	NS

Table 2-1

Summary of Primary Soil and Groundwater Samples Collected Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 4)

Area	Soil Sample Designation	Direct-Push Boring Designation	Sample Matrix	Sampling Depth Interval (feet, bgs)
West Area Red Water Ponds (Cont.)	PBOW-98-SO-WARP-DP11-8500-(0002)	DP11	Soil	0 - 2
	PBOW-98-SO-WARP-DP11-8510-(0406)			4 - 6
	PBOW-98-SO-WARP-DP11-8520-(0810)			8 - 10
	PBOW-98-GW-WARP-DP11-8530		Groundwater	NA
	PBOW-98-SO-WARP-DP12-8540-(0002)	DP12	Soil	0 - 2
	PBOW-98-SO-WARP-DP12-8550-(0406)			4 - 6
	PBOW-98-SO-WARP-DP12-8560-(0810)			8 - 10
	PBOW-98-GW-WARP-DP12-8570		Groundwater	NA
	PBOW-98-SO-WARP-DP13-8580-(0002)	DP13	Soil	0 - 2
	PBOW-98-SO-WARP-DP13-8590-(0406)			4 - 6
	PBOW-98-SO-WARP-DP13-8600-(0810)			8 - 10
	PBOW-98-GW-WARP-DP13-8610		Groundwater	NA
	PBOW-98-SO-WARP-DP14-8620-(0002)	DP14	Soil	NS
	PBOW-98-SO-WARP-DP14-8630-(0406)			NS
	PBOW-98-SO-WARP-DP14-8640-(0810)			NS
	PBOW-98-GW-WARP-DP14-8650		Groundwater	NS
	PBOW-98-SO-WARP-DP15-8660-(0002)	DP15	Soil	0 - 2
	PBOW-98-SO-WARP-DP15-8670-(0406)			4 - 6
	PBOW-98-SO-WARP-DP15-8680-(0810)			8 - 10
	PBOW-98-GW-WARP-DP15-8690		Groundwater	NA
	PBOW-98-SO-WARP-DP16-8700-(0002)	DP16	Soil	0 - 2
	PBOW-98-SO-WARP-DP16-8710-(0406)			4 - 6
	PBOW-98-SO-WARP-DP16-8720-(0810)			8 - 10
	PBOW-98-GW-WARP-DP16-8730		Groundwater	NA
	PBOW-98-SO-WARP-DP17-8740-(0002)	DP17	Soil	0 - 2
	PBOW-98-SO-WARP-DP17-8750-(0406)			4 - 6
	PBOW-98-SO-WARP-DP17-8760-(0810)			8 - 10
	PBOW-98-GW-WARP-DP17-8770		Groundwater	NA
	PBOW-98-SO-WARP-DP18-8780-(0002)	DP18	Soil	0 - 2
	PBOW-98-SO-WARP-DP18-8790-(0406)			4 - 6
	PBOW-98-SO-WARP-DP18-8800-(0810)			8 - 10
	PBOW-98-GW-WARP-DP18-8810		Groundwater	NS
	PBOW-98-SO-WARP-DP19-8820-(0002)	DP19	Soil	0 - 2
	PBOW-98-SO-WARP-DP19-8830-(0406)			4 - 6
	PBOW-98-SO-WARP-DP19-8840-(0810)			8 - 10
	PBOW-98-GW-WARP-DP19-8850		Groundwater	NA
	PBOW-98-SO-WARP-DP20-8860-(0002)	DP20	Soil	0 - 2
	PBOW-98-SO-WARP-DP20-8870-(0406)			4 - 6
	PBOW-98-SO-WARP-DP20-8880-(0810)			8 - 10
	PBOW-98-GW-WARP-DP20-8890		Groundwater	NS

Table 2-1

Summary of Primary Soil and Groundwater Samples Collected Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 4)

Area	Soil Sample Designation	Direct-Push Boring Designation	Sample Matrix	Sampling Depth Interval (feet, bgs)
Pentolite Road Red Water Ponds	PBOW-98-SO-PRRP-DP01-7200-(0002)	DP01	Soil	0 - 2
	PBOW-98-SO-PRRP-DP01-7210-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP01-7220-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP01-7230		Groundwater	NA
	PBOW-98-SO-PRRP-DP02-7240-(0002)	DP02	Soil	0 - 2
	PBOW-98-SO-PRRP-DP02-7250-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP02-7260--(0810)			8 - 10
	PBOW-98-GW-PRRP-DP02-7270		Groundwater	NA
	PBOW-98-SO-PRRP-DP03-7280-(0002)	DP03	Soil	0 - 2
	PBOW-98-SO-PRRP-DP03-7290-(0406)			4 - 5
	PBOW-98-SO-PRRP-DP03-7300-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP03-7310		Groundwater	NA
	PBOW-98-SO-PRRP-DP04-7320-(0002)	DP04	Soil	0 - 2
	PBOW-98-SO-PRRP-DP04-7330-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP04-7340-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP04-7350		Groundwater	NA
	PBOW-98-SO-PRRP-DP05-7360-(0002)	DP05	Soil	0 - 2
	PBOW-98-SO-PRRP-DP05-7370-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP05-7380-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP05-7390		Groundwater	NA
	PBOW-98-SO-PRRP-DP06-7400-(0002)	DP06	Soil	0 - 2
	PBOW-98-SO-PRRP-DP06-7410-(0406)			4 - 5
	PBOW-98-SO-PRRP-DP06-7420-(0810)			9 - 10
	PBOW-98-GW-PRRP-DP06-7430		Groundwater	NA
	PBOW-98-SO-PRRP-DP07-7440-(0002)	DP07	Soil	0 - 2
	PBOW-98-SO-PRRP-DP07-7450-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP07-7460-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP07-7470		Groundwater	NA
	PBOW-98-SO-PRRP-DP08-7480-(0002)	DP08	Soil	0 - 2
	PBOW-98-SO-PRRP-DP08-7490-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP08-7500-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP08-7510		Groundwater	NA
	PBOW-98-SO-PRRP-DP09-7520-(0002)	DP09	Soil	0 - 2
	PBOW-98-SO-PRRP-DP09-7530-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP09-7540-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP09-7550		Groundwater	NA
	PBOW-98-SO-PRRP-DP10-7560-(0002)	DP10	Soil	0 - 1
	PBOW-98-SO-PRRP-DP10-7570-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP10-7580-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP10-7590		Groundwater	NA

Table 2-1

Summary of Primary Soil and Groundwater Samples Collected
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 4 of 4)

Area	Soil Sample Designation	Direct-Push Boring Designation	Sample Matrix	Sampling Depth Interval (feet, bgs)
Pentolite Road Red Water Ponds (Cont.)	PBOW-98-SO-PRRP-DP11-7600-(0002)	DP11	Soil	0 - 2
	PBOW-98-SO-PRRP-DP11-7610-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP11-7620-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP11-7630		Groundwater	NA
	PBOW-98-SO-PRRP-DP12-7640-(0002)	DP12	Soil	0 - 2
	PBOW-98-SO-PRRP-DP12-7650-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP12-7660-(0810)			9 - 10
	PBOW-98-GW-PRRP-DP12-7670		Groundwater	NA
	PBOW-98-SO-PRRP-DP13-7680-(0002)	DP13	Soil	0 - 2
	PBOW-98-SO-PRRP-DP13-7690-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP13-7700-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP13-7710		Groundwater	NA
	PBOW-98-SO-PRRP-DP14-7720-(0002)	DP14	Soil	0 - 2
	PBOW-98-SO-PRRP-DP14-7730-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP14-7740-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP14-7750		Groundwater	NA
	PBOW-98-SO-PRRP-DP15-7760-(0002)	DP15	Soil	0 - 2
	PBOW-98-SO-PRRP-DP15-7770-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP15-7780-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP15-7790		Groundwater	NA
	PBOW-98-SO-PRRP-DP16-7800-(0002)	DP16	Soil	0 - 2
	PBOW-98-SO-PRRP-DP16-7810-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP16-7820-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP16-7830		Groundwater	NA
	PBOW-98-SO-PRRP-DP17-7840-(0002)	DP17	Soil	0 - 2
	PBOW-98-SO-PRRP-DP17-7850-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP17-7860-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP17-7870		Groundwater	NA
	PBOW-98-SO-PRRP-DP18-7880-(0002)	DP18	Soil	0 - 2
	PBOW-98-SO-PRRP-DP18-7890-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP18-7900-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP18-7910		Groundwater	NA
	PBOW-98-SO-PRRP-DP19-7920-(0002)	DP19	Soil	0 - 2
	PBOW-98-SO-PRRP-DP19-7930-(0406)			4 - 6
	PBOW-98-SO-PRRP-DP19-7940-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP19-7950		Groundwater	NA
	PBOW-98-SO-PRRP-DP20-7960-(0002)	DP20	Soil	0 - 2
	PBOW-98-SO-PRRP-DP20-7970-(0406)			4 - 5
	PBOW-98-SO-PRRP-DP20-7980-(0810)			8 - 10
	PBOW-98-GW-PRRP-DP20-7990		Groundwater	NA

NA - Groundwater not available.
NS - Not sampled.

Table 2-2

Summary of Primary Surface Water and Sediment Samples
Red Water Ponds, PBOW, Sandusky, Ohio

Area	Sample Designation	Sample Location	Sample Matrix
West Area Red Water Ponds	PBOW-98-SW-WARP-SW01-12100	SW-01	Surface Water
	PBOW-98-SD-WARP-SD01-11100	SD-01	Sediment
	PBOW-98-SW-WARP-SW02-12110	SW-02	Surface Water
	PBOW-98-SD-WARP-SD02-11110	SD-02	Sediment
	PBOW-98-SW-WARP-SW03-12120	SW-03	Surface Water
	PBOW-98-SD-WARP-SD03-11120	SD-03	Sediment
	PBOW-98-SW-WARP-SW04-12130	SW-04	Surface Water
	PBOW-98-SD-WARP-SD04-11130	SD-04	Sediment
	PBOW-98-SW-WARP-SW05-12140	SW-05	Surface Water
	PBOW-98-SD-WARP-SD05-11140	SD-05	Sediment
	PBOW-98-SW-WARP-SW06-12150	SW-06	Surface Water
	PBOW-98-SD-WARP-SD06-11150	SD-06	Sediment
Pentolite Road Red Water Ponds	PBOW-98-SW-PRRP-SW01-12160	SW-01	Surface Water
	PBOW-98-SD-PRRP-SD01-11160	SD-01	Sediment
	PBOW-98-SW-PRRP-SW02-12170	SW-02	Surface Water
	PBOW-98-SD-PRRP-SD02-11170	SD-02	Sediment
	PBOW-98-SW-PRRP-SW03-12180	SW-03	Surface Water
	PBOW-98-SD-PRRP-SD03-11180	SD-03	Sediment
	PBOW-98-SW-PRRP-SW04-12190	SW-04	Surface Water
	PBOW-98-SD-PRRP-SD04-11190	SD-04	Sediment

Table 2-3

Summary of Variances Documented During the Direct-Push Investigation
Red Water Ponds, PBOW, Sandusky, Ohio

Variance Number	Date Recorded	Area Affected	Location Affected	Variance and Justification
1	6/9/98	Pentolite Road Red Water Ponds	PRRP-DP06	Low yield, limited quantity sample collected for explosives only
2	6/10/98		PRRP-DP07	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
3	6/10/98		PRRP-DP08	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
4	6/10/98		PRRP-DP10	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
5	6/11/98		PRRP-DP17	Field duplicate (7871)/field split (7872) samples were collected from this location
6	6/11/98		PRRP-DP12	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
7	6/12/98		PRRP-DP01	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
8	6/12/98		PRRP-DP18	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
9	6/12/98		PRRP-DP15	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
10	6/12/98		PRRP-DP13	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
11	6/13/98		PRRP-DP16	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
12	6/13/98		PRRP-DP19	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
13	6/14/98		PRRP-DP20	Matrix spike/matrix spike duplicate samples were collected from this location
14	6/14/98		PRRP-DP05	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
15	6/15/98	West Area Red Water Ponds	WARP-DP12	Low yield, sample collected for explosives and VOCs only
16	6/16/98		WARP-DP08	Low yield, sample collected for explosives and VOCs only
17	6/16/98		WARP-DP05	Completely dry, no sample collected
18	6/23/98		WARP-DP03	Completely dry, no sample collected
19	6/23/98		WARP-DP06	Low yield, sample collected for explosives and VOCs only
20	6/24/98		WARP-DP02	Low yield, sample collected for explosives, metals, and VOCs only
21	6/24/98		WARP-DP20	Completely dry, no sample collected
22	6/24/98		WARP-DP04	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
23	6/24/98		WARP-DP18	Completely dry, no sample collected
24	6/25/98		WARP-DP16	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
25	6/25/98		WARP-DP01	Low yield, sample collected for explosives and VOCs only
26	6/25/98		WARP-DP17	Low yield, sample collected for explosives, metals, VOCs, SVOCs, PCBs only
27	6/26/98		WARP-DP15	Low yield, sample collected for explosives and VOCs only
28	6/26/98		WARP-DP19	Low yield, sample collected for explosives and VOCs only
29	6/26/98		WARP-DP14	Drill rig failure, no soil or groundwater samples collected
30	6/26/98		WARP-DP11	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
31	6/26/98		WARP-DP07	Low yield, sample collected for explosives, metals, VOCs, SVOCs only
32	6/26/98		WARP-DP10	Drill rig failure, no soil sample collected from 8'-10'; no water samples collected

Note: variance logs were completed in the field by either the site coordinator or the sample coordinator. Variances were approved by the project manager in consultation with USACE representative. Variance logs were archived in the project file.

Table 3-1

Summary of Analytical Methods for Groundwater, Surface Water, Sediment, and Soil Samples
Red Water Ponds, PBOW, Sandusky, Ohio

Parameter Name	Surface/Subsurface Soil and Sediment Method Number	Surface Water and Groundwater Method Number
TCL Volatile Organic Compounds	8260A	8260A
TCL Semivolatile Organic Compounds	3540B/8270B	3520B/8270B
Nitroaromatics	8330	Modified 8330
Total TAL Metals	3050A/6010A 7471A	3005A/6010A/ 7470
Dissolved TAL Metals	NA	3005A/6010A 7470
Polychlorinated Biphenyls	3540B/8081	3520B/8081
Hardness	NA	EPA 130.2
Alkalinity	NA	EPA 310.1
Total Organic Carbons	NA	SW-846 9060
Total Dissolved Solids	NA	EPA 160.1
Total Suspended Solids	NA	EPA 160.2
Chloride	NA	EPA 325.3
Cyanide (Total)	NA	9010A
Nitrate	NA	EPA 352.2
Sulfate	NA	EPA 375.4

The analytical methods above are found in the following references:
Test Method for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition, update II September 1994.
Test Method for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition, update I July 1992.
Test Method for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition, Revision I December 1990.

PCB - Polychlorinated biphenyls.
TCL - Target compound list.
TAL - Target Analyte List. Metals include Ag, Al, Ba, Ca, Cd, Co, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Tl, V, As, Hg, and Se.

Table 4-1

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Soils
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

Sample Location:		WARWP-DP01		WARWP-DP02		WARP-DP04		WARWP-DP06		WARWP-DP08		WARWP-DP09			
Sample No:		8110		8140		8240		8300		8380		8430		8440	
Sample Date:		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98		15-Jun-98		16-Jun-98		16-Jun-98	
Depth (ft):		4-6		0-2		8-10		0-2		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds															
Acetone	mg/kg									0.035					
Methylene chloride	mg/kg									0.002	J				
Toluene	mg/kg	0.0022	J	0.0018	J	0.0025	J	0.0023	J						
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	mg/kg														
Acenaphthylene	mg/kg														
Anthracene	mg/kg														
Benzo(a)anthracene	mg/kg														
Benzo(a)pyrene	mg/kg														
Benzo(b)fluoranthene	mg/kg														
Benzo(ghi)perylene	mg/kg														
Benzo(k)fluoranthene	mg/kg														
Chrysene	mg/kg														
Fluoranthene	mg/kg											0.058	J		
Indeno(1,2,3-cd)pyrene	mg/kg														
Phenanthrene	mg/kg														
Pyrene	mg/kg											0.043	J		
Nitroaromatic Compounds															
1,3,5-Trinitrobenzene	mg/kg													0.31	
2,4,6-Trinitrotoluene	mg/kg														
2,4-Dinitrotoluene	mg/kg													0.49	
2,6-Dinitrotoluene	mg/kg														

Table 4-1

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Soils
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

Sample Location:		WARWP-DP10		WARWP-DP11				WARWP-DP12		WARWP-DP13		WARWP-DP15		WARWP-DP17	
Sample No:		8470		8500		8520		8550		8580		8670		8750	
Sample Date:		26-Jun-98		25-Jun-98		25-Jun-98		15-Jun-98		15-Jun-98		24-Jun-98		25-Jun-98	
Depth (ft):		4-6		0-2		8-10		4-6		0-2		4-6		4-6	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds															
Acetone	mg/kg														
Methylene chloride	mg/kg							0.002	J	0.0023	J				
Toluene	mg/kg			0.0032	J							0.0021	J	0.0022	J
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	mg/kg			0.043	J										
Acenaphthylene	mg/kg									0.041	J				
Anthracene	mg/kg									0.23	J				
Benzo(a)anthracene	mg/kg									0.4					
Benzo(a)pyrene	mg/kg									0.39					
Benzo(b)fluoranthene	mg/kg									0.3	J				
Benzo(ghi)perylene	mg/kg									0.22	J				
Benzo(k)fluoranthene	mg/kg									0.35	J				
Chrysene	mg/kg									0.42					
Fluoranthene	mg/kg									0.76					
Indeno(1,2,3-cd)pyrene	mg/kg									0.23	J				
Phenanthrene	mg/kg									0.36	J				
Pyrene	mg/kg									0.55					
Nitroaromatic Compounds															
1,3,5-Trinitrobenzene	mg/kg	4.4				0.74									
2,4,6-Trinitrotoluene	mg/kg	0.38													
2,4-Dinitrotoluene	mg/kg	1.4													
2,6-Dinitrotoluene	mg/kg	1.5													

Table 4-1

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Soils
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 3)

	Sample Location:	WARWP-DP18		WARWP-DP20	
	Sample No:	8800		8870	
	Sample Date:	25-Jun-98		24-Jun-98	
	Depth (ft):	8-10		4-6	
Parameter	Units	Result	VQ	Result	VQ
Volatile Organic Compounds					
Acetone	mg/kg				
Methylene chloride	mg/kg				
Toluene	mg/kg			0.0015	J
Semivolatile Organic Compounds					
2,4-Dinitrotoluene	mg/kg				
Acenaphthylene	mg/kg			0.04	J
Anthracene	mg/kg			0.12	J
Benzo(a)anthracene	mg/kg			0.17	J
Benzo(a)pyrene	mg/kg			0.14	J
Benzo(b)fluoranthene	mg/kg			0.14	J
Benzo(ghi)perylene	mg/kg			0.076	J
Benzo(k)fluoranthene	mg/kg			0.11	J
Chrysene	mg/kg			0.17	J
Fluoranthene	mg/kg			0.38	
Indeno(1,2,3-cd)pyrene	mg/kg			0.076	J
Phenanthrene	mg/kg			0.25	J
Pyrene	mg/kg			0.28	J
Nitroaromatic Compounds					
1,3,5-Trinitrobenzene	mg/kg	0.98			
2,4,6-Trinitrotoluene	mg/kg				
2,4-Dinitrotoluene	mg/kg				
2,6-Dinitrotoluene	mg/kg				

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP01						WARWP-DP02					
Sample No:		8100		8110		8120		8140		8150		8160	
Sample Date:		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	6880		9190		6010		17900		7540		14500	
Antimony	mg/kg												
Arsenic	mg/kg	2.8		8.6		4.5		7.2		2.5		11.7	
Barium	mg/kg			40.3		27.9		124		32.1		75.3	
Beryllium	mg/kg							1				0.7	
Cadmium	mg/kg												
Calcium	mg/kg	1490		35700		67600		5930		3010		56600	
Chromium	mg/kg	9.9	J	16.1	J	10.9	J	20.8	J	12.1	J	22.2	J
Cobalt	mg/kg			8.5		6.2		16.2				10	
Copper	mg/kg	4		20.1		17.1		20		7		25.6	
Iron	mg/kg	10300		19600		15000		26800		11500		26400	
Lead	mg/kg	3.6	J	8.1	J	7.1	J	13.5	J	4.8	J	10.8	J
Magnesium	mg/kg	1090		14500		20700		4020		2110		15100	
Manganese	mg/kg	89.6		282		329		1190		92.5		423	
Mercury	mg/kg							0.061					
Nickel	mg/kg	7.6		19.4		14		29.1		13		27.8	
Potassium	mg/kg			2010	J	1480	J	2490	J	1210	J	3370	J
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	18.9		28		20.5		37.7		17.8		34.6	
Zinc	mg/kg	21.7		51.2		40		87.4		33.9		68.1	
Moisture Content													
% moisture	%	12.1		20.4		19.5		16.6		16.9		21.1	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP03						WARP-DP04					
Sample No:		8180		8190		8200		8220		8230		8240	
Sample Date:		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	16500		7040		9400		17000		8640		13400	
Antimony	mg/kg												
Arsenic	mg/kg	8.1		6.8		5.8		6.1		4.5		11.2	
Barium	mg/kg	112		87.2		58		85.4		45.7		35.3	
Beryllium	mg/kg	0.76	J					0.78	J				
Cadmium	mg/kg	0.59											
Calcium	mg/kg	2710		2200		40200		1900		1860		40300	
Chromium	mg/kg	19.9	J	11.4	J	14.8	J	19.2	J	11.9	J	20	J
Cobalt	mg/kg	17.9		21		8.5		14.7		9.2		11.6	
Copper	mg/kg	21.4				20.3		21.9				34.7	
Iron	mg/kg	30200		19600		20100		23900		14500		27800	
Lead	mg/kg	11.7		9.4		7.6		10.3		6.2		12.3	
Magnesium	mg/kg	3760		2020		10800		3220		1990		11000	
Manganese	mg/kg	1340		495		372		915		267		363	
Mercury	mg/kg												
Nickel	mg/kg	44.3		24		23		29.7		20.9		36	
Potassium	mg/kg	2970	J	941	J	2460	J	2510	J	1370	J	3570	J
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	32.5	J	19.6	J	23.3	J	32.9	J	18.2	J	24.7	J
Zinc	mg/kg	111		64.1		54.7		88.1		53.8		80	
Moisture Content													
% moisture	%	15.1		15.2		20.1		14.5		11		21.3	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP05						WARWP-DP06					
Sample No:		8260		8270		8280		8300		8310		8320	
Sample Date:		16-Jun-98		16-Jun-98		16-Jun-98		23-Jun-98		23-Jun-98		23-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	8120		8840		9510		5600		8610		12100	
Antimony	mg/kg												
Arsenic	mg/kg	4.8		4.6		6.7		2.3		6.8		6.6	
Barium	mg/kg	51.2		62.4		54.3				31.3		82.3	
Beryllium	mg/kg												
Cadmium	mg/kg												
Calcium	mg/kg	2390		54500		50400		1620		2530		55700	
Chromium	mg/kg	13.1		15.3		17.4		8.9	J	15.5	J	17.9	J
Cobalt	mg/kg	8.5		9.6		9.2				7.9		12.8	
Copper	mg/kg	11.7		19.3		19		4.5		12.4		23.5	
Iron	mg/kg	17600		17000		18200		10200		17000		21500	
Lead	mg/kg	6.1		10.5		8.4		2.8	J	7.1	J	11.6	J
Magnesium	mg/kg	2150		23400		14800		1060		1860		17700	
Manganese	mg/kg	468		527		362		143		413		768	
Mercury	mg/kg												
Nickel	mg/kg	17		23.2		21.7		7.1		14.8		31.4	
Potassium	mg/kg	813		1740		1730				924	J	2860	J
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	24.1	J	27.1	J	25.9	J	17.9		25.4		30.8	
Zinc	mg/kg	40.4		53.6		53.4		21.1		39.3		62.2	
Moisture Content													
% moisture	%	10.9		18.2		17.7		10.7		14.5		20.3	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP07						WARWP-DP08					
Sample No:		8340		8350		8360		8380		8390		8400	
Sample Date:		25-Jun-98		25-Jun-98		25-Jun-98		15-Jun-98		15-Jun-98		15-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	11500		9160		10900		4880		8740		5570	
Antimony	mg/kg												
Arsenic	mg/kg	3.7		3.1		7.4		2.2		6.9		4	
Barium	mg/kg	69.7		43.3		55.4				43.8			
Beryllium	mg/kg	0.7				0.65							
Cadmium	mg/kg												
Calcium	mg/kg	2700		2410		25000		1480		1810		1460	
Chromium	mg/kg	15.8	J	14.1	J	17.1	J	6.8		17.4		7.5	
Cobalt	mg/kg	9		7.3		13.8				7.4			
Copper	mg/kg	15.9		12.5		21.4		2.9		10.4		6.9	
Iron	mg/kg	16800		13900		20700		8460		22000		10000	
Lead	mg/kg	10.1	J	6.9	J	11.6	J	2.2		5.4		4.4	
Magnesium	mg/kg	2720		2340		5620				1810		832	
Manganese	mg/kg	186		123		472		107		231		215	
Mercury	mg/kg												
Nickel	mg/kg	22.3		18.3		29.7		7.5		17		10.8	
Potassium	mg/kg	1650	J	1650	J	2390	J			643			
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	21.1		20.4		24.2		15.8		30		17.8	
Zinc	mg/kg	70.5		57.5		75.6		15.9		37.8		26.5	
Moisture Content													
% moisture	%	16.4		14.4		18.1		13.7		15.9		13.5	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP09						WARWP-DP10					
Sample No:		8420		8430		8440		8460		8470		Not Sampled	
Sample Date:		16-Jun-98		16-Jun-98		16-Jun-98		26-Jun-98		26-Jun-98			
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	7610		6470		11100		12300		12000			
Antimony	mg/kg					7.7							
Arsenic	mg/kg	6.8		2.2		14		5.2		7.9			
Barium	mg/kg	53.9		41.3		78.2		77.4		80.3			
Beryllium	mg/kg					0.65		0.73		0.86			
Cadmium	mg/kg												
Calcium	mg/kg	58600		1220		7860		3260		2130			
Chromium	mg/kg	22.2		8.2		20.9		15.7	J	17.9	J		
Cobalt	mg/kg					11.9		15.7		11.2			
Copper	mg/kg	18.5		4.9		24.2		16.5		20.4			
Iron	mg/kg	14200		8490		29000		20000		27000			
Lead	mg/kg	11.7		5.8		10.6		11	J	11.5	J		
Magnesium	mg/kg	4510		2010		4980		2930		2850			
Manganese	mg/kg	213		83.4		405		681		243			
Mercury	mg/kg	0.1						0.045					
Nickel	mg/kg	10.6		7.4		36.6		29		33.5			
Potassium	mg/kg					1160		1600	J	1340	J		
Selenium	mg/kg												
Sodium	mg/kg									1270			
Vanadium	mg/kg	21.1	J	14.2	J	27.5	J	22.4		24.6			
Zinc	mg/kg	36.9		30.6		72.5		74.6		94.6			
Moisture Content													
% moisture	%	27.8		16.4		21.7		14.2		16.7			

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP11						WARWP-DP12					
Sample No:		8500		8510		8520		8540		8550		8560	
Sample Date:		25-Jun-98		25-Jun-98		25-Jun-98		15-Jun-98		15-Jun-98		15-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	11300		5980		11400		4720		5080		9320	
Antimony	mg/kg												
Arsenic	mg/kg	3.7		6.5		7.9		2		23.6		8.3	
Barium	mg/kg	72.9		35.5		51.5		24.8		39.3		54.5	
Beryllium	mg/kg	0.64				0.59							
Cadmium	mg/kg												
Calcium	mg/kg	2600		1570		51000		757		18800		57200	
Chromium	mg/kg	15.8	J	9.4	J	16.8	J	5.4		10.6		16.2	
Cobalt	mg/kg	11.5		6.9		10.1				8.2		8.9	
Copper	mg/kg	12.3		10.4		24.3		3.5		19.3		22.6	
Iron	mg/kg	18700		16800		22500		7190		23200		19500	
Lead	mg/kg	9.1	J	6.2	J	8.2	J	2.9		6.4		9.8	
Magnesium	mg/kg	3030		1580		11300		684		6810		17400	
Manganese	mg/kg	375		114		392		172		551		433	
Mercury	mg/kg												
Nickel	mg/kg	22.6		16.6		30.2		8.6		24.9		23.9	
Potassium	mg/kg	1660	J	903	J	3140	J			803		1860	
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	21.1		13.9		24.2		10.1		22.3		25.9	
Zinc	mg/kg	75.4		42.4		58.9		22.9		55		60.6	
Moisture Content													
% moisture	%	16.2		14.4		13.9		10.6		19.7		19.8	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP13						WARWP-DP15					
Sample No:		8580		8590		8600		8660		8670		8680	
Sample Date:		15-Jun-98		15-Jun-98		15-Jun-98		24-Jun-98		24-Jun-98		24-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	11900		5910		13700		14300		11100		13800	
Antimony	mg/kg												
Arsenic	mg/kg	11.5		3.1		15.3		9.3		3.7		7.6	
Barium	mg/kg	82		27.9		76.3		91.4		53.8		165	
Beryllium	mg/kg	0.67				0.83		0.63	J			0.64	J
Cadmium	mg/kg					0.68							
Calcium	mg/kg	16600		4680		3580		31400		2480		3480	
Chromium	mg/kg	20.3		10.3		22.2		19.7	J	13	J	12.9	J
Cobalt	mg/kg	11.1		6		18.4		13		6.2		16.2	
Copper	mg/kg	26.8		14		29.1		22.7				18	
Iron	mg/kg	27400		10900		34000		24700		13400		24500	
Lead	mg/kg	11.3		4.9		14		10.7		5.9		13.2	
Magnesium	mg/kg	8890		2050		4310		12200		2010		4220	
Manganese	mg/kg	391		231		780		781		269		1900	
Mercury	mg/kg												
Nickel	mg/kg	29.1		10.3		45		32.1		13.6		40.8	
Potassium	mg/kg	1830				1630		2640	J	1370	J	2070	J
Selenium	mg/kg												
Sodium	mg/kg					1030							
Vanadium	mg/kg	31		17		36.7		36.3	J	23.2	J	27.7	J
Zinc	mg/kg	69.9		27.2		82.9		63.4		45.3		75.7	
Moisture Content													
% moisture	%	12.1		13.7		19.1		17		15.4		14.7	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP16						WARWP-DP17					
Sample No:		8700		8710		8720		8740		8750		8760	
Sample Date:		24-Jun-98		24-Jun-98		24-Jun-98		25-Jun-98		25-Jun-98		25-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	20600		12400		18400		11200		9420		12500	
Antimony	mg/kg	7.4	J										
Arsenic	mg/kg	11.4		11		9.5		5.1		11.6		10	
Barium	mg/kg	130		117		118		61.9		67.7		74.8	
Beryllium	mg/kg	1.2	J			0.82	J					0.74	
Cadmium	mg/kg												
Calcium	mg/kg	3760		31700		13300		1460		2240		2460	
Chromium	mg/kg	25.4	J	15.8	J	22.7	J	14.8	J	15.5	J	19.6	J
Cobalt	mg/kg	17.1		13		15		11.5		15.5		13.8	
Copper	mg/kg	30.9		26.2		26.4		15.4		19.2		21.7	
Iron	mg/kg	36000		29200		31100		19800		26100		26600	
Lead	mg/kg	11.4		9.1		10.1		10.6		9		8.7	
Magnesium	mg/kg	4870		10100		6970		2500	J	2530	J	2920	J
Manganese	mg/kg	982		1280		1170		207		326		362	
Mercury	mg/kg	0.04											
Nickel	mg/kg	46.9		33.9		39.3		20.5		31.6		31.1	
Potassium	mg/kg	2590	J	1830	J	3240	J	898	J	1030	J	1580	J
Selenium	mg/kg							0.65					
Sodium	mg/kg	681				726				858		952	
Vanadium	mg/kg	40.5	J	31	J	40.3	J	19.2		22.1		27.5	
Zinc	mg/kg	103		70.9		81.2		65.4		66.1		74.3	
Moisture Content													
% moisture	%	16.6		18.5		21.6		14.6		17.8		16.3	

Table 4-2

Summary of Detected Inorganic Compounds and Soil Moisture Content
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		WARWP-DP18						WARWP-DP19					
Sample No:		8780		8790		8800		8820		8830		8840	
Sample Date:		25-Jun-98		25-Jun-98		25-Jun-98		24-Jun-98		24-Jun-98		24-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	10700		8670		21000		6680		18000		17000	
Antimony	mg/kg												
Arsenic	mg/kg	5.3		4.1		4.9		2.1		9.4		9.8	
Barium	mg/kg	61.9		58.8		92.7		26.4		70		83.3	
Beryllium	mg/kg	0.59				1				0.83	J	0.75	J
Cadmium	mg/kg												
Calcium	mg/kg	7330		4890		39100		1620		2600		34600	
Chromium	mg/kg	15.3	J	13	J	28.6	J	9.1	J	23.3	J	25.1	J
Cobalt	mg/kg	11.1		8.1		11.5				19		14.5	
Copper	mg/kg	17.3		14		25.2				30.6		30.9	
Iron	mg/kg	18400		15400		26000		10600		32000		30000	
Lead	mg/kg	9.6		7.6		11		3.4		13.2		11.2	
Magnesium	mg/kg	4680	J	2860	J	10300	J	1290		4480		14700	
Manganese	mg/kg	453		261		374		184		898		568	
Mercury	mg/kg												
Nickel	mg/kg	23.5		20.4		35.9		9.8		42.3		37.9	
Potassium	mg/kg	1270	J	1080	J	5630	J	742	J	2430	J	3960	J
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	23		17.8		37.2		19.8	J	38.9	J	37.3	J
Zinc	mg/kg	60.3		55.2		64.9		28.7		85.1		81.6	
Moisture Content													
% moisture	%	11.8		12.1		26.3		10.7		18		21.9	

Table 4-2

mary of Detected Inorganic Compounds and Soil Moisture Co
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		WARWP-DP20					
Sample No:		8860		8870		8880	
Sample Date:		24-Jun-98		24-Jun-98		24-Jun-98	
Depth (ft):		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ
Metals							
Aluminum	mg/kg	13000		10900		12000	
Antimony	mg/kg						
Arsenic	mg/kg	8.5		7		4.6	
Barium	mg/kg	66		56.1		80.3	
Beryllium	mg/kg						
Cadmium	mg/kg						
Calcium	mg/kg	35600		23500		5120	
Chromium	mg/kg	16.7	J	16.1	J	16.9	J
Cobalt	mg/kg	11.9		7.8		10.1	
Copper	mg/kg						
Iron	mg/kg	20900		19100		18800	
Lead	mg/kg	9.4		7.4		7.4	
Magnesium	mg/kg	9970		8670		3690	
Manganese	mg/kg	551		320		484	
Mercury	mg/kg						
Nickel	mg/kg	19.3		18.6		28.7	
Potassium	mg/kg	2040	J	1350	J	1710	J
Selenium	mg/kg						
Sodium	mg/kg					619	
Vanadium	mg/kg	35	J	29.1	J	24.1	J
Zinc	mg/kg	49.8		48.2		77.5	
Moisture Content							
% moisture	%	11.7		13		14.1	

Table 4-3

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

Sample Location:		WARWP-DP02		WARWP-DP04		WARWP-DP06		WARWP-DP08	
Sample No:		8170		8250		8330		8410	
Sample Date:		24-Jun-98		24-Jun-98		23-Jun-98		16-Jun-98	
Depth (ft):		0-0		0-0		0-0		0-0	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds									
2-Butanone	µg/L								
Benzene	µg/L	0.15	J						
Carbon disulfide	µg/L							0.15	J
Ethylbenzene	µg/L								
Tetrachloroethene	µg/L							0.2	J
Semivolatile Organic Compounds									
2,4-Dinitrotoluene	µg/L								
2,6-Dinitrotoluene	µg/L								
3-Nitroaniline	µg/L			3.2	J				
4,6-Dinitro-2-methylphenol	µg/L								
4-Nitrophenol	µg/L								
Nitroaromatic Compounds									
1,3,5-Trinitrobenzene	µg/L								
1,3-Dinitrobenzene	µg/L					0.2		0.74	
2,4,6-Trinitrotoluene	µg/L								
2,4-Dinitrotoluene	µg/L							2.3	
2,6-Dinitrotoluene	µg/L							0.28	

Table 4-3

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

Sample Location:		WARWP-DP09		WARWP-DP11		WARWP-DP12		WARWP-DP13	
Sample No:		8450		8530		8570		8610	
Sample Date:		16-Jun-98		26-Jun-98		15-Jun-98		15-Jun-98	
Depth (ft):		0-0		0-0		0-0		0-0	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds									
2-Butanone	µg/L								
Benzene	µg/L			0.13	J				
Carbon disulfide	µg/L								
Ethylbenzene	µg/L							0.19	J
Tetrachloroethene	µg/L	0.15	J						
Semivolatile Organic Compounds									
2,4-Dinitrotoluene	µg/L	60		1.8	J			660	
2,6-Dinitrotoluene	µg/L	6.3	J					56	J
3-Nitroaniline	µg/L	5.1	J	2.1	J			15	J
4,6-Dinitro-2-methylphenol	µg/L	24	J						
4-Nitrophenol	µg/L	2.4	J						
Nitroaromatic Compounds									
1,3,5-Trinitrobenzene	µg/L	9.4		7.2				680	
1,3-Dinitrobenzene	µg/L	8.6				0.69		270	
2,4,6-Trinitrotoluene	µg/L			7.1					
2,4-Dinitrotoluene	µg/L	28				2		950	
2,6-Dinitrotoluene	µg/L	2.7				0.25			

Table 4-3

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 3)

Sample Location:		WARWP-DP15		WARWP-DP16		WARWP-DP17		WARWP-DP19	
Sample No:		8690		8730		8770		8850	
Sample Date:		26-Jun-98		25-Jun-98		25-Jun-98		26-Jun-98	
Depth (ft):		0-0		0-0		0-0		0-0	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds									
2-Butanone	µg/L	1.2	J					1.8	J
Benzene	µg/L								
Carbon disulfide	µg/L							0.18	J
Ethylbenzene	µg/L								
Tetrachloroethene	µg/L								
Semivolatile Organic Compounds									
2,4-Dinitrotoluene	µg/L			60	J	52	J		
2,6-Dinitrotoluene	µg/L			15	J	18	J		
3-Nitroaniline	µg/L			43	J	49	J		
4,6-Dinitro-2-methylphenol	µg/L								
4-Nitrophenol	µg/L								
Nitroaromatic Compounds									
1,3,5-Trinitrobenzene	µg/L			40		32			
1,3-Dinitrobenzene	µg/L							0.24	
2,4,6-Trinitrotoluene	µg/L								
2,4-Dinitrotoluene	µg/L	1.1				22			
2,6-Dinitrotoluene	µg/L								

Table 4-4

Summary of Detected Inorganic Constituents in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 4)

Sample Location:		WARWP-DP02		WARWP-DP04		WARWP-DP07		WARWP-DP09	
Sample No:		8170		8250		8370		8450	
Sample Date:		24-Jun-98		24-Jun-98		26-Jun-98		16-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Total Metals (Unfiltered)									
Aluminum	µg/L	13100		1240		51100		11100	
Antimony	µg/L								
Arsenic	µg/L	21.4						15.2	
Barium	µg/L					248			
Beryllium	µg/L								
Calcium	µg/L	336000		569000		644000		230000	
Chromium	µg/L	28.8				91.6			
Cobalt	µg/L					68.4			
Copper	µg/L	90.2				126			
Iron	µg/L	39900		2650		123000		28500	
Lead	µg/L	14.4						11.8	
Magnesium	µg/L	95100	J	234000	J	105000	J	219000	
Manganese	µg/L	750		1410		3310		8610	
Mercury	µg/L								
Nickel	µg/L	61.5				220			
Potassium	µg/L	6880		17400		17100			
Selenium	µg/L								
Sodium	µg/L	408000		81800		182000		44300	
Thallium	µg/L								
Vanadium	µg/L	62				125			
Zinc	µg/L	123		22.1		411			

Table 4-4

Summary of Detected Inorganic Constituents in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 4)

Sample Location:		WARWP-DP02		WARWP-DP04		WARWP-DP07		WARWP-DP09	
Sample No:		8170		8250		8370		8450	
Sample Date:		24-Jun-98		24-Jun-98		26-Jun-98		16-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Dissolved Metals (Filtered)									
Aluminum	µg/L								
Cadmium	µg/L								
Calcium	µg/L	211000		549000		364000		237000	
Chromium	µg/L								
Cobalt	µg/L								
Copper	µg/L	42.1							
Iron	µg/L							120	
Lead	µg/L							4.4	
Magnesium	µg/L	62800	J	242000	J	71400	J	227000	
Manganese	µg/L	84.5		1450		480		8480	
Nickel	µg/L								
Potassium	µg/L			18200		6170			
Sodium	µg/L	443000		114000		185000		44800	
Zinc	µg/L								
Water Quality Parameters									
Alkalinity	µg/L							1E+06	
Hardness	µg/L							1E+06	
Total suspended	µg/L							85000	
Total dissolved so	µg/L							2E+06	
Total organic carb	µg/L							32000	
Nitrate	µg/L								
Sulfate	µg/L							305000	

Table 4-4

Summary of Detected Inorganic Constituents in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 4)

Sample Location:		WARWP-DP11		WARWP-DP13		WARWP-DP16		WARWP-DP17	
Sample No:		8530		8610		8730		8770	
Sample Date:		26-Jun-98		15-Jun-98		25-Jun-98		25-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Total Metals (Unfiltered)									
Aluminum	µg/L	59700		77200		206000		38500	
Antimony	µg/L					106			
Arsenic	µg/L	56.2		1780		111			
Barium	µg/L	386				773		217	
Beryllium	µg/L					9.5			
Calcium	µg/L	982000		315000		2680000		555000	
Chromium	µg/L	96.8		127		296		58.7	
Cobalt	µg/L	85.2				264		173	
Copper	µg/L	214				654		153	
Iron	µg/L	137000		153000		339000		73000	
Lead	µg/L	68.3		459		157		28.9	
Magnesium	µg/L	242000	J	86200		651000	J	178000	J
Manganese	µg/L	4840		12600		9280		2470	
Mercury	µg/L	0.24		0.65		0.47		0.25	
Nickel	µg/L	249				515		134	
Potassium	µg/L	20500				33100		7640	
Selenium	µg/L			1790					
Sodium	µg/L	503000		187000		907000		1060000	
Thallium	µg/L			1770					
Vanadium	µg/L	161				381		113	
Zinc	µg/L	467		397		1260		265	

Table 4-4

Summary of Detected Inorganic Constituents in Groundwater
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 4 of 4)

Sample Location:		WARWP-DP11		WARWP-DP13		WARWP-DP16		WARWP-DP17	
Sample No:		8530		8610		8730		8770	
Sample Date:		26-Jun-98		15-Jun-98		25-Jun-98		25-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Dissolved Metals (Filtered)									
Aluminum	µg/L					203		1350	
Cadmium	µg/L					46			
Calcium	µg/L	395000		156000		735000		301000	
Chromium	µg/L							32.9	
Cobalt	µg/L					162		142	
Copper	µg/L	67				117		94.6	
Iron	µg/L	121				373		2600	
Lead	µg/L								
Magnesium	µg/L	80100	J			193000	J	145000	J
Manganese	µg/L	1070		7870		635		891	
Nickel	µg/L	62				46.3			
Potassium	µg/L	10200							
Sodium	µg/L	614000		192000		1040000		993000	
Zinc	µg/L					28.2			
Water Quality Parameters									
Alkalinity	µg/L			643000					
Hardness	µg/L			960000					
Total suspended	µg/L			15000					
Total dissolved so	µg/L			1E+06					
Total organic carb	µg/L			36600					
Nitrate	µg/L			1600					
Sulfate	µg/L			278000					

Table 4-5

Summary of Detected Constituents in Surface Water and Sediment Samples
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

		Surface Water Samples											
		WARP-SW01 12100 5-Nov-98		WARP-SW02 12110 5-Nov-98		WARP-SW03 12120 5-Nov-98		WARP-SW04 12130 5-Nov-98		WARP-SW05 12140 5-Nov-98		WARP-SW06 12150 5-Nov-98	
Parameter	Units	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.
Organic Compounds													
Bromomethane	µg/L	0.22	J			0.16	J	0.21	J	0.21	J	0.16	J
di-n-Octyl phthalate	µg/L									7.8	J		
Total Metals													
Aluminum	µg/L	631	J			300	J			13800	J	12400	J
Arsenic	µg/L									20.2		21.8	
Calcium	µg/L	107000		106000		106000		105000		31100		115000	
Chromium	µg/L									17.4		23.3	J
Iron	µg/L	1300		126		747		646		21100		19000	
Lead	µg/L									25		32.9	
Magnesium	µg/L	26000		26500		26200		25800		46500		50700	
Manganese	µg/L	890		30.6		261		126		1150		1550	
Potassium	µg/L	9400		9730		9750		9910		5590		5180	
Sodium	µg/L	38200		39300		38300		39000		104000		107000	
Vanadium	µg/L											52.2	
Zinc	µg/L	27								84.8		92.5	
Dissolved Metals													
Aluminum	µg/L					233				6340		11400	
Arsenic	µg/L									10.9		17.2	
Calcium	µg/L	104000		106000		104000		103000		27600		71500	
Chromium	µg/L											21.2	J
Iron	µg/L	153				484		589		8630		15500	
Lead	µg/L									7.2		20.4	J
Magnesium	µg/L	25600		26500		25700		25400		44300		49100	
Manganese	µg/L	218				97.2		107		669		907	
Potassium	µg/L	8870		9340		9080		9370				5900	
Sodium	µg/L	37400		38800		37200		37900		103000		112000	
Zinc	µg/L									42.3		68	
Hardness													
Hardness	µg/L	380000		408000		400000		420000		372000		592000	

Table 4-5

Summary of Detected Constituents in Surface Water and Sediment Samples
West Area
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

		Sediment Samples											
		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05		WARP-SD06	
		11100		11110		11120		11130		11140		11150	
		5-Nov-98		5-Nov-98		5-Nov-98		5-Nov-98		5-Nov-98		5-Nov-98	
		0 - 0.5 ft		0 - 0.5 ft		0 - 0.5 ft		0 - 0.5 ft		0 - 0.5 ft		0 - 0.5 ft	
Parameter	Units	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.
Organic Compounds													
2-Butanone	mg/kg					0.029	J			0.021	J		
Acetone	mg/kg									0.11	J	0.071	J
Benzo(a)anthracene	mg/kg	0.051	J										
Benzo(a)pyrene	mg/kg	0.053	J										
Benzo(k)fluoranthene	mg/kg	0.052	J										
Chrysene	mg/kg	0.06	J										
Fluoranthene	mg/kg	0.11	J					0.047	J				
Phenanthrene	mg/kg	0.055	J										
Pyrene	mg/kg	0.079	J										
Metals													
Aluminum	mg/kg	3170		2450		4260		3230		6880		9600	
Arsenic	mg/kg	5.4		3.5		7.3		8.6		4.6		8.7	
Barium	mg/kg	26.6				36		34.8		65			
Calcium	mg/kg	10800		13900		12300		16000		6710		74700	
Chromium	mg/kg	6.7		5.3		8.1		7.4		12.6		28.7	
Cobalt	mg/kg	10.9		6.4		10.6		10.8					
Copper	mg/kg	13.7		8.8		15		9.8		15.2		24.5	
Iron	mg/kg	14900		9900		16500		24300		16000		18000	
Lead	mg/kg	9.7		6.5		9.4		8.1		22.6		32.1	
Magnesium	mg/kg	2110		2720		2520		2950		3130		6770	
Manganese	mg/kg	305		231		290		255		338		726	
Nickel	mg/kg	23		13.7		24.4		18.3		15.2		24.5	
Vanadium	mg/kg											25	
Potassium	mg/kg					821		45.3		54.4		77	
Zinc	mg/kg	48		35.1		58.4							
Total Organic Carbon													
Total organic carbon	mg/kg	5430		3960		9650		5520		40200		93400	

Table 4-6

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Soils
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

Sample Location:		PRRWP-DP01				PRRWP-DP02		PRRWP-DP03			
Sample No:		7210		7220		7260		7280		7290	
Sample Date:		11-Jun-98		11-Jun-98		14-Jun-98		8-Jun-98		8-Jun-98	
Depth (ft):		4-6		8-10		8-10		0-2		4-5	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds											
Acetone	mg/kg										
Methylene chloride	mg/kg										
Toluene	mg/kg										
Semivolatile Organic Compounds											
2,4-Dinitrotoluene	mg/kg					0.081	J			8.8	
2,6-Dinitrotoluene	mg/kg									0.58	J
3-Nitroaniline	mg/kg										
Nitroaromatic Compounds											
1,3,5-Trinitrobenzene	mg/kg	0.56		2.7						43	
1,3-Dinitrobenzene	mg/kg									9.3	
2,4,6-Trinitrotoluene	mg/kg					0.38					
2,4-Dinitrotoluene	mg/kg	0.96		0.29		0.28		1.2		25	
2,6-Dinitrotoluene	mg/kg	0.35									
4-Amino-2,6-dinitrotoluene	mg/kg										

Table 4-6

Volatile Organcis, Semivolatile Organics, and Nitroaromatic Analytical Results in Soils
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

Sample Location:		PRRWP-DP06		PRRWP-DP07		PRRWP-DP09				PRRWP-DP10	
Sample No:		7420		7450		7530R		7540R		7580	
Sample Date:		8-Jun-98		9-Jun-98		25-Jun-98		25-Jun-98		10-Jun-98	
Depth (ft):		9-10		4-6		4-6		8-10		9-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds											
Acetone	mg/kg			0.0082	J						
Methylene chloride	mg/kg										
Toluene	mg/kg					0.0017	J				
Semivolatile Organic Compounds											
2,4-Dinitrotoluene	mg/kg					0.056	J				
2,6-Dinitrotoluene	mg/kg										
3-Nitroaniline	mg/kg										
Nitroaromatic Compounds											
1,3,5-Trinitrobenzene	mg/kg	1.8						1.3		18	
1,3-Dinitrobenzene	mg/kg									5.2	
2,4,6-Trinitrotoluene	mg/kg										
2,4-Dinitrotoluene	mg/kg	1.1								15	
2,6-Dinitrotoluene	mg/kg									1.7	
4-Amino-2,6-dinitrotoluene	mg/kg										

Table 4-6

Volatile Organic, Semivolatile Organics, and Nitroaromatic Analytical Results in Soils
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 3)

Sample Location:		PRRWP-DP11						PRRWP-DP15		PRRWP-DP16		PRRWP-DP19	
Sample No:		7600		7610		7620		7780		7820		7920	
Sample Date:		13-Jun-98		13-Jun-98		13-Jun-98		12-Jun-98		12-Jun-98		12-Jun-98	
Depth (ft):		0-2		4-6		8-10		8-10		8-10		0-2	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds													
Acetone	mg/kg												
Methylene chloride	mg/kg									0.0021	J	0.0018	J
Toluene	mg/kg												
Semivolatile Organic Compounds													
2,4-Dinitrotoluene	mg/kg	0.16	J					0.19	J	0.0004	J		
2,6-Dinitrotoluene	mg/kg	0.05	J							0.049	J		
3-Nitroaniline	mg/kg							0.053	J				
Nitroaromatic Compounds													
1,3,5-Trinitrobenzene	mg/kg			0.43		7				1.9			
1,3-Dinitrobenzene	mg/kg			0.43		5.8				0.25			
2,4,6-Trinitrotoluene	mg/kg	0.27											
2,4-Dinitrotoluene	mg/kg	0.32		1.6		1.2				0.5			
2,6-Dinitrotoluene	mg/kg			0.29		0.3				0.5			
4-Amino-2,6-dinitrotoluene	mg/kg	2.7											

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 10)

Sample Location:		PRRWP-DP01						PRRWP-DP02					
Sample No:		7200		7210		7220		7240R		7250		7260	
Sample Date:		11-Jun-98		11-Jun-98		11-Jun-98		22-Jun-98		14-Jun-98		14-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	9370		11500		10100		9210		11200		11500	
Antimony	mg/kg			7.9	J								
Arsenic	mg/kg	4.5	J	27.9	J	9.1	J	5		6.1		12.5	
Barium	mg/kg	84.3		239		88.5		45.1		61.5		91.9	
Beryllium	mg/kg	0.69		0.71						0.68			
Cadmium	mg/kg												
Calcium	mg/kg	5740		35300		35600		10300		3670		7720	
Chromium	mg/kg	14.7		9		17.7		13.3	J	20.4		20.8	
Cobalt	mg/kg	11.1		21.2		11.6		6.6		11.2		13.6	
Copper	mg/kg	22.6		34.5		23.3		12.6		14.5		25.8	
Iron	mg/kg	18000		34500		22500		14300		21900		23800	
Lead	mg/kg	8.6		13.2		10.4		12.3	J	7.8		12.2	
Magnesium	mg/kg	2480		12500		13900		5150		2590		5650	
Manganese	mg/kg	321		2230		706		234		315		521	
Mercury	mg/kg							0.04		0.045			
Nickel	mg/kg	27.2		57.2		32.5		14.6		25.6		32.2	
Potassium	mg/kg	777		2330		1790		1460	J	916		1630	
Selenium	mg/kg	0.84								0.69		0.82	
Sodium	mg/kg	1240		1080		1050							
Vanadium	mg/kg	19.1		30		26.6		23.1		27.3	J	26.2	J
Zinc	mg/kg	78.5		83.1		65.9		45.5		64.6		70.3	
Moisture Content													
% moisture	%	19		19.7		20.8		13.2		19.3		25	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP03						PRRP-DP04					
Sample No:		7280		7290				7320		7330		7340	
Sample Date:		8-Jun-98		8-Jun-98				9-Jun-98		9-Jun-98		9-Jun-98	
Depth (ft):		0-2		4-5		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	6330		9580				7030		6990		8040	
Antimony	mg/kg												
Arsenic	mg/kg	5.4		9.7				6.6		5.4		5.2	
Barium	mg/kg	65.7		67.9				37.2		39.4		50.5	
Beryllium	mg/kg												
Cadmium	mg/kg												
Calcium	mg/kg	2560		2600				2680		19800		61200	
Chromium	mg/kg	8.7		15.7				15.5		12.4		14.1	
Cobalt	mg/kg			6.3						7.4		9.8	
Copper	mg/kg	8.4		18.7				7		13.3		23.6	
Iron	mg/kg	14100		23700				16700		13900		18200	
Lead	mg/kg	9.3	J	11.6	J			4.3	J	9.8	J	10.3	J
Magnesium	mg/kg	1160		2810				1290		10700		19500	
Manganese	mg/kg	320		338				144		292		327	
Mercury	mg/kg												
Nickel	mg/kg	9.3		22.9				12.2		16.6		25.9	
Potassium	mg/kg			968						864		1580	
Selenium	mg/kg	0.59								0.64		1.1	
Sodium	mg/kg			3760									
Vanadium	mg/kg	17.3	J	23.9	J			28.5	J	19.7	J	23.7	J
Zinc	mg/kg	34.2		61.3				30.6		43.7		56.9	
Moisture Content													
% moisture	%	8.7		20.8				17.1		20.7		20.6	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP05						PRRWP-DP06					
Sample No:		7360R		7370		7380R		7400		7410		7420	
Sample Date:		25-Jun-98		14-Jun-98		25-Jun-98		8-Jun-98		8-Jun-98		8-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-5		9-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	6820		11300		9040		6110		8710		7260	
Antimony	mg/kg			9.3									
Arsenic	mg/kg	2.9		42.8		17.6		3.6		9.1		5.3	
Barium	mg/kg	27.6		128		115				57.3		44.9	
Beryllium	mg/kg			0.67									
Cadmium	mg/kg												
Calcium	mg/kg	1490		58500		57800		945		62300		43700	
Chromium	mg/kg	9.3		18.4		14.4		10.9		15.9		14.4	
Cobalt	mg/kg			19		10.2							
Copper	mg/kg	4.9		24.6		19.7		5.9		26.2		15.2	
Iron	mg/kg	9170		43700		22700		13700		24200		15300	
Lead	mg/kg	5.5		10.6		8		3.5	J	11.3	J	7.6	J
Magnesium	mg/kg	1010		17400		17100		885		16000		12600	
Manganese	mg/kg	127	J	797		731	J	166		430		321	
Mercury	mg/kg												
Nickel	mg/kg	7.4		40.1		23.8		9.4		22.9		17.6	
Potassium	mg/kg			2250		2190				1380		1190	
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	16.3	J	38.4	J	25.4	J	23.1	J	27.1	J	21.8	J
Zinc	mg/kg	24.9		104		52.1		22.6		68.9		45.5	
Moisture Content													
% moisture	%	11.6		20.8		20.4		15.8		18.4		20.3	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP07						PRRWP-DP08					
Sample No:		7440		7450		7460		7480		7490		7500	
Sample Date:		9-Jun-98		9-Jun-98		9-Jun-98		10-Jun-98		10-Jun-98		10-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	4120		8560		7960		4450		8700		7140	
Antimony	mg/kg												
Arsenic	mg/kg	2.5		6.3		6.5		4.2		12.9		4.2	
Barium	mg/kg			55.3		54.5				42.5		47.4	
Beryllium	mg/kg												
Cadmium	mg/kg												
Calcium	mg/kg	1420		62800		62000		1820		57000		52200	
Chromium	mg/kg	6.1		14.3		13		10.6		14.6		12.6	
Cobalt	mg/kg			13.1		9.8		6		9.8		7.9	
Copper	mg/kg	4.3		20.3		23.9		6.5		21.7		16.5	
Iron	mg/kg	8330		17500		20000		13400		19400		16000	
Lead	mg/kg	3.2	J	10.3	J	10.9	J	3.1	J	9.2	J	7.6	J
Magnesium	mg/kg	830		19100		19200		894		16800		15700	
Manganese	mg/kg	116		536		520		207		283		393	
Mercury	mg/kg												
Nickel	mg/kg	7		29.7		26.1		7.9		25.7		19.6	
Potassium	mg/kg			1720		1660				1820		1580	
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	12.9	J	24.4	J	22.9	J	24.4	J	24.1	J	21.3	J
Zinc	mg/kg	17.9		54.7		61.9		21.7		64.8		46.6	
Moisture Content													
% moisture	%	6.1		18.6		18.9		13.6		18.5		18	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP09						PRRWP-DP10					
Sample No:		7520R		7530R		7540R		7560		7570		7580	
Sample Date:		25-Jun-98		25-Jun-98		25-Jun-98		10-Jun-98		10-Jun-98		10-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-1		4-5		9-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	7220		4410		4630		4620		9510		11600	
Antimony	mg/kg												
Arsenic	mg/kg	2.4		2.6		6.3		3.4		5.6		14.9	
Barium	mg/kg	24.3				26.5				81.5		90.9	
Beryllium	mg/kg									0.83		0.77	
Cadmium	mg/kg												
Calcium	mg/kg	1750		63200		58500		2440		4620		4510	
Chromium	mg/kg	8.8		9.2		8.7		10.9		12.6		20.1	
Cobalt	mg/kg											10.2	
Copper	mg/kg	4.9		11.2		15.1		5.9		17.5		22.1	
Iron	mg/kg	8430		9480		10600		13700		16100		28700	
Lead	mg/kg	5.1		4.9		6.3		3.2	J	11.3	J	14.3	J
Magnesium	mg/kg	1110		16800		16900		920		2090		3970	
Manganese	mg/kg	102	J	184	J	273	J	273		230		484	
Mercury	mg/kg												
Nickel	mg/kg	6.3		8.4		15.5		9.6		11.4		30	
Potassium	mg/kg			1050		1200						1080	
Selenium	mg/kg					0.87				0.71			
Sodium	mg/kg									4130		4280	
Vanadium	mg/kg	15.8	J	20.9	J	17.5	J	23.6	J	22.1	J	31.6	J
Zinc	mg/kg	22.5		24.8		35.5		24.4		49.7		72.7	
Moisture Content													
% moisture	%	11.2		19.6		23		10.5		22.4		20.4	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP11						PRRWP-DP12					
Sample No:		7600		7610		7620		7640		7650		7660	
Sample Date:		13-Jun-98		13-Jun-98		13-Jun-98		11-Jun-98		11-Jun-98		11-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	6200		8950		11200		9560		12000		12300	
Antimony	mg/kg											7.8	J
Arsenic	mg/kg	7		25.3		5.3		7.3	J	5.7	J	7.4	J
Barium	mg/kg	39.4		209		51.5		71.5		60.3		69.5	
Beryllium	mg/kg			0.66				0.68					
Cadmium	mg/kg												
Calcium	mg/kg	17300		3380		61600		4310		37100		55600	
Chromium	mg/kg	11.2		11		19		14		19.7		20	
Cobalt	mg/kg	7.4		30.3		10.8		6.4		10.8		12	
Copper	mg/kg	10.1		13.1		23.3		10.4		26.7		25.4	
Iron	mg/kg	14700		36200		20800		16000		22300		23200	
Lead	mg/kg	7.9		9.8		9.9		9.6		10.7		10.6	
Magnesium	mg/kg	6390		2500		20500		1900		16600		19100	
Manganese	mg/kg	365		1640		457		337		306		521	
Mercury	mg/kg												
Nickel	mg/kg	14.4		26.8		30.1		12.1		31.6		30.9	
Potassium	mg/kg	849		1060		2580		684		2430		2730	
Selenium	mg/kg												
Sodium	mg/kg	741		1200		1520							
Vanadium	mg/kg	20.1	J	34.2	J	31	J	23.7		26.8		29.9	
Zinc	mg/kg	39.1		68.5		62.2		38.5		71.9		65.3	
Moisture Content													
% moisture	%	13.5		17.1		20.4		12.4		19.9		19.6	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP13						PRRWP-DP14					
Sample No:		7680		7690		7700		7720		7730		7740	
Sample Date:		12-Jun-98		12-Jun-98		12-Jun-98		11-Jun-98		11-Jun-98		11-Jun-98	
Depth (ft):		0-2		4-6		8-10				4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	7760		6380		5930		12700		9640		8710	
Antimony	mg/kg												
Arsenic	mg/kg	3.4		5.3		4.1		7.4		8.2		8.1	
Barium	mg/kg			29.2		42.4		49.6		39		64.8	
Beryllium	mg/kg							0.69					
Cadmium	mg/kg												
Calcium	mg/kg			2100		67100		3010		4340		53400	
Chromium	mg/kg	9.4		11.3		10.7		20.2		17.4		15.9	
Cobalt	mg/kg			7		7.2		8.3		8.4		10.3	
Copper	mg/kg	6.5		13.7		16.2		14.7		14.3		21.1	
Iron	mg/kg	11200		15400		13000		22900		20100		18700	
Lead	mg/kg	4.1		5.1		7.7		6.8		6.5		9.6	
Magnesium	mg/kg	938		1560		25300		2310		2940		21100	
Manganese	mg/kg	74.5		313		472		173		275		506	
Mercury	mg/kg							0.043					
Nickel	mg/kg	8.4		20.2		19.4		20.5		19.4		26.5	
Potassium	mg/kg					1330		771		713		1850	
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	19.8		19.1		21		35.2		27		25.2	
Zinc	mg/kg	23.1		40.6		43.7		46.1		41.2		57.3	
Moisture Content													
% moisture	%	10		17		17.2		19.3		17.3		17.8	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:						PRRWP-DP16					
Sample No:		7770		7780		7800		7810		7820	
Sample Date:		12-Jun-98		12-Jun-98		12-Jun-98		12-Jun-98		12-Jun-98	
Depth (ft):		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals											
Aluminum	mg/kg	8870		6010		7300		9850		9430	
Antimony	mg/kg										
Arsenic	mg/kg	15.9		6.9		5.4		9.7		4.8	
Barium	mg/kg	176		41.5		30.4		59.5		47.5	
Beryllium	mg/kg							0.55			
Cadmium	mg/kg										
Calcium	mg/kg	53300		67400		7980		3080		57600	
Chromium	mg/kg	5.2		11.6		11		17.5		16.8	
Cobalt	mg/kg	26.7		9				14.4		9.1	
Copper	mg/kg	24.6		19.3		11.2		21.7		24.3	
Iron	mg/kg	20500		18300		13300		22000		19300	
Lead	mg/kg	13.4		8.1		7.7	J	10.7	J	10.5	J
Magnesium	mg/kg	17200		20300		3100		4020		18100	
Manganese	mg/kg	2270		467		147		437		303	
Mercury	mg/kg										
Nickel	mg/kg	56.1		22.2		12		31.1		27	
Potassium	mg/kg	1380		1370				1210		1750	
Selenium	mg/kg										
Sodium	mg/kg			1030				1160		1090	
Vanadium	mg/kg	26.7		19.3		21.4	J	23.3	J	26.1	J
Zinc	mg/kg	59.7		52		37.4		67.2		64.2	
Moisture Content											
% moisture	%	19.4		17.9		18.8		9.4		20.2	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Sample Location:		PRRWP-DP17						PRRWP-DP18					
Sample No:		7840		7850		7860		7880		7890		7900	
Sample Date:		10-Jun-98		10-Jun-98		10-Jun-98		11-Jun-98		11-Jun-98		11-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	7140		5570		3320		10700		7340		9140	
Antimony	mg/kg												
Arsenic	mg/kg	2.3	J	3.1	J	4.5	J	4	J	27.3	J	5.8	J
Barium	mg/kg							32.3		41.8		66.2	
Beryllium	mg/kg												
Cadmium	mg/kg											0.63	
Calcium	mg/kg	817		1850		61500		1040		38400		61600	
Chromium	mg/kg	10.8		15.5		7.3		14.6		13.6		15.7	
Cobalt	mg/kg			7.3				6.2		8.7		10.6	
Copper	mg/kg	3.8		5.3		10.6		7.5		19		24.3	
Iron	mg/kg	13100		16400		8940		17800		20000		20600	
Lead	mg/kg	3.3		2.9		4.3		5.6		7.6		9.6	
Magnesium	mg/kg	791		917		16200		1120		12800		19200	
Manganese	mg/kg	104		323		252		158		300		534	
Mercury	mg/kg												
Nickel	mg/kg	6.4		8.1		11		9.8		21.5		29	
Potassium	mg/kg					726				1310		1990	
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	23.4		29.3		15		30.3		25.7		24.6	
Zinc	mg/kg	21.3		22.7		31.6		27.9		56.2		64.5	
Moisture Content													
% moisture	%	9.7		16.3		18.1		12.9		21.7		19.9	

Table 4-7

Summary of Detected Inorganic Compounds and Soil Moisture Content
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP19						PRRWP-DP20					
Sample No:		7920		7930		7940		7960		7970		7980	
Sample Date:		12-Jun-98		12-Jun-98		12-Jun-98		13-Jun-98		13-Jun-98		13-Jun-98	
Depth (ft):		0-2		4-6		8-10		0-2		4-6		8-10	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Metals													
Aluminum	mg/kg	2370		7060		9590		5360		7580		10800	
Antimony	mg/kg											7.7	
Arsenic	mg/kg	14.1		4.7		4.9		3.6		4.7		5.5	
Barium	mg/kg	33.6		51.2		61				58.2		69.3	
Beryllium	mg/kg												
Cadmium	mg/kg												
Calcium	mg/kg	54000		56900		68000		2160		61900		70400	
Chromium	mg/kg	4.2		12.5		15.7		11.4		13.1		17	
Cobalt	mg/kg			8.7		9.4		5.8		9.3		11.3	
Copper	mg/kg	10.6		19.1		22.4		7.2		18.3		20.1	
Iron	mg/kg	15900		16200		19900		16000		18000		22500	
Lead	mg/kg	3.2		8.5		9.4		3.2		9		9.7	
Magnesium	mg/kg	11500		22500		21300		999		24600		20200	
Manganese	mg/kg	658		495		512		262		527		513	
Mercury	mg/kg												
Nickel	mg/kg	11.6		22.8		26.1		9.3		24		29.6	
Potassium	mg/kg			1490		2330				1610		2640	
Selenium	mg/kg												
Sodium	mg/kg												
Vanadium	mg/kg	13.2		21.4		26.2		27.6	J	23.8	J	28.6	J
Zinc	mg/kg	26.8		52.8		60.5		26		50.6		69.5	
Moisture Content													
% moisture	%	8.9		17.1		17.6		13.5		18.1		18.7	

Table 4-8

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

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Sample Location:		PRRWP-DP01		PRRWP-DP03		PRRWP-DP04		PRRWP-DP05	
Sample No:		7230		7310		7350		7390	
Sample Date:		12-Jun-98		8-Jun-98		9-Jun-98		14-Jun-98	
Depth (ft):		0-0		0-0		12-Aug		0-0	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds									
2-Butanone	µg/L			24	J				
2-Hexanone	µg/L			1.8	J				
Acetone	µg/L			20	J				
Benzene	µg/L			0.14	J				
Carbon disulfide	µg/L					0.26	J		
Ethylbenzene	µg/L			0.19	J				
Tetrachloroethene	µg/L			0.22	J			0.26	J
Total xylenes	µg/L			0.88	J				
Trichloroethene	µg/L								
Semivolatile Organic Compounds									
2,4-Dinitrophenol	µg/L	8.3	J	5800	D				
2,4-Dinitrotoluene	µg/L	20		9200	D				
2,6-Dinitrotoluene	µg/L	3.3	J	550					
2-Nitroaniline	µg/L	3.2	J						
2-Nitrophenol	µg/L								
3-Nitroaniline	µg/L	88							
4,6-Dinitro-2-methylphenol	µg/L			2300					
4-Nitrophenol	µg/L			290	J				
Naphthalene	µg/L							1.9	J
bis(2-Ethylhexyl)phthalate	µg/L								
Nitroaromatic Compounds									
1,3,5-Trinitrobenzene	µg/L								
1,3-Dinitrobenzene	µg/L			4800		0.28			
2,4-Dinitrotoluene	µg/L	10		6800		0.47			
2,6-Dinitrotoluene	µg/L								
Tetryl	µg/L								

Table 4-8

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 4)

		Sample Location:	PRRWP-DP06		PRRWP-DP07		PRRWP-DP08		PRRWP-DP10	
		Sample No:	7430		7470		7510		7590	
		Sample Date:	9-Jun-98		10-Jun-98		10-Jun-98		10-Jun-98	
		Depth (ft):	0-0		0-0		0-0		0-0	
Parameter	Units	RBC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds										
2-Butanone	µg/L	190								
2-Hexanone	µg/L	150								
Acetone	µg/L	370								
Benzene	µg/L	0.36								
Carbon disulfide	µg/L	100					0.16	J		
Ethylbenzene	µg/L	130								
Tetrachloroethene	µg/L	1.1			0.17	J				
Total xylenes	µg/L	1200								
Trichloroethene	µg/L	1.6			0.43	J	0.16	J		
Semivolatile Organic Compounds										
2,4-Dinitrophenol	µg/L	7.3							5900	D
2,4-Dinitrotoluene	µg/L	7.3					2.8	J	4100	D
2,6-Dinitrotoluene	µg/L	3.7							390	
2-Nitroaniline	µg/L	NE								
2-Nitrophenol	µg/L	NE								
3-Nitroaniline	µg/L	NE								
4,6-Dinitro-2-methylphenol	µg/L	0.37							1700	
4-Nitrophenol	µg/L	29							210	J
Naphthalene	µg/L	150								
bis(2-Ethylhexyl)phthalate	µg/L	4.8								
Nitroaromatic Compounds										
1,3,5-Trinitrobenzene	µg/L	110								
1,3-Dinitrobenzene	µg/L	0.37	10		0.42		1.2		2100	
2,4-Dinitrotoluene	µg/L	7.3	31		0.82		1.4		2200	
2,6-Dinitrotoluene	µg/L	3.7	5.1				0.28		400	
Tetryl	µg/L	37								

Table 4-8

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 4)

		Sample Location:	PRRWP-DP11		PRRWP-DP12		PRRWP-DP13		PRRWP-DP14		PRRWP-DP15	
		Sample No:	7630		7670		7710		7750		7790	
		Sample Date:	14-Jun-98		11-Jun-98		12-Jun-98		12-Jun-98		12-Jun-98	
		Depth (ft):	0-0		0-0		0-0		0-0		0-0	
Parameter	Units	RBC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds												
2-Butanone	µg/L	190										
2-Hexanone	µg/L	150										
Acetone	µg/L	370										
Benzene	µg/L	0.36										
Carbon disulfide	µg/L	100			0.16	J						
Ethylbenzene	µg/L	130										
Tetrachloroethene	µg/L	1.1										
Total xylenes	µg/L	1200										
Trichloroethene	µg/L	1.6										
Semivolatile Organic Compounds												
2,4-Dinitrophenol	µg/L	7.3										
2,4-Dinitrotoluene	µg/L	7.3	380	J					2.5	J	80	J
2,6-Dinitrotoluene	µg/L	3.7										
2-Nitroaniline	µg/L	NE										
2-Nitrophenol	µg/L	NE										
3-Nitroaniline	µg/L	NE										
4,6-Dinitro-2-methylphenol	µg/L	0.37									830	J
4-Nitrophenol	µg/L	29										
Naphthalene	µg/L	150										
bis(2-Ethylhexyl)phthalate	µg/L	4.8			10				3.2	J		
Nitroaromatic Compounds												
1,3,5-Trinitrobenzene	µg/L	110	600									
1,3-Dinitrobenzene	µg/L	0.37	840		1.3		1.6					
2,4-Dinitrotoluene	µg/L	7.3	150		2.3		2.4					
2,6-Dinitrotoluene	µg/L	3.7			0.35		0.36					
Tetryl	µg/L	37					0.2					

Table 4-8

Volatile Organic, Semivolatile Organic, and Nitroaromatic Analytical Results in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 4 of 4)

		Sample Location:	PRRWP-DP16		PRRWP-DP17		PRRWP-DP18		PRRWP-DP19	
		Sample No:	7830		7870		7910		7950	
		Sample Date:	13-Jun-98		11-Jun-98		12-Jun-98		13-Jun-98	
		Depth (ft):	0-0		0-0		0-0		0-0	
Parameter	Units	RBC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Volatile Organic Compounds										
2-Butanone	µg/L	190								
2-Hexanone	µg/L	150								
Acetone	µg/L	370								
Benzene	µg/L	0.36								
Carbon disulfide	µg/L	100								
Ethylbenzene	µg/L	130								
Tetrachloroethene	µg/L	1.1							0.13	J
Total xylenes	µg/L	1200								
Trichloroethene	µg/L	1.6								
Semivolatile Organic Compounds										
2,4-Dinitrophenol	µg/L	7.3	22	J						
2,4-Dinitrotoluene	µg/L	7.3	35		1.5	J			2.3	J
2,6-Dinitrotoluene	µg/L	3.7	6.2	J						
2-Nitroaniline	µg/L	NE	1.3	J						
2-Nitrophenol	µg/L	NE	2.1	J						
3-Nitroaniline	µg/L	NE								
4,6-Dinitro-2-methylphenol	µg/L	0.37								
4-Nitrophenol	µg/L	29	5	J						
Naphthalene	µg/L	150								
bis(2-Ethylhexyl)phthalate	µg/L	4.8								
Nitroaromatic Compounds										
1,3,5-Trinitrobenzene	µg/L	110								
1,3-Dinitrobenzene	µg/L	0.37			6.4		1.1			
2,4-Dinitrotoluene	µg/L	7.3			8.9		2.4			
2,6-Dinitrotoluene	µg/L	3.7			1.7		0.36			
Tetryl	µg/L	37								

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 1 of 8)

Sample Location:		PRRWP-DP01		PRRWP-DP02		PRRWP-DP03		PRRWP-DP04		PRRWP-DP05	
Sample No:		7230		7270		7310		7350		7390	
Sample Date:		12-Jun-98		14-Jun-98		8-Jun-98		9-Jun-98		14-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Total Metals (Unfiltered)											
Aluminum	µg/L	52900		52200		88400		3E+05		32700	
Antimony	µg/L										
Arsenic	µg/L			63.3				305	J	53.9	
Barium	µg/L							1680			
Beryllium	µg/L										
Cadmium	µg/L										
Calcium	µg/L	4E+05		221000		683000		2E+06		6E+05	
Chromium	µg/L	112		113		208		561		82.6	
Cobalt	µg/L					2610					
Copper	µg/L	277				1410		669			
Iron	µg/L	1E+05		100000		200000		7E+05		98200	
Lead	µg/L	58.3	J	42.6		96.7	J	292	J	48.4	
Magnesium	µg/L	1E+05		66300		172000		6E+05		2E+05	
Manganese	µg/L	4040		1120		39600		12400		3240	
Mercury	µg/L			0.23				0.55			
Nickel	µg/L					2380		740			
Potassium	µg/L							31500			
Sodium	µg/L	8E+05		266000		5930000				1E+05	
Vanadium	µg/L							821			
Zinc	µg/L	374		299		597		2010		279	

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 2 of 8)

Sample Location:		PRRWP-DP01		PRRWP-DP02		PRRWP-DP03		PRRWP-DP04		PRRWP-DP05	
Sample No:		7230		7270		7310		7350		7390	
Sample Date:		12-Jun-98		14-Jun-98		8-Jun-98		9-Jun-98		14-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Dissolved Metals (Filtered)											
Arsenic	µg/L							13.4			
Barium	µg/L										
Calcium	µg/L	2E+05		193000		542000		90900		3E+05	
Chromium	µg/L										
Cobalt	µg/L					3090					
Copper	µg/L					1600					
Iron	µg/L			150		7480		166			
Lead	µg/L										
Magnesium	µg/L	52800		44400		139000		25300		96100	
Manganese	µg/L	1680		257		42700		39.3		818	
Nickel	µg/L					2760					
Sodium	µg/L	1E+06		288000		7260000				1E+05	
Zinc	µg/L							21.6			
Cyanide											
Cyanide, total	µg/L					780					
Water Quality Parameters											
Alkalinity	µg/L			450000		1500000		3E+05			
Hardness	µg/L			780000		3400000		9E+05			
Total suspended	µg/L					110000					
Total dissolved so	µg/L			1E+06		1.5E+07		4E+05			
Total organic carb	µg/L			19300		6600000					
Chloride	µg/L			9800				2300			
Nitrate	µg/L					465000					
Sulfate	µg/L			574000		1E+07		22700			

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 3 of 8)

Sample Location:		PRRWP-DP07		PRRWP-DP08		PRRWP-DP09		PRRWP-DP10		PRRWP-DP11	
Sample No:		7470		7510		7550		7590		7630	
Sample Date:		10-Jun-98		10-Jun-98		14-Jun-98		10-Jun-98		14-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Total Metals (Unfiltered)											
Aluminum	µg/L	69000		178000		56800		78300		4820	
Antimony	µg/L			118	J						
Arsenic	µg/L			259	J						
Barium	µg/L	556		1210							
Beryllium	µg/L			8.8							
Cadmium	µg/L			6.5							
Calcium	µg/L	7E+05		863000		9E+05		662000		8E+05	
Chromium	µg/L	114		273		141		223			
Cobalt	µg/L	77.6		208				5610		3360	
Copper	µg/L	194		472		438		2800		1530	
Iron	µg/L	2E+05		468000		1E+05		202000		15500	
Lead	µg/L	86.2	J	323	J	67.1					
Magnesium	µg/L	2E+05		253000		2E+05		326000		2E+05	
Manganese	µg/L	4310		11800		4050		55100		35300	
Mercury	µg/L			0.2		0.29					
Nickel	µg/L	191		521		407		5040		1950	
Potassium	µg/L	12300		22700							
Sodium	µg/L	7060				7E+05		9410000		4E+06	
Vanadium	µg/L	212		438							
Zinc	µg/L	525		1550		441		736			

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 4 of 8)

Sample Location:		PRRWP-DP07		PRRWP-DP08		PRRWP-DP09		PRRWP-DP10		PRRWP-DP11	
Sample No:		7470		7510		7550		7590		7630	
Sample Date:		10-Jun-98		10-Jun-98		14-Jun-98		10-Jun-98		14-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Dissolved Metals (Filtered)											
Arsenic	µg/L	11									
Barium	µg/L										
Calcium	µg/L	66500		58000		3E+05		681000		7E+05	
Chromium	µg/L									495	
Cobalt	µg/L							6660		3030	
Copper	µg/L					311		3260		2000	
Iron	µg/L	190		116				15300		5870	
Lead	µg/L					31.5					
Magnesium	µg/L	15800		12900		73600		348000		2E+05	
Manganese	µg/L	71.4				1120		62400		31300	
Nickel	µg/L							5820		1970	
Sodium	µg/L	5490				8E+05		1.3E+07		3E+06	
Zinc	µg/L	77.7		26.5				225		1100	
Cyanide											
Cyanide, total	µg/L					23				400	
Water Quality Parameters											
Alkalinity	µg/L					5E+05				9E+05	
Hardness	µg/L					2E+06				2E+06	
Total suspended	µg/L					12000				34000	
Total dissolved so	µg/L					4E+06				2E+07	
Total organic carb	µg/L					7E+05				3E+06	
Chloride	µg/L										
Nitrate	µg/L					16900				4E+05	J
Sulfate	µg/L					1E+06				4E+06	

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

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Sample Location:		PRRWP-DP12		PRRWP-DP13		PRRWP-DP14		PRRWP-DP15		PRRWP-DP16	
Sample No:		7670		7710		7750		7790		7830	
Sample Date:		11-Jun-98		12-Jun-98		12-Jun-98		12-Jun-98		13-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Total Metals (Unfiltered)											
Aluminum	µg/L	2E+05		7220		7970				15500	
Antimony	µg/L	105	J								
Arsenic	µg/L	238	J	11.1	J						
Barium	µg/L	896									
Beryllium	µg/L	8.5									
Cadmium	µg/L										
Calcium	µg/L	9E+05		249000		281000				3E+05	
Chromium	µg/L	277		16		105					
Cobalt	µg/L	172								668	
Copper	µg/L	515		27.7						510	
Iron	µg/L	4E+05		18800		27500				40200	
Lead	µg/L	202	J	9.5	J	38.1	J	33	J		
Magnesium	µg/L	3E+05		71900		83800				88000	
Manganese	µg/L	6460		496		927				2080	
Mercury	µg/L	0.32									
Nickel	µg/L	490								468	
Potassium	µg/L	21600									
Sodium	µg/L	5960		29700		79400				1E+06	
Vanadium	µg/L	391		52.3		877		1000			
Zinc	µg/L	1350		76							

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 6 of 8)

Sample Location:		PRRWP-DP12		PRRWP-DP13		PRRWP-DP14		PRRWP-DP15		PRRWP-DP16	
Sample No:		7670		7710		7750		7790		7830	
Sample Date:		11-Jun-98		12-Jun-98		12-Jun-98		12-Jun-98		13-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Dissolved Metals (Filtered)											
Arsenic	µg/L										
Barium	µg/L										
Calcium	µg/L	98800		189000		405000		8E+05		2E+05	
Chromium	µg/L										
Cobalt	µg/L							1290		784	
Copper	µg/L							531		568	
Iron	µg/L	125		237		2400		3240		1950	
Lead	µg/L										
Magnesium	µg/L	25100		53800		143000		3E+05		67700	
Manganese	µg/L	150		108		454		1460		1700	
Nickel	µg/L							2370		441	
Sodium	µg/L			33500		256000		3E+06		1E+06	
Zinc	µg/L										
Cyanide											
Cyanide, total	µg/L										
Water Quality Parameters											
Alkalinity	µg/L										
Hardness	µg/L										
Total suspended	µg/L										
Total dissolved so	µg/L										
Total organic carb	µg/L										
Chloride	µg/L										
Nitrate	µg/L										
Sulfate	µg/L										

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 7 of 8)

Sample Location:		PRRWP-DP17		PRRWP-DP18		PRRWP-DP19		PRRWP-DP20	
Sample No:		7870		7910		7950		7990	
Sample Date:		11-Jun-98		12-Jun-98		13-Jun-98		14-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Total Metals (Unfiltered)									
Aluminum	µg/L	38600				118000		13400	
Antimony	µg/L					77.8	J		
Arsenic	µg/L			584	J	122	J	31.3	
Barium	µg/L	218				1020			
Beryllium	µg/L					5.5			
Cadmium	µg/L								
Calcium	µg/L	1E+06				787000		300000	
Chromium	µg/L	65.8				176		26.9	
Cobalt	µg/L					140			
Copper	µg/L	106				334		33.2	
Iron	µg/L	87000				266000		31500	
Lead	µg/L			320	J	142	J	21.6	
Magnesium	µg/L	3E+05				240000		75900	
Manganese	µg/L	3280				5940		1220	
Mercury	µg/L			0.25					
Nickel	µg/L	113				338			
Potassium	µg/L	6430				20800			
Sodium	µg/L	6010				14500		6480	
Vanadium	µg/L	163		101		288		76.5	
Zinc	µg/L	341				799		151	

Table 4-9

Summary of Detected Inorganic Constituents in Groundwater
Pentolite Road
Red Water Ponds, PBOW, Sandusky Ohio

(Page 8 of 8)

Sample Location:		PRRWP-DP17		PRRWP-DP18		PRRWP-DP19		PRRWP-DP20	
Sample No:		7870		7910		7950		7990	
Sample Date:		11-Jun-98		12-Jun-98		13-Jun-98		14-Jun-98	
Parameter	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Dissolved Metals (Filtered)									
Arsenic	µg/L					22.9		16.9	
Barium	µg/L					237			
Calcium	µg/L	55000		244000		63400		58800	
Chromium	µg/L								
Cobalt	µg/L								
Copper	µg/L								
Iron	µg/L			1260		119		456	
Lead	µg/L								
Magnesium	µg/L	13200		80300		16400		14300	
Manganese	µg/L	22.4		252		28.4		78.4	
Nickel	µg/L								
Sodium	µg/L			140000		11500		6810	
Zinc	µg/L	28.7							
Cyanide									
Cyanide, total	µg/L								
Water Quality Parameters									
Alkalinity	µg/L							155000	
Hardness	µg/L							670000	
Total suspended	µg/L							6000	
Total dissolved so	µg/L							276000	
Total organic carb	µg/L							1800	
Chloride	µg/L							2300	
Nitrate	µg/L								
Sulfate	µg/L							24700	

µg/L = Micrograms per liter.
VQ = Validation qualifier.

Table 4-10

Summary of Detected Constituents in Surface Water and Sediment Samples
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Surface Water Samples									
		PRRP-SW01 12160 5-Nov-98		PRRP-SW02 12170 5-Nov-98		PRRP-SW03 12180 5-Nov-98		PRRP-SW04 12190 5-Nov-98	
Parameter	Units	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.
Organic Compounds									
Acetone	µg/L	2.5	B	1.7	B	2.5	B	1.2	B
bis(2-Ethylhexyl)phthalate	µg/L			2.1	B				
Bromodichloromethane	µg/L	0.72	J						
Bromomethane	µg/L	0.17	J	0.11	J				
Chloroform	µg/L	3.5	B	0.55	B				
Dibromochloromethane	µg/L	0.21	J						
Phenol	µg/L	2.2	B	1.9	B	2.3	B		
Total Metals									
Aluminum	µg/L	778	J	530	J	3040	J		
Calcium	µg/L	74200		71700		118000		97900	
Iron	µg/L	1420		972		5790		948	
Magnesium	µg/L	16000		15800		37300		36800	
Manganese	µg/L	245		261		404		67.1	
Sodium	µg/L	24900		24700		13700		14800	
Zinc	µg/L					58		20.2	
Dissolved Metals									
Aluminum	µg/L	463		874		10200			
Barium	µg/L					215			
Calcium	µg/L	74000		71400		179000		98100	
Chromium	µg/L					17.2			
Iron	µg/L	809		1260		16800		550	
Lead	µg/L					8.7			
Magnesium	µg/L	15700		15800		46700		36900	
Manganese	µg/L	144		249		649		34.4	
Potassium	µg/L					7130			
Sodium	µg/L	25700		24500		15000		15300	
Vanadium	µg/L					53.9			
Zinc	µg/L					145			
Hardness									
Hardness	µg/L	328000		284000		488000		432000	

Table 4-10

Summary of Detected Constituents in Surface Water and Sediment Samples
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

		Sediment Samples							
		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
		11160		11170		11180		11190	
		5-Nov-98		5-Nov-98		5-Nov-98		5-Nov-98	
		0 - 0.5 ft		0 - 0.5 ft		0 - 0.5 ft		0 - 0.5 ft	
Parameter	Units	Result	V.Q.	Result	V.Q.	Result	V.Q.	Result	V.Q.
Organic Compounds									
2-Butanone	mg/kg	0.011	J			0.01	J		
Acenaphthene	mg/kg			0.11	J				
Acetone	mg/kg	0.051	J			0.049	J		
Anthracene	mg/kg			0.077	J			0.029	J
Benzo(a)anthracene	mg/kg							0.084	J
Benzo(a)pyrene	mg/kg							0.096	J
Benzo(b)fluoranthene	mg/kg							0.1	J
Benzo(ghi)perylene	mg/kg							0.053	J
Benzo(k)fluoranthene	mg/kg							0.084	J
Carbazole	mg/kg			0.18	J				
Chrysene	mg/kg							0.11	J
Dibenzofuran	mg/kg			0.06	J				
Fluoranthene	mg/kg			0.14	J			0.23	J
Fluorene	mg/kg			0.11	J				
Indeno(1,2,3-cd)pyrene	mg/kg							0.054	J
Phenanthrene	mg/kg			0.32	J			0.12	J
Pyrene	mg/kg			0.11	J			0.16	J
Metals									
Aluminum	mg/kg	6020		2830		5130		3400	
Arsenic	mg/kg	4.5		5.1		4.3		4.4	
Barium	mg/kg	53.4				48.1		30.9	
Calcium	mg/kg	96000		46300		62000		8110	
Chromium	mg/kg	11.5		6.3		10.4		6.8	
Copper	mg/kg	17.9		7.6		14.5		7.4	
Iron	mg/kg	16200		9620		13700		9330	
Lead	mg/kg	12.8		4.8		7.8		5.6	
Magnesium	mg/kg	10700		19300		13500		2710	
Manganese	mg/kg	865		421		404		104	
Nickel	mg/kg	18.6		9.5		17.9		10.4	
Potassium	mg/kg					1040			
Vanadium	mg/kg	17.4		12.9		14.2		7.9	
Zinc	mg/kg	73.3		23.2		58.4		42.1	
Total Organic Carbon									
Total organic carbon	mg/kg	33000		5450		17000		12000	J

Table 5-1

Background Concentrations of Metals in Soil
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UTL [a]	Background Screening Criterion [b]
Aluminum	12 / 12	3520 - 15500	NA	L	8.43E+03	2.69E+04	2.69E+04
Antimony	9 / 25	5.9 - 9.3	5.4 - 74	NP	4.68E+00	NA	9.30E+00
Arsenic	23 / 26	2.1 - 36.5	1.2 - 3.7	L	1.08E+01	7.10E+01	7.10E+01
Barium	9 / 12	35.6 - 826	23.2 - 24.7	L	1.16E+02	1.30E+03	1.30E+03
Beryllium	6 / 25	0.57 - 1	0.57 - 1.2	L	5.65E-01	1.17E+00	1.17E+00
Cadmium	0 / 25	NA	0.57 - 1.2	NP	4.49E-01	NA	NA
Chromium	25 / 26	4.4 - 29	12.3 - 12.3	NP	1.34E+01	NA	2.90E+01
Cobalt	9 / 12	9.6 - 116	5.8 - 6.2	L	2.26E+01	2.48E+02	2.48E+02
Copper	23 / 26	2.3 - 56.2	2.2 - 2.9	L	1.70E+01	1.47E+02	1.47E+02
Iron	12 / 12	5880 - 234000	NA	L	4.01E+04	3.58E+05	3.58E+05
Lead	26 / 26	1.9 - 48.6	NA	L	1.28E+01	5.13E+01	5.13E+01
Manganese	26 / 26	21 - 13300	NA	L	7.29E+02	3.51E+03	3.51E+03
Mercury	2 / 26	0.085 - 0.085	0.037 - 0.3	L	9.06E-02	5.60E-01	5.60E-01
Nickel	26 / 26	5.4 - 55.1	NA	L	2.28E+01	7.79E+01	7.79E+01
Selenium	5 / 25	0.61 - 2	0.57 - 4.9	NP	1.55E+00	NA	2.00E+00
Silver	2 / 26	1.1 - 11.1	1.1 - 1.3	NP	1.00E+00	NA	1.11E+01
Thallium	2 / 25	1.2 - 1.3	1.1 - 6.1	NP	1.91E+00	NA	1.30E+00
Vanadium	11 / 12	9 - 40.9	61.7 - 61.7	L	2.48E+01	8.31E+01	8.31E+01
Zinc	26 / 26	6.6 - 655	NA	L	7.30E+01	3.22E+02	3.22E+02

NA = Not applicable; not available.

[a] 95% UTL = 95% upper tolerance limit calculated as described in Section 2.1.3 and rounded to 3 significant figures.

[b] The maximum detected concentration is used as the background screening criterion for nonparametric data sets.

Note: Reporting limits from sample 6990 were deleted when calculating the mean and UTL for antimony, beryllium, cadmium, selenium and thallium, because the reporting limits were elevated by dilution factors.

Table 5-2

Background Concentrations of Metals in Surface Water
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (μg/L)	Frequency of Detection	Range of Detected Concentration	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	Background Screening Criterion [b]
Inorganics (unfiltered)						
Aluminum	3 / 4	530 - 3040	200 - 200	NA	1.08E+03	3.04E+03
Calcium	4 / 4	71700 - 118000	5000 - 5000	NA	1.01E+05	Nutrient
Iron	4 / 4	126 - 5790	100 - 100	NA	2.05E+03	Nutrient
Magnesium	4 / 4	15800 - 37300	5000 - 5000	NA	2.64E+04	Nutrient
Manganese	4 / 4	30.6 - 890	15 - 15	NA	3.96E+02	8.90E+02
Potassium	2 / 4	9400 - 9730	5000 - 5000	NA	7.28E+03	Nutrient
Sodium	4 / 4	13700 - 39300	5000 - 5000	NA	2.90E+04	Nutrient
Zinc	2 / 4	27 - 58	20 - 20	NA	2.88E+01	5.80E+01

[a] Insufficient number of samples (less than 5), to determine statistical distribution or calculate an upper tolerance limit.
[b] The maximum detected concentration is used as the background screening criterion.

Table 5-3

Background Concentrations of Metals in Sediment
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentration	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	Background Screening Criterion [b]
Inorganics						
Aluminum	4 / 4	2450 - 6020	24.1 - 52.4	NA	3.76E+03	6.02E+03
Arsenic	4 / 4	3.5 - 5.4	1.2 - 2.6	NA	4.45E+00	5.40E+00
Barium	3 / 4	26.6 - 53.4	24.1 - 52.4	NA	3.07E+01	5.34E+01
Calcium	4 / 4	8110 - 96000	603 - 1310	NA	3.22E+04	Nutrient
Chromium	4 / 4	5.3 - 11.5	1.2 - 2.6	NA	7.58E+00	1.15E+01
Cobalt	2 / 4	6.4 - 10.9	6 - 13.1	NA	9.25E+00	1.09E+01
Copper	4 / 4	7.4 - 17.9	3 - 6.5	NA	1.20E+01	1.79E+01
Iron	4 / 4	9330 - 16200	12.1 - 26.2	NA	1.26E+04	Nutrient
Lead	4 / 4	5.6 - 12.8	0.36 - 0.79	NA	8.65E+00	1.28E+01
Magnesium	4 / 4	2110 - 10700	603 - 1310	NA	4.56E+03	Nutrient
Manganese	4 / 4	104 - 865	1.8 - 3.9	NA	3.76E+02	8.65E+02
Nickel	4 / 4	10.4 - 23	4.8 - 10.5	NA	1.64E+01	2.30E+01
Vanadium	2 / 4	7.9 - 17.4	6 - 13.1	NA	7.85E+00	1.74E+01
Zinc	4 / 4	35.1 - 73.3	2.4 - 5.2	NA	4.96E+01	7.33E+01

[a] Insufficient number of samples (less than 5), to determine statistical distribution or calculate an upper tolerance limit.
[b] The maximum detected concentration is used as the background screening criterion.

Table 5-4

Statistical Summary and COPC Selection of Surface Soil[a] Sample Analyses, West Area Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]		COPC? [e,f]	Source Term Concentration
Inorganics											
ALUMINUM	19 / 19	4720 - 20600	22.4 - 27.7	N	1.12E+04	1.30E+04	2.69E+04	7.60E+03		Y (b)	1.30E+04
ANTIMONY	2 / 40	7.4 - 7.4	5.4 - 8.3	NP	3.44E+00		9.30E+00	3.10E+01		N (a)	--
ARSENIC	36 / 40	2 - 11.5	1.1 - 4.3	NP	5.21E+00	6.08E+00	7.10E+01	3.90E-02		Y (b)	6.08E+00
BARIUM	16 / 19	24.8 - 130	22.4 - 27.7	N	6.45E+01		1.30E+03	5.40E+02		N (a)	--
BERYLLIUM	10 / 40	0.59 - 1.2	0.56 - 1.4	NP	5.72E-01		1.17E+00	1.50E+01		N (a)	--
CADMIUM	1 / 40	0.59 - 0.59	0.56 - 1.4	NP	4.60E-01			3.70E+00		N (a)	--
CALCIUM	19 / 19	757 - 58600	559 - 693	NP	9.64E+03			Nutrient		N (b)	--
CHROMIUM	40 / 40	5.4 - 35	1.1 - 1.4	L	1.67E+01	1.87E+01	2.90E+01	2.10E+01	g	Y (a)	1.87E+01
COBALT	13 / 19	8.5 - 17.9	5.6 - 6.9	NP	9.83E+00		2.48E+02	4.70E+02		N (a)	--
COPPER	36 / 40	2.4 - 30.9	2.2 - 3.5	L	9.62E+00		1.47E+02	2.90E+02		N (a)	--
IRON	19 / 19	7190 - 36000	11.2 - 13.9	N	1.91E+04			Nutrient		N (b)	--
LEAD	40 / 40	2.2 - 23	0.34 - 3.6	N	1.20E+01		5.13E+01	4.00E+02		N (a)	--
MAGNESIUM	18 / 19	684 - 12200	559 - 693	L	3.89E+03			Nutrient		N (b)	--
MANGANESE	40 / 40	89.6 - 1340	1.7 - 5.8	L	4.69E+02	6.02E+02	3.51E+03	1.80E+02		Y (b)	6.02E+02
MERCURY	4 / 40	0.04 - 0.1	0.037 - 0.36	NP	9.18E-02		5.60E-01	2.30E+00		N (a)	--
NICKEL	40 / 40	7.1 - 46.9	2.2 - 5.5	L	2.14E+01		7.79E+01	1.60E+02		N (a)	--
POTASSIUM	14 / 19	742 - 2970	559 - 693	N	1.43E+03			Nutrient		N (b)	--
SELENIUM	1 / 40	0.65 - 0.65	0.56 - 5.8	NP	1.41E+00		2.00E+00	3.90E+01		N (a)	--
SODIUM	1 / 19	681 - 681	559 - 693	NP	3.13E+02			Nutrient		N (b)	--
VANADIUM	19 / 19	10.1 - 40.5	5.6 - 6.9	L	2.53E+01		8.31E+01	5.50E+01		N (a)	--
ZINC	39 / 40	15.9 - 111	2.2 - 2.9	N	5.87E+01		3.22E+02	2.30E+03		N (a)	--
Nitroaromatics											
4-AMINO-2,6-DINITROTOLUENE	1 / 40	0.3 - 0.3	0.25 - 0.25	NP	1.29E-01			3.70E-01	h	N (a)	--
2,4-DINITROTOLUENE	4 / 40	0.3 - 0.4	0.25 - 0.25	NP	1.43E-01	4.00E-01		7.20E-02	i	Y (a)	4.00E-01
1,3,5-TRINITROBENZENE	3 / 40	0.3 - 0.7	0.25 - 0.25	NP	1.56E-01			1.80E+02		N (a)	--
2,4,6-TRINITROTOLUENE	1 / 40	0.3 - 0.3	0.25 - 0.25	NP	1.29E-01			1.60E+00		N (a)	--
Semivolatile Organics											
2,4-Dinitrotoluene-svoc	10	0.043 0.043	0.37 0.4	NP	1.76E-01			7.20E-02	k	N (a)	--
ACENAPHTHYLENE	1 / 10	0.041 - 0.041	0.37 - 0.4	NP	1.77E-01			3.70E+02	h	N (a)	--
ANTHRACENE	1 / 10	0.23 - 0.23	0.37 - 0.4	NP	1.96E-01			2.20E+03		N (a)	--
BENZO(A)ANTHRACENE	1 / 10	0.4 - 0.4	0.37 - 0.4	NP	2.13E-01	4.00E-01		6.20E-02		Y (a)	4.00E-01
BENZO(A)PYRENE	1 / 10	0.39 - 0.39	0.37 - 0.4	NP	2.12E-01	3.90E-01		6.20E-03		Y (a)	3.90E-01
BENZO(B)FLUORANTHENE	1 / 10	0.3 - 0.3	0.37 - 0.4	NP	2.03E-01	3.00E-01		6.20E-02		Y (a)	3.00E-01
BENZO(GHI)PERYLENE	1 / 10	0.22 - 0.22	0.37 - 0.4	NP	1.95E-01			2.30E+02	h	N (a)	--
BENZO(K)FLUORANTHENE	1 / 10	0.35 - 0.35	0.37 - 0.4	NP	2.08E-01			6.20E-01		N (a)	--

Table 5-4

Statistical Summary and COPC Selection of Surface Soil[a] Sample Analyses, West Area Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
CHRYSENE	1 / 10	0.42 - 0.42	0.37 - 0.4	NP	2.15E-01			6.20E+00	N (a)	--
FLUORANTHENE	1 / 10	0.76 - 0.76	0.37 - 0.4	NP	2.49E-01			2.30E+02	N (a)	--
INDENO(1,2,3-CD)PYRENE	1 / 10	0.23 - 0.23	0.37 - 0.4	NP	1.96E-01	2.30E-01		6.20E-02	Y (a)	2.30E-01
PHENANTHRENE	1 / 10	0.36 - 0.36	0.37 - 0.4	NP	2.09E-01			2.30E+02 h	N (a)	--
PYRENE	1 / 10	0.55 - 0.55	0.37 - 0.4	NP	2.28E-01			2.30E+02	N (a)	--
Volatile Organics										
ACETONE	1 / 10	0.035 - 0.035	0.022 - 0.024	NP	1.40E-02			1.60E+02	N (a)	--
METHYLENE CHLORIDE	3 / 10	0.00185 - 0.0023	0.0056 0.006	L	1.50E-03			8.90E-01	N (a)	--
TOLUENE	3 / 10	0.0018 - 0.0032	0.0056 - 0.006	NP	2.76E-03			5.20E+01	N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per kilogram.

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the beginning depth of the sample.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 5-1.
[d] Residential Soil PRGs from EPA, 1999, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.
[f] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation.
[g] Based on PRG for total chromium.
[h] Calculated; reference Appendix H.1.
[i] Based on PRG for mixed dinitrotoluene.

Table 5-5

Statistical Summary and COPC Selection of Subsurface Soil[a] Sample Analyses, West Area Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	37 / 37	5080 - 21000	22.5 - 27.1	L	1.07E+04	1.19E+04	2.69E+04	7.60E+03	Y (b)	1.19E+04
ANTIMONY	1 / 56	7.7 - 7.7	5.3 - 8.1	L*	3.49E+00	3.51E+00	9.30E+00	3.10E+00	Y (b)	3.51E+00
ARSENIC	52 / 56	2.2 - 23.6	1.1 - 4	L	6.89E+00	8.03E+00	7.10E+01	3.90E-02	Y (b)	8.03E+00
BARIUM	36 / 37	27.9 - 165	22.5 - 27.1	L	6.24E+01		1.30E+03	5.40E+02	N (a)	--
BERYLLIUM	12 / 56	0.59 - 1	0.56 - 1.3	N	4.97E-01		1.17E+00	1.50E+01	N (a)	--
CADMIUM	2 / 56	0.68 - 1.4	0.56 - 1.3	L	4.24E-01			3.70E+00	N (a)	--
CALCIUM	37 / 37	1220 - 67600	562 - 678	NP	2.04E+04			Nutrient	N (b)	--
CHROMIUM	56 / 56	7.5 - 29	1.1 - 1.4	L	1.65E+01	1.78E+01	2.90E+01	2.10E+01 g	Y (b)	1.78E+01
COBALT	34 / 37	6 - 21	5.6 - 6.8	N	1.04E+01		2.48E+02	4.70E+02	N (a)	--
COPPER	52 / 56	2.4 - 34.7	2.1 - 3.4	N	1.46E+01		1.47E+02	2.90E+02	N (a)	--
IRON	37 / 37	8490 - 34000	11.2 - 13.6	N	2.10E+04	2.29E+04		Nutrient	N (b)	--
LEAD	56 / 56	4.4 - 20	0.34 - 3.3	L	9.99E+00		5.13E+01	4.00E+02	N (a)	--
MAGNESIUM	37 / 37	832 - 23400	562 - 678	NP	7.39E+03			Nutrient	N (b)	--
MANGANESE	56 / 56	83.4 - 1900	1.7 - 5.3	L	4.34E+02	5.06E+02	3.51E+03	1.80E+02	Y (b)	5.06E+02
NICKEL	56 / 56	7.4 - 45	2.1 - 5.4	N	2.45E+01		7.79E+01	1.60E+02	N (a)	--
POTASSIUM	34 / 37	643 - 5630	562 - 678	L	1.82E+03			Nutrient	N (b)	--
SODIUM	6 / 37	619 - 1270	562 - 678	NP	4.01E+02			Nutrient	N (b)	--
VANADIUM	37 / 37	13.9 - 40.3	5.6 - 6.8	L	2.57E+01		8.31E+01	5.50E+01	N (a)	--
ZINC	56 / 56	26.5 - 94.6	2.1 - 2.7	N	5.77E+01		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
2-AMINO-4,6-DINITROTOLUENE	1 / 19	0.5 - 0.5	0.25 - 0.25	NP	1.45E-01	5.00E-01		3.70E-01 h	Y (a)	5.00E-01
4-AMINO-2,6-DINITROTOLUENE	5 / 56	0.3 - 0.7	0.25 - 1.2	L*	1.63E-01	6.00E-01		3.70E-01 h	Y (a)	6.00E-01
1,3-DINITROBENZENE	6 / 56	0.3 - 2.4	0.25 - 1.2	L*	2.65E-01	2.12E+00		6.10E-01	Y (a)	2.12E+00
2,4-DINITROTOLUENE	11 / 56	0.3 - 6.3	0.25 - 1.2	L*	5.07E-01	3.09E+00		7.20E-02 i	Y (a)	3.09E+00
2,6-DINITROTOLUENE	3 / 56	0.3 - 1.5	0.25 - 1.2	L*	1.66E-01	1.50E+00		7.20E-02 i	Y (a)	1.50E+00
3,4-DINITROTOLUENE	2 / 19	0.3 - 0.5	0.25 - 0.25	NP	1.54E-01	5.00E-01		7.20E-02 i	Y (a)	5.00E-01
1,3,5-TRINITROBENZENE	19 / 56	0.28 - 5.5	0.25 - 1.2	L	7.06E-01			1.80E+02	N (a)	--
2,4,6-TRINITROTOLUENE	5 / 56	0.3 - 2.1	0.25 - 1.2	L	1.84E-01			1.60E+01	N (a)	--
Semivolatile Organics										
ACENAPHTHYLENE	1 / 9	0.04 - 0.04	0.38 - 0.42	NP	1.83E-01			3.70E+02 h	N (a)	--
ANTHRACENE	1 / 9	0.12 - 0.12	0.38 - 0.42	NP	1.92E-01			2.20E+03	N (a)	--
BENZO(A)ANTHRACENE	1 / 9	0.17 - 0.17	0.38 - 0.42	NP	1.97E-01	2.05E-01		6.20E-02	Y (a)	1.70E-01
BENZO(A)PYRENE	1 / 9	0.14 - 0.14	0.38 - 0.42	NP	1.94E-01	1.96E-01		6.20E-03	Y (a)	1.40E-01
BENZO(B)FLUORANTHENE	1 / 9	0.14 - 0.14	0.38 - 0.42	NP	1.94E-01	1.96E-01		6.20E-02	Y (a)	1.40E-01
BENZO(GHI)PERYLENE	1 / 9	0.076 - 0.076	0.38 - 0.42	NP	1.87E-01			2.30E+02 h	N (a)	--
BENZO(K)FLUORANTHENE	1 / 9	0.11 - 0.11	0.38 - 0.42	NP	1.91E-01			6.20E-01	N (a)	--

Table 5-5

Statistical Summary and COPC Selection of Subsurface Soil[a] Sample Analyses, West Area Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
CHRYSENE	1 / 9	0.17 - 0.17	0.38 - 0.42	NP	1.97E-01			6.20E+00	N (a)	--
FLUORANTHENE	2 / 9	0.058 - 0.38	0.38 - 0.42	NP	2.05E-01			2.30E+02	N (a)	--
INDENO(1,2,3-CD)PYRENE	1 / 9	0.076 - 0.076	0.38 - 0.42	NP	1.87E-01	1.96E-01		6.20E-02	Y (a)	7.60E-02
PHENANTHRENE	1 / 9	0.25 - 0.25	0.38 - 0.42	NP	2.06E-01			2.30E+02 h	N (a)	--
PYRENE	2 / 9	0.043 - 0.28	0.38 - 0.42	NP	1.93E-01			2.30E+02	N (a)	--
Volatile Organics										
METHYLENE CHLORIDE	1 / 9	0.002 - 0.002	0.0057 - 0.0064	NP	2.91E-03			8.90E-01	N (a)	--
TOLUENE	5 / 9	0.0015 - 0.0025	0.0057 - 0.0064	N	2.51E-03			5.20E+01	N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per killogram.

[a] Subsurface soil is defined as the interval from 2 to 10 feet below the ground surface.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 5-1.
[d] Residential Soil PRGs from EPA, *Region iX Preliminary Remediation Goals* (PRG), December 3, 1999, adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.
[f] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation.
[g] Based on PRG for total chromium.
[h] Calculated; reference Appendix H.1.
[i] Based on PRG for mixed dinitrotoluene.

Table 5-6

Screening of VOCs from Subsurface Soil in Indoor Air, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Chemical Concentration In Soil (mg/kg)	VOC Concentration In Soil Gas C_{source} (g/cm^3)	Effective Diffusion Coefficient D^{eff} (cm^2)	Attenuation Coefficient α (unitless)	VOC Concentration in Indoor Air In the Building (mg/m^3)	Risk-Based Screening Criterion [a] (mg/m^3)	COPC?
Volatile Organics							
ACENAPHTHYLENE	4.00E-02	9.08E-09	5.16E-03	3.66E-06	3.32E-05	2.20E-02	No
METHYLENE CHLORIDE	2.00E-03	9.59E-10	7.88E-03	5.59E-06	5.36E-06	4.10E-04	No
TOLUENE	2.50E-03	5.47E-10	6.79E-03	4.81E-06	2.63E-06	4.00E-02	No

COPC = Chemical of potential concern.

[a] Ambient Air PRGs from EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3,1999, adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.

Table 5-7

COPC Selection for Total Soil[a], West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	COPC? [b]	Source Term Concentration	MDC Surface Soil [c]	MDC Subsurface Soil [d]
Inorganics				
ALUMINUM	Y (b)	1.30E+04	--	--
ANTIMONY	Y (b)	3.51E+00	--	--
ARSENIC	Y (b)	8.03E+00	--	--
CHROMIUM	Y (a)	1.87E+01	3.50E+01	2.90E+01
MANGANESE	Y (b)	6.02E+02	--	--
Nitroaromatics				
2-AMINO-4,6-DINITROTOLUENE	Y (a)	5.00E-01	--	5.00E-01
4-AMINO-2,6-DINITROTOLUENE	Y (a)	6.00E-01	--	7.00E-01
1,3-DINITROBENZENE	Y (a)	2.12E+00	--	2.40E+00
2,4-DINITROTOLUENE	Y (a)	3.09E+00	4.00E-01	6.30E+00
2,6-DINITROTOLUENE	Y (a)	1.50E+00	--	1.50E+00
3,4-DINITROTOLUENE	Y (a)	5.00E-01	--	5.00E-01
Semivolatile Organics				
BENZO(A)ANTHRACENE	Y (a)	4.00E-01	4.00E-01	1.70E-01
BENZO(A)PYRENE	Y (a)	3.90E-01	3.90E-01	1.40E-01
BENZO(B)FLUORANTHENE	Y (a)	3.00E-01	3.00E-01	1.40E-01
INDENO(1,2,3-CD)PYRENE	Y (a)	2.30E-01	2.30E-01	7.60E-02

COPC - Chemical of potential concern.
MDC - Maximum detected concentration.
mg/kg - Milligrams per kilogram.

[a] Total soil is defined in Section 5.2.1.1 of the text.
[b] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than risk-based screening concentration.
(b) = included in background risk calculation
[c] See Table 5-4.
[d] See Table 5-5.

Table 5-8

Statistical Summary and COPC Selection of Surface Water Sample Analyses, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (µg/L)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]		COPC? [e,f]	Source Term Concentration
Inorganics											
ALUMINUM	3 / 4	300 - 13800	200 - 200	NA	6.65E+03		3.04E+03	3.60E+04		N (a)	--
ARSENIC	2 / 9	20.2 - 21.8	10 - 30	NP	1.41E+01	1.50E+01		4.50E-02		Y (a)	1.50E+01
CALCIUM	4 / 4	31100 - 115000	5000 - 5000	NA	8.93E+04			Nutrient		N (b)	--
CHROMIUM	3 / 9	10 - 23.3	10 - 10	NP	8.97E+00			1.10E+02	g	N (a)	--
IRON	4 / 4	646 - 21100	100 - 100	NA	1.04E+04			Nutrient		N (b)	--
LEAD	3 / 9	25 - 77	3 - 25	NP	2.09E+01	7.70E+01		1.50E+01	h	Y (a)	7.70E+01
MAGNESIUM	4 / 4	25800 - 50700	5000 - 5000	NA	3.73E+04			Nutrient		N (b)	--
MANGANESE	9 / 9	126 - 1600	15 - 40	NP	6.25E+02	1.60E+03	8.90E+02	8.80E+02		Y (a)	1.60E+03
NICKEL	1 / 9	20 - 20	20 - 40	NP	1.56E+01			7.30E+02		N (a)	--
POTASSIUM	4 / 4	5180 - 9910	5000 - 5000	NA	7.61E+03			Nutrient		N (b)	--
SODIUM	4 / 4	38300 - 107000	5000 - 5000	NA	7.21E+04			Nutrient		N (b)	--
VANADIUM	1 / 4	52.2 - 52.2	50 - 50	NA	3.18E+01			2.60E+02		N (a)	--
ZINC	7 / 9	20 - 92.5	20 - 20	NP	4.44E+01		5.80E+01	1.10E+04		N (a)	--
Nitroaromatics											
4-AMINO-2-NITROTOLUENE	1 / 5	0.6 - 0.6	0.55 - 0.55	NP	3.40E-01			2.00E+00		N (a)	--
1,3-DINITROBENZENE	1 / 9	0.3 - 0.3	0.15 - 0.2	NP	1.11E-01			3.60E+00		N (a)	--
2,4-DINITROTOLUENE	1 / 9	0.5 - 0.5	0.1 - 0.2	NP	1.22E-01	5.00E-01		9.90E-02	i	Y (a)	5.00E-01
2,6-DINITROTOLUENE	1 / 9	0.8 - 0.8	0.1 - 0.2	NP	1.56E-01	8.00E-01		9.90E-02	i	Y (a)	8.00E-01
3,4-DINITROTOLUENE	4 / 5	0.5 - 0.6	0.21 - 0.21	NP	4.81E-01	6.00E-01		9.90E-02	i	Y (a)	6.00E-01
3-NITROTOLUENE	4 / 9	2.3 - 54	0.2 - 1.4	L	6.92E+00			6.10E+01		N (a)	--
Semivolatile Organics											
DI-n-OCYLPHTHALATE	1 / 4	7.8 - 7.8	10 - 10	NA	5.70E+00			7.30E+02		N (a)	--
Volatile Organics											
BROMOMETHANE	4 / 4	0.16 - 0.21	2 - 2	NA	1.85E-01			8.70E+00		N (a)	--

UCL - Upper confidence limit.
COPC - Chemical of potential concern.
NA - Not applicable.
µg/L - Micrograms per liter.
[a] Statistical Distribution: L = Lognormal distribution; NP = Nonparametric distribution; NA = sample size is less than 5 and distribution is not characterized.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 5-2.
[d] EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, S. J. Smucker, Ph.D., unadjusted tap water PRGs.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.
[f] Y = Chemical is chosen as COPC.
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation.
[g] RBSC based on the PRG for chromium VI.
[h] EPA, 1996, *Drinking Water Regulations and Health Advisories,* Office of Water, Washington, DC, October.
[i] Based on PRG for mixed dinitrotoluene.

Table 5-9

Statistical Summary and COPC Selection of Sediment Sample Analyses, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentration	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL[b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	4 / 4	3230 - 9600	24.2 - 98.5	NA	5.99E+03		6.02E+03	7.60E+04	N (a)	--
ARSENIC	9 / 17	4 - 11.3	1.2 - 4.9	NP	4.58E+00	8.38E+00	5.40E+00	3.90E-01	Y (a)	8.38E+00
BARIUM	3 / 4	34.8 - 65	24.2 - 98.5	NA	4.63E+01		5.34E+01	5.40E+03	N (a)	--
CALCIUM	4 / 4	6710 - 74700	606 - 2460	NA	2.74E+04			Nutrient	N (b)	--
CHROMIUM	17 / 17	7.4 - 28.7	1.2 - 4.9	L	1.51E+01		1.15E+01	2.10E+02 g	N (a)	--
COBALT	2 / 4	10.6 - 10.8	6.1 - 24.6	NA	1.01E+01		1.09E+01	4.70E+03	N (a)	--
COPPER	7 / 17	3.2 - 24.5	2.4 - 12.3	NP	5.24E+00		1.79E+01	2.90E+03	N (a)	--
IRON	4 / 4	16000 - 24300	12.1 - 49.3	NA	1.87E+04			Nutrient	N (b)	--
LEAD	17 / 17	8.1 - 32.1	0.36 - 4	L	1.60E+01		1.28E+01	4.00E+02	N (a)	--
MAGNESIUM	4 / 4	2520 - 6770	606 - 2460	NA	3.84E+03			Nutrient	N (b)	--
MANGANESE	17 / 17	149 - 726	1.8 - 7.4	NP	2.49E+02		8.65E+02	1.80E+03	N (a)	--
NICKEL	17 / 17	8.8 - 24.5	2.4 - 19.7	N	1.77E+01		2.30E+01	1.60E+03	N (a)	--
POTASSIUM	2 / 5	821 - 1500	27 - 2460	N	9.04E+02			Nutrient	N (b)	--
VANADIUM	1 / 4	25 - 25	6.1 - 24.6	NA	9.54E+00		1.74E+01	5.50E+02	N (a)	--
ZINC	17 / 17	36 - 94	2.4 - 9.9	L	6.09E+01		7.33E+01	2.30E+04	N (a)	--
Nitroaromatics										
2-AMINO-4,6-DINITROTOLUENE	1 / 17	0.3 - 0.3	0.25 - 0.25	NP	1.35E-01			3.70E+00 h	N (a)	--
1,3-DINITROBENZENE	4 / 17	0.3 - 0.7	0.25 - 0.25	NP	2.37E-01			6.10E+00	N (a)	--
2,4-DINITROTOLUENE	6 / 17	0.3 - 0.7	0.25 - 0.25	NP	2.57E-01			7.20E-01 i	N (a)	--
2,6-DINITROTOLUENE	1 / 17	0.4 - 0.4	0.25 - 0.26	NP	1.45E-01			7.20E-01 i	N (a)	--
1,3,5-TRINITROBENZENE	3 / 17	0.6 - 0.8	0.25 - 0.25	NP	2.21E-01			1.80E+03	N (a)	--
Semivolatile Organics										
FLUORANTHENE	1 / 4	0.047 - 0.047	0.4 - 1.6	NA	3.79E-01			2.30E+03	N (a)	--
Volatile Organics										
2-BUTANONE	2 / 4	0.021 - 0.029	0.024 - 0.099	NA	2.79E-02			7.30E+03	N (a)	--
ACETONE	2 / 2	0.071 - 0.11	0.053 - 0.099	NA	9.05E-02			1.60E+03	N (a)	--

COPC - Chemical of potential concern.
UCL - Upper confidence limit.
mg/kg - Milligrams per kilogram.
[a] Statistical Distribution: L = Lognormal distribution; NP = Nonparametric distribution; NA = sample size is less than 5 and distribution is not characterized.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 5-3.
[c] EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, S. J. Smucker, Ph.D., unadjusted residential soil PRG.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.
[f] Y = Chemical is chosen as COPC.
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation.
[g] RBSC based on the PRG for total chromium.
[h] Calculated; reference Appendix H.1.
[i] Based on PRG for mixed dinitrotoluene.

Table 5-10

Statistical Summary and COPC Selection of Surface Soil[a] Sample Analyses, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC?[e,f]	Source Term Concentration
Inorganics										
ALUMINUM	20 / 20	2370 - 12700	21.3 - 24.8	N	7.05E+03	7.99E+03	2.69E+04	7.60E+03	Y (b)	7.99E+03
ARSENIC	36 / 50	2.3 - 22	1.1 - 3.8	NP	4.59E+00	5.80E+00	7.10E+01	3.90E-02	Y (b)	5.80E+00
BARIUM	13 / 20	24.3 - 84.3	21.3 - 24.8	NP	3.27E+01		1.30E+03	5.40E+02	N (a)	--
BERYLLIUM	3 / 50	0.68 - 0.69	0.53 - 1.3	NP	4.77E-01		1.17E+00	1.50E+01	N (a)	--
CALCIUM	19 / 20	817 - 54000	532 - 620	L	6.25E+03			Nutrient	N (b)	--
CHROMIUM	50 / 50	4.2 - 21	1 - 1.3	L	1.07E+01	1.15E+01	2.90E+01	2.10E+01 g	N (a)	--
COBALT	9 / 20	5.8 - 11.1	5.3 - 6.2	NP	4.74E+00		2.48E+02	4.70E+02	N (a)	--
COPPER	29 / 50	2.5 - 22.6	2.1 - 3.1	NP	4.77E+00		1.47E+02	2.90E+02	N (a)	--
IRON	20 / 20	8330 - 22900	10.6 - 12.4	N	1.43E+04			Nutrient	N (b)	--
LEAD	50 / 50	3.1 - 19	0.32 - 3.2	L	7.68E+00		5.13E+01	4.00E+02	N (a)	--
MAGNESIUM	20 / 20	791 - 11500	532 - 620	NP	2.32E+03			Nutrient	N (b)	--
MANGANESE	50 / 50	74.5 - 820	1.6 - 5.1	L	2.38E+02	2.74E+02	3.51E+03	1.80E+02	Y (b)	2.74E+02
MERCURY	2 / 50	0.04 - 0.043	0.035 - 0.31	NP	9.29E-02		5.60E-01	2.30E+00	N (a)	--
NICKEL	50 / 50	4.7 - 27.2	2.1 - 5	NP	9.62E+00		7.79E+01	1.60E+02	N (a)	--
POTASSIUM	5 / 20	684 - 1460	532 - 620	NP	4.41E+02			Nutrient	N (b)	--
SELENIUM	2 / 50	0.59 - 0.84	0.53 - 5	NP	1.48E+00		2.00E+00	3.90E+01	N (a)	--
SODIUM	2 / 20	741 - 1240	532 - 620	NP	3.57E+02			Nutrient	N (b)	--
VANADIUM	20 / 20	12.9 - 35.2	5.3 - 6.2	N	2.21E+01		8.31E+01	5.50E+01	N (a)	--
ZINC	50 / 50	17 - 78.5	2.1 - 2.5	NP	3.00E+01		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1 / 50	2.7 - 2.7	0.25 - 0.25	NP	1.77E-01	2.70E+00		3.70E-01 h	Y (a)	2.70E+00
1,3-DINITROBENZENE	6 / 50	0.3 - 1.6	0.25 - 0.25	NP	1.98E-01	8.97E-01		6.10E-01	Y (a)	8.97E-01
2,4-DINITROTOLUENE	12 / 50	0.3 - 2.4	0.25 - 0.25	NP	3.31E-01	1.57E+00		7.20E-02 i	Y (a)	1.57E+00
2,6-DINITROTOLUENE	2 / 50	0.4 - 0.8	0.25 - 0.26	NP	1.47E-01	8.00E-01		7.20E-02 i	Y (a)	8.00E-01
3,4-DINITROTOLUENE	1 / 30	0.3 - 0.3	0.25 - 0.25	NP	1.31E-01	3.00E-01		7.20E-02 i	Y (a)	3.00E-01
1,3,5-TRINITROBENZENE	5 / 50	0.4 - 1.7	0.25 - 0.25	NP	2.01E-01			1.80E+02	N (a)	--
2,4,6-TRINITROTOLUENE	1 / 50	0.27 - 0.27	0.25 - 0.25	NP	1.28E-01			1.60E+00	N (a)	--

Table 5-10

Statistical Summary and COPC Selection of Surface Soil[a] Sample Analyses, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC?[e,f]	Source Term Concentration
Volatile Organics										
METHYLENE CHLORIDE	1 / 10	0.0018 - 0.0018	0.0055 - 0.0062	NP	2.82E-03			8.90E-01	N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per kilogram.

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the beginning depth of the sample.

[b] Method of estimation based on statistical distribution (please see Section 5.2.2).

[c] Please see Table 5-1.

[d] Residential Soil PRGs from EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.

[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.

[f] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation

[g] Based on PRG for total chromium.

[h] Calculated; reference Appendix H.1.

[i] Based on PRG for mixed dinitrotoluene.

Table 5-11

Statistical Summary and COPC Selection of Subsurface[a] Soil Sample Analyses, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Inorganics										
ALUMINUM	39 / 39	3320 - 12300	22.1 - 26.7	N	8.65E+03	9.25E+03	2.69E+04	7.60E+03	Y (b)	9.25E+03
ANTIMONY	12 / 73	5.6 - 9.3	5.2 - 8	L*	4.00E+00	6.80E+00	9.30E+00	3.10E+00	Y (b)	6.80E+00
ARSENIC	69 / 73	2.6 - 42.8	1.1 - 3.8	L	8.80E+00	1.01E+01	7.10E+01	3.90E-02	Y (b)	1.01E+01
BARIUM	36 / 39	26.5 - 239	22.1 - 26.7	NP	6.81E+01		1.30E+03	5.40E+02	N (a)	--
BERYLLIUM	7 / 73	0.55 - 0.83	0.55 - 1.3	N	4.76E-01		1.17E+00	1.50E+01	N (a)	--
CADMIUM	1 / 73	0.63 - 0.63	0.55 - 1.3	N	4.43E-01			3.70E+00	N (a)	--
CALCIUM	39 / 39	1850 - 70400	552 - 667	NP	4.20E+04			Nutrient	N (b)	--
CHROMIUM	73 / 73	5.2 - 27	1 - 1.3	N	1.51E+01	1.58E+01	2.90E+01	2.10E+01 g	Y (b)	1.58E+01
COBALT	33 / 39	6.3 - 30.3	5.5 - 6.7	NP	1.03E+01		2.48E+02	4.70E+02	N (a)	--
COPPER	68 / 73	3 - 34.5	2.1 - 3.3	N	1.40E+01		1.47E+02	2.90E+02	N (a)	--
IRON	39 / 39	8940 - 43700	11 - 13.3	L	2.04E+04			Nutrient	N (b)	--
LEAD	73 / 73	2.9 - 18	0.33 - 3.2	N	9.89E+00		5.13E+01	4.00E+02	N (a)	--
MAGNESIUM	39 / 39	917 - 25300	552 - 667	NP	1.41E+04			Nutrient	N (b)	--
MANGANESE	73 / 73	140 - 2270	1.7 - 5.1	L	5.15E+02	5.63E+02	3.51E+03	1.80E+02	Y (b)	5.63E+02
MERCURY	1 / 73	0.045 - 0.045	0.036 - 0.32	N	8.08E-02		5.60E-01	2.30E+00	N (a)	--
NICKEL	73 / 73	6.4 - 57.2	2.1 - 5.3	L	2.24E+01		7.79E+01	1.60E+02	N (a)	--
POTASSIUM	37 / 40	713 - 2730	27 - 667	N	1.50E+03			Nutrient	N (b)	--
SELENIUM	6 / 73	0.64 - 1.1	0.55 - 5.1	L	1.33E+00		2.00E+00	3.90E+01	N (a)	--
SODIUM	10 / 39	1030 - 4280	552 - 667	NP	7.51E+02			Nutrient	N (b)	--
VANADIUM	39 / 39	15 - 38.4	5.5 - 6.7	L	2.51E+01		8.31E+01	5.50E+01	N (a)	--
ZINC	73 / 73	22.7 - 104	2.1 - 2.7	N	5.32E+01		3.22E+02	2.30E+03	N (a)	--
Nitroaromatics										
4-AMINO-2-NITROTOLUENE	2 / 34	0.6 - 0.9	0.25 - 2.5	NP	1.95E-01			1.50E+00	N (a)	--
4-AMINO-2,6-DINITROTOLUENE	6 / 73	0.3 - 9.5	0.25 - 2.5	L*	3.35E-01	1.88E+00		3.70E-01 h	Y (a)	1.88E+00
1,3-DINITROBENZENE	24 / 73	0.25 - 9.3	0.25 - 5	L*	1.12E+00	2.20E+00		6.10E-01	Y (a)	2.20E+00
2,4-DINITROTOLUENE	29 / 73	0.28 - 25	0.25 - 2.5	L*	1.97E+00	5.34E+00		7.20E-02 i	Y (a)	5.34E+00
2,6-DINITROTOLUENE	15 / 73	0.29 - 3.6	0.25 - 2.6	L*	3.42E-01	9.51E-01		7.20E-02 i	Y (a)	9.51E-01
3,4-DINITROTOLUENE	5 / 34	0.5 - 4.5	0.25 - 2.5	NP	3.60E-01	3.68E+00		7.20E-02 i	Y (a)	3.68E+00
NITROBENZENE	1 / 73	1.1 - 1.1	0.25 - 2.6	L	1.80E-01			2.00E+00	N (a)	--
2-NITROTOLUENE	1 / 73	0.9 - 0.9	0.25 - 2.5	L	1.75E-01			3.70E+01	N (a)	--
1,3,5-TRINITROBENZENE	31 / 73	0.4 - 58	0.25 - 5	L	4.01E+00			1.80E+02	N (a)	--
2,4,6-TRINITROTOLUENE	5 / 73	0.3 - 12000	0.25 - 2.5	L*	1.69E+02	1.20E+04		1.60E+00	Y (a)	1.20E+04
Semivolatile Organics										
3-NITROANILINE	1 / 9	0.053 - 0.053	1.9 - 20	NP	1.89E+00			1.80E+00	N (a)	--

Table 5-11

Statistical Summary and COPC Selection of Subsurface[a] Soil Sample Analyses, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UCL [b]	Background Screening Criterion [c]	Risk-Based Screening Criterion [d]	COPC? [e,f]	Source Term Concentration
Volatile Organics										
ACETONE	1 / 8	0.0082 - 0.0082	0.024 - 0.027	NP	1.20E-02			1.60E+02	N (a)	--
METHYLENE CHLORIDE	1 / 9	0.0021 - 0.0021	0.006 - 0.0067	NP	3.00E-03			8.90E-01	N (a)	--
TOLUENE	1 / 9	0.0017 - 0.0017	0.006 - 0.0067	NP	2.96E-03			5.90E+01	N (a)	--

COPC - Chemical of potential concern; UCL - Upper confidence limit.
L - Data are found to have lognormal distribution; N - Data are found to have normal distribution; NP - Nonparmametric; data are found to be neither normally nor lognormally distributed.
mg/kg - Milligrams per kilogram.

* Please see section 5.2.2.1.
[a] Subsurface soil is defined as the interval from 2 to 10 feet below the ground surface.
[b] Method of estimation based on statistical distribution (please see Section 5.2.2).
[c] Please see Table 5-1.
[d] Residential Soil PRGs from EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.
[e] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.
[f] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation
[g] Based on PRG for total chromium.
[h] Calculated; reference Appendix H.1.
[i] Based on PRG for mixed dinitrotoluene.

Table 5-12

Screening of VOCs from Subsurface Soil in Indoor Air, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Chemical Concentration In Soil (mg/kg)	VOC Concentration In Soil Gas C_{source} (g/cm^3)	Effective Diffusion Coefficient D^{eff} (cm^2/s)	Attenuation Coefficient α (unitless)	VOC Concentration in Indoor Air In the Building (mg/m^3)	Risk-Based Screening Criterion [a] (mg/m^3)	COPC?
Volatile Organics							
Acetone	8.20E-03	1.26E-10	9.74E-03	6.91E-06	8.69E-07	3.70E-02	No
Methylene chloride	2.10E-03	1.01E-09	7.88E-03	5.59E-06	5.63E-06	4.10E-04	No
Toluene	1.70E-03	3.72E-10	6.79E-03	4.81E-06	1.79E-06	4.00E-02	No

COPC = Chemical of potential concern.
mg/kg - Milligrams per kilogram.
g/cm^3 - Grams per cubic centimeter.
cm^2/s - Square centimeters per second.
mg/m^3 - Milligrams per cubic meter.

[a] Ambient Air PRGs from EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3,1999, adjusted to reflect a cancer risk of 1E-7 and a hazard index of 0.1.

Table 5-13

COPC Selection for Total Soil[a], Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	COPC? [b]	Source Term Concentration	MDC Surface Soil [c]	MDC Subsurface Soil [d]
Inorganics				
ALUMINUM	Y (b)	9.25E+03	--	--
ANTIMONY	Y (b)	6.80E+00	--	--
ARSENIC	Y (b)	1.01E+01	--	--
CHROMIUM	Y (b)	1.58E+01	--	--
MANGANESE	Y (b)	5.63E+02	--	--
Nitroaromatics				
4-AMINO-2,6-DINITROTOLUENE	Y (a)	2.70E+00	2.70E+00	9.50E+00
1,3-DINITROBENZENE	Y (a)	2.20E+00	1.60E+00	9.30E+00
2,4-DINITROTOLUENE	Y (a)	5.34E+00	2.40E+00	2.50E+01
2,6-DINITROTOLUENE	Y (a)	9.51E-01	8.00E-01	3.60E+00
3,4-DINITROTOLUENE	Y (a)	3.68E+00	3.00E-01	4.50E+00
2,4,6-TRINITROTOLUENE	Y (a)	1.20E+04	--	1.20E+04

COPC - Chemical of potential concern.
MDC - Maximum detected concentration.
mg/kg - Milligrams per kilogram.

[a] Total soil is defined in Section 5.2.1.1 of the text.
[b] Y = Chemical is chosen as COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation
[c] Please see Table 5-10.
[d] Please see Table 5-11.

Table 5-14

Statistical Summary and COPC Selection of Surface Water Samples, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (µg/L)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL [a]	Background Screening Criterion [b]	Risk-Based Screening Criterion [c]	COPC?[d]
Inorganics (unfiltered)									
Aluminum	2 / 2	530 - 3040	200 - 200	NA	1.79E+03	NA	3.04E+03	3.60E+04	N (a)
Calcium	2 / 2	71700 - 118000	5000 - 5000	NA	9.49E+04	NA		Nutrient	N (b)
Iron	2 / 2	972 - 5790	100 - 100	NA	3.38E+03	NA		Nutrient	N (b)
Magnesium	2 / 2	15800 - 37300	5000 - 5000	NA	2.66E+04	NA		Nutrient	N (b)
Manganese	2 / 2	261 - 404	15 - 15	NA	3.33E+02	NA	8.90E+02	8.80E+02	N (a)
Sodium	2 / 2	13700 - 24700	5000 - 5000	NA	1.92E+04	NA		Nutrient	N (b)
Zinc	1 / 2	58 - 58	20 - 20	NA	3.90E+01	NA	5.80E+01	1.10E+04	N (a)
Volatile Organics									
Bromomethane	1 / 2	0.11 - 0.11	2 - 2	NA	1.06E+00	NA		8.70E+00	N (a)

UCL - Upper confidence limit.
COPC - Chemical of potential concern.
NA - Not available or not applicable.
µg/L - Micrograms per liter.

[a] Insufficient number of samples (less than five) to determine statistical distribution or calculate a UCL.
[b] Please see Table 5-2.
[c] EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, S. J. Smucker, Ph.D., unadjusted tap water PRGs.
[d] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.

Table 5-15

Statistical Summary and COPC Selection in Sediment Sample Analyses, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentration	Range of Reporting Limits	Statistical Distribution [a]	Arithmetic Mean	95% UCL mg/kg [a]	Background Screening Criterion [b]	Risk-Based Screening Criterion [c]	COPC? [d,e]	Source Term Concentration
Inorganics										
ALUMINUM	2 / 2	2830 - 5130	25.3 - 34.6	NA	3.98E+03	NA	6.02E+03	7.60E+04	N (a)	--
ARSENIC	2 / 2	4.3 - 5.1	1.3 - 1.7	NA	4.70E+00	NA	5.40E+00	3.90E-01	Y (b)	5.1
BARIUM	1 / 2	48.1 - 48.1	25.3 - 34.6	NA	3.67E+01	NA	5.34E+01	5.40E+03	N (a)	--
CALCIUM	2 / 2	46300 - 62000	631 - 865	NA	5.42E+04	NA		Nutrient	N (b)	--
CHROMIUM	2 / 2	6.3 - 10.4	1.3 - 1.7	NA	8.35E+00	NA	1.15E+01	2.10E+02 f	N (a)	--
COPPER	2 / 2	7.6 - 14.5	3.2 - 4.3	NA	1.11E+01	NA	1.79E+01	2.90E+03	N (a)	--
IRON	2 / 2	9620 - 13700	12.6 - 17.3	NA	1.17E+04	NA		Nutrient	N (b)	--
LEAD	2 / 2	4.8 - 7.8	0.38 - 0.52	NA	6.30E+00	NA	1.28E+01	4.00E+02	N (a)	--
MAGNESIUM	2 / 2	13500 - 19300	631 - 865	NA	1.64E+04	NA		Nutrient	N (b)	--
MANGANESE	2 / 2	404 - 421	1.9 - 2.6	NA	4.13E+02	NA	8.65E+02	1.80E+03	N (a)	--
NICKEL	2 / 2	9.5 - 17.9	5.1 - 6.9	NA	1.37E+01	NA	2.30E+01	1.60E+03	N (a)	--
POTASSIUM	1 / 2	1040 - 1040	631 - 865	NA	8.36E+02	NA		Nutrient	N (b)	--
VANADIUM	2 / 2	12.9 - 14.2	6.3 - 8.7	NA	1.36E+01	NA	1.74E+01	5.50E+02	N (a)	--
ZINC	2 / 2	23.2 - 58.4	2.5 - 3.5	NA	4.08E+01	NA	7.33E+01	2.30E+04	N (a)	--
Semivolatile Organics										
ACENAPHTHENE	1 / 2	0.11 - 0.11	0.42 - 0.57	NA	3.40E-01	NA		3.70E+03	N (a)	--
ANTHRACENE	1 / 2	0.077 - 0.077	0.42 - 0.57	NA	3.24E-01	NA		2.20E+04	N (a)	--
CARBAZOLE	1 / 2	0.18 - 0.18	0.42 - 0.57	NA	3.75E-01	NA		2.40E+01	N (a)	--
DIBENZOFURAN	1 / 2	0.06 - 0.06	0.42 - 0.57	NA	3.15E-01	NA		2.90E+02	N (a)	--
FLUORANTHENE	1 / 2	0.14 - 0.14	0.42 - 0.57	NA	3.55E-01	NA		2.30E+03	N (a)	--
FLUORENE	1 / 2	0.11 - 0.11	0.42 - 0.57	NA	3.40E-01	NA		2.60E+03	N (a)	--
PHENANTHRENE	1 / 2	0.32 - 0.32	0.42 - 0.57	NA	4.45E-01	NA		2.30E+03 g	N (a)	--
PYRENE	1 / 2	0.11 - 0.11	0.42 - 0.57	NA	3.40E-01	NA		2.30E+03	N (a)	--
Volatile Organics										
ACETONE	1 / 1	0.049 - 0.049	0.035 - 0.035	NA	4.90E-02	NA		1.60E+03	N (a)	--
2-BUTANONE	1 / 2	0.01 - 0.01	0.025 - 0.035	NA	1.75E-02	NA		7.30E+03	N (a)	--

COPC - Chemical of potential concern.
NA - Not available or not applicable.
UCL - Upper confidence limit.
mg/kg - Milligrams per kilogram.
[a] Insufficient number of samples (less than five), to determine statistical distribution or calculate a UCL..
[b] Please see Table 5-3.
[c] EPA, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, S. J. Smucker, Ph.D., unadjusted residential soil PRG.
[d] N = Chemical is not chosen as a COPC:
(a) = maximum detection is less than the risk-based screening concentration (RBSC).
(b) = essential nutrient.
[e] Y = Chemical is chosen as a COPC:
(a) = maximum detection is greater than RBSC.
(b) = included in background risk calculation.
[f] PRG based on total chromium.
[g] Calculated; reference Appendix H.1.

Table 5-16

Receptor/Exposure Scenarios
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

Source Medium	Model	Exposure Medium	Exposure Pathway
Groundskeeper			
Surface soil	None	Soil	Incidental ingestion
			Dermal contact
	Volatilization from soil	Air	Inhalation
	Dust emissions based on activity	Air	Inhalation
Total soil	Not quantified[a]		
Surface water	Not quantified[b]		
Sediment	Not quantified[b]		
Groundwater	Not evaluated at this time[c]		
Indoor Worker			
Surface soil	None	Soil	Incidental ingestion
Subsurface soil	Volatilization from soil	Indoor air	Inhalation
Total soil	Not quantified[a]		
Surface water	Not quantified[a]		
Sediment	Not quantified[a]		
Groundwater	Not evaluated at this time[c]		

Table 5-16

Receptor/Exposure Scenarios
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

Source Medium	Model	Exposure Medium	Exposure Pathway
Construction Worker			
Total soil	None	Soil	Incidental ingestion
			Dermal contact
	Volatilization from soil	Air	Inhalation
	Dust emissions based on activity	Air	Inhalation
Surface water	None	Surface water	Dermal contact
	Volatilization from water	Air	Inhalation[d]
Sediment	None	Sediment	Incidental ingestion
			Dermal contact
Groundwater	Not evaluated at this time[c]		

Table 5-16

Receptor/Exposure Scenarios
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 3)

Source Medium	Model	Exposure Medium	Exposure Pathway
Future On-Site Resident			
Total soil	None	Soil	Incidental ingestion
			Dermal contact
	Volatilization from soil	Air	Inhalation
	Dust emissions based on wind erosion	Air	Inhalation[e]
Subsurface soil	Volatilization from soil	Indoor air	Inhalation
Groundwater	Not evaluated at this time[c]		
Surface water	None	Surface water	Dermal contact
	Volatilization from water	Air	Inhalation[d]
Sediment	None	Sediment	Incidental ingestion
			Dermal contact

[a] There is no plausible pathway for exposure to this medium.
[b] Although contact with this medium is possible, exposure would be sporadic, rather than continuous or predictable. Such exposures do not lend themselves to evaluation under the chronic toxicity paradigm used in a baseline risk assessment.
[c] No groundwater data are available at this writing. Future groundwater exposures will be assessed when data become available.
[d] Although theoretically complete, this pathway is not quantified as explained in text.
[e] It is assumed that residential soil is 80 percent covered with pavement or vegetation for evaluating inhalation exposure via dust emissions.

Table 5-17

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 4)

Pathway Variable	Grounds-keeper	Construction Worker	On-Site Resident	Indoor Worker
General Variables Used in All Intake Models				
Exposure duration (ED), years	25[a]	0.5[b]	Child: 6[c] Adult: 24[c]	25[a]
Body weight (BW), kg	70[a]	70[a]	Child: 15[c] Adult: 70[a]	70[a]
Averaging time, noncancer (AT), days[d]	9125	183	Child: 2190 Adult: 8760	9125
Averaging time, cancer (AT), days[e]	25550	25550	25550	25550
Inhalation of VOCs and Resuspended Dust from Soil				
Fraction exposed to contaminated medium (FI_a), unitless	1[b]	1[b]	1[b]	NA
Inhalation rate (IR_a), m^3/day	20[a]	20[a]	Child: 10[c] Adult: 20[a]	NA
Exposure frequency (EF), days/year	250[a]	250[a]	350[a]	NA
Inhalation of VOCs, Entrapped in Building				
Fraction exposed to contaminated medium (FI_a), unitless	NA	NA	1[b]	1[b]
Inhalation rate (IR_a), m^3/day	NA	NA	Child: 6.8[b] Adult: 13.7[b]	20[a]
Exposure frequency (EF), days/year	NA	NA	350[a]	250[a]

Table 5-17

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 4)

Pathway Variable	Grounds-keeper	Construction Worker	On-Site Resident	Indoor Worker
Incidental Ingestion of Soil				
Fraction exposed to contaminated medium (FI_{so}), unitless	1[b]	0.5[b]	0.9[b]	1[b]
Soil incidental ingestion rate (IR_{so}), mg/day	100[a]	290[b]	Child: 200[c] Adult: 100[a]	50[a]
Exposure frequency (EF), days/year	250[a]	250[a]	350[a]	250[a]
Incidental Ingestion of Sediment				
Fraction exposed to contaminated medium (FI_{sd}), unitless	NA	0.5[b]	0.1[b]	NA
Sediment incidental ingestion rate (IR_{sd}), mg/day	NA	480[b]	Child: 200[c] Adult: 100[a]	NA
Exposure frequency (EF), days/year	NA	250[a]	52[b]	NA
Dermal Contact with Soil				
Fraction exposed to contaminated medium ($_{FIso}$), unitless	1[b]	0.5[b]	0.9[b]	NA
Body surface area exposed to soil (SA_{so}), cm^2	11,300[f]	11,300[f]	Child: 1750[g] Adult: 4550[g]	NA
Soil-to-skin adherence factor (AF_{so}), mg/cm^2	0.009[f]	0.08[f]	0.2[g]	NA
Dermal absorption factor (ABS), unitless	csv	csv	csv	NA
Exposure frequency (EF), days/year	250[a]	250[a]	350[a]	NA

Table 5-17

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 4)

Pathway Variable	Grounds-keeper	Construction Worker	On-Site Resident	Indoor Worker
Dermal Contact with Sediment				
Fraction exposed to contaminated medium (FI_{sd}), unitless	NA	0.5[b]	0.1[b]	NA
Body surface area exposed to sediment (SA_{sd}), cm^2	NA	3100[f]	Child: 1750[g] Adult: 4550[g]	NA
Sediment-to-skin adherence factor (AF_{sd}), mg/cm^2	NA	0.24[f]	0.2[g]	NA
Dermal absorption factor (ABS), unitless	NA	csv	csv	NA
Exposure frequency (EF), days/year	NA	250[a]	52[b]	NA
Dermal Contact with Surface Water				
Body surface area exposed to surface water, (SA_{sw}), cm^2	NA	3100[f]	Child: 2100[g] Adult: 5450[g]	NA
Permeability coefficient (PC), cm/hour	NA	csv	csv	NA
Exposure time (ET_{sw}), hour/day	NA	4[b]	3[b]	NA
Exposure frequency (EF), days/year	NA	250[a]	52[b]	NA

Table 5-17

Variables Used to Estimate Potential Chemical Intakes and Contact Rates for Receptors Red Water Ponds, PBOW, Sandusky, Ohio

[a] U.S. Environmental Protection Agency (EPA), 1991, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors*, Interim Final, Office of Solid Waste and Emergency Response, OSWER Directive: 9285.603.

[b] Assumed; see text.

[c] U.S. Environmental Protection Agency (EPA), 1999, *Region IX Preliminary Remediation Goals* (PRG), December 3, 1999, on-line.

[d] Calculated as the product of ED (years) x 365 days/year.

[e] Calculated as the product of 70 years (assumed human lifetime) x 365 days/year.

[f] U.S. Environmental Protection Agency (EPA), 1997, *Exposure Factors Handbook*, Final, National Center for Environmental Assessment, Washington, DC, EPA/600/P-95/002Fa, August.

[g] EPA, 1992, *Dermal Exposure Assessment: Principles and Applications*, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, including Supplemental Guidance dated August 18, 1992.

NA = Not applicable to this receptor; csv = chemical-specific value (see Table 4-1).

Table 5-18

Chemical-Specific Physical Property Values Used in Exposure Assessment[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	ABS (unitless)	PC (cm/hr)	Henry's Law Constant	Koc unitless	Kd cm^3/g	Da cm^2/s	Dw cm^2/s
Inorganics							
Aluminum	0.01	NA	NA	NA	NA	NA	NA
Antimony	0.01	NA	NA	NA	NA	NA	NA
Arsenic	0.01	1.00E-03	NA	NA	NA	NA	NA
Chromium	0.01	NA	NA	NA	NA	NA	NA
Lead	0.01	4.00E-06	NA	NA	NA	NA	NA
Manganese	0.01	1.00E-03	NA	NA	NA	NA	NA
Nitroaromatics							
2-Amino-4,6-dinitrotoluene	0.1	NA	NA	NA	NA	NA	NA
4-Amino-2,6-dinitrotoluene	0.1	NA	NA	NA	NA	NA	NA
1,3-Dinitrobenzene	0.1	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	0.1	3.80E-03	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	0.1	2.50E-03	NA	NA	NA	NA	NA
3,4-Dinitrotoluene	0.1	3.88E-03	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	0.1	NA	NA	NA	NA	NA	NA
Semivolatile Organics							
Acenapthylene	0.1	NA	1.45E-03	2.51E+01	1.51E-01	6.61E-02	6.60E-06
Benzo(a)anthracene	0.1	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.1	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	0.1	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.1	NA	NA	NA	NA	NA	NA
Volatile Organics							
Acetone	NA	NA	3.88E-05	5.75E-01	3.45E-03	1.24E-01	1.14E-05
Methylene Chloride	NA	NA	2.19E-03	1.17E+01	7.05E-02	1.01E-01	1.17E-05
Toluene	NA	NA	6.63E-03	1.82E+02	1.09E+00	8.70E-02	8.60E-06

NA = Not applicable.
[a] Please see toxicity profiles in Appendix H.3 for documentation of the values.
cm/hr - Centimeters per hour.
cm^3/g - Cubic centimeters per gram.
cm^2/s - Square centimeters per second.

Table 5-19

COPC-Specific Toxicity Values[a] Used in Risk Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	GAF	Oral RfD (mg/kg-day)	Target Organs (Oral)	Dermal RfD (mg/kg-day)	Inhalation RfD (mg/kg-day)	Target Organs (Inhalation)	Cancer Weight-of-Evidence Group	Oral SF (mg/kg-day)	Dermal SF (mg/kg-day)	Inhalation SF (mg/kg-day)
Inorganics										
Aluminum	0.27	1.00E+00	N	2.70E-01	1.40E-03	N	ND	ND	ND	ND
Antimony	0.1	4.00E-04	H	4.00E-05	ND	NA	D	ND	ND	ND
Arsenic	0.95	3.00E-04	S, CV	2.85E-04	ND	NA	A	1.50E+00	1.58E+00	1.50E+01
Chromium	0.01	1.50E+00	ND	1.50E-02	2.90E-05	Lung	A	ND	ND	4.20E+01
Lead	0.1	ND	NA	NA	ND	NA	B2	ND	ND	ND
Manganese	0.05	4.70E-02	N	2.35E-03	1.40E-05	N	D	ND	ND	ND
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	0.6	6.00E-05	L, E	3.60E-05	ND	NA	D	ND	ND	ND
4-Amino-2,6-dinitrotoluene	0.6	6.00E-05	L, E	3.60E-05	ND	NA	D	ND	ND	ND
1,3-Dinitrobenzene	0.8	1.00E-04	E, T	8.00E-05	ND	NA	D	ND	ND	ND
2,4-Dinitrotoluene	1	2.00E-03	N, E, L	2.00E-03	ND	NA	B2	6.80E-01	6.80E-01	ND
2,6-Dinitrotoluene	1	1.00E-03	N, E, L, K	1.00E-03	ND	NA	B2	6.80E-01	6.80E-01	ND
3,4-Dinitrotoluene	1	2.00E-03	N, E, L	2.00E-03	ND	NA	ND	ND	ND	ND
2,4,6-Trinitrotoluene	0.6	5.00E-04	L, E	3.00E-04	ND	NA	C	3.00E-02	5.00E-02	ND
Semivolatile Organics										
Acenapthylene	0.5	6.00E-02	L	3.00E-02	ND	NA	D	ND	ND	ND
Benzo(a)anthracene	0.5	ND	NA	NA	ND	NA	B2	7.30E-01	1.46E+00	3.10E-01
Benzo(a)pyrene	0.5	ND	NA	NA	ND	NA	B2	7.30E+00	1.46E+01	3.10E+00
Benzo(b)fluoranthene	0.5	ND	NA	NA	ND	NA	B2	7.30E-01	1.46E+00	3.10E-01
Indeno(1,2,3-cd)pyrene	0.5	ND	NA	NA	ND	NA	B2	7.30E-01	1.46E+00	3.10E-01

ND = No data; NA = Not applicable.
mg/kg-day - Milligrams per kilogram per day.
[a] Please see toxicity profiles in Appendix H.3 for documentation of the values.

Target Organs:
N = nervous system, H = heart, S = skin, CV = cardiovascular, L = liver, K = kidney, E = erythrocyte, T = testis.

Weight of Evidence Group:
A - Human carcinogen; B1 - Probable human carcinogen (human data); B2 - Probable human carcinogen (animal data);
C - Possible human carcinogen; D - Not classifiable as to carcinogenicity to humans.

Table 5-20

Cancer Risk and Noncancer Hazard Index: Groundskeeper Exposure to Surface Soil, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm²-day	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration in Air (mg/m³)	Inhalation Noncancer Dose (mg/kg-day)	Inhalation Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK																	
Inorganics																	
Aluminum	1.30E+04	1.28E-02	4.55E-03	1.28E-02	NA	1.17E-06	1.30E-04	4.63E-05	4.80E-04	NA	1.30E-03	2.55E-04	9.11E-05	1.82E-01	NA	1.95E-01	NA
Arsenic	6.08E+00	5.95E-06	2.13E-06	1.98E-02	3.19E-06	5.47E-10	6.05E-08	2.16E-08	2.12E-04	3.41E-08	6.08E-07	1.19E-07	4.25E-08	NA	6.38E-07	2.00E-02	3.86E-06
Chromium	1.87E+01	1.83E-05	6.54E-06	1.22E-05	NA	1.68E-09	1.86E-07	6.65E-08	1.24E-05	NA	1.87E-06	3.66E-07	1.31E-07	1.26E-02	5.49E-06	1.26E-02	5.49E-06
Manganese	6.02E+02	5.89E-04	2.10E-04	1.25E-02	NA	5.42E-08	5.99E-06	2.14E-06	2.55E-03	NA	6.02E-05	1.18E-05	4.21E-06	8.41E-01	NA	8.56E-01	NA
Nitroaromatics																	
2,4-Dinitrotoluene	4.00E-01	3.91E-07	1.40E-07	1.96E-04	9.51E-08	3.60E-10	3.98E-08	1.42E-08	1.99E-05	9.67E-09	4.00E-08	7.83E-09	2.80E-09	NA	NA	2.16E-04	1.05E-07
Semivolatile Organics																	
Benzo(a)anthracene	4.00E-01	3.91E-07	1.40E-07	NA	1.02E-07	3.60E-10	3.98E-08	1.42E-08	NA	2.08E-08	4.00E-08	7.83E-09	2.80E-09	NA	8.67E-10	NA	1.24E-07
Benzo(a)pyrene	3.90E-01	3.82E-07	1.36E-07	NA	9.95E-07	3.51E-10	3.88E-08	1.39E-08	NA	2.02E-07	3.90E-08	7.63E-09	2.73E-09	NA	8.45E-09	NA	1.21E-06
Benzo(b)fluoranthene	3.00E-01	2.94E-07	1.05E-07	NA	7.65E-08	2.70E-10	2.99E-08	1.07E-08	NA	1.56E-08	3.00E-08	5.87E-09	2.10E-09	NA	6.50E-10	NA	9.27E-08
Indeno(1,2,3-cd)pyrene	2.30E-01	2.25E-07	8.04E-08	NA	5.87E-08	2.07E-10	2.29E-08	8.17E-09	NA	1.19E-08	2.30E-08	4.50E-09	1.61E-09	NA	4.98E-10	NA	7.11E-08
Total HI				**4.63E-02**					**3.27E-03**					**1.04E+00**		**1.08E+00**	
Total ILCR					**4.61E-06**					**2.94E-07**					**6.14E-06**		**1.09E-05**
BACKGROUND RISK																	
Inorganics																	
Aluminum	1.30E+04	1.28E-02	4.55E-03	1.28E-02	NA	1.17E-06	1.30E-04	4.63E-05	4.80E-04	NA	1.30E-03	2.55E-04	9.11E-05	1.82E-01	NA	1.95E-01	NA
Arsenic	6.08E+00	5.95E-06	2.13E-06	1.98E-02	3.19E-06	5.47E-10	6.05E-08	2.16E-08	2.12E-04	3.41E-08	6.08E-07	1.19E-07	4.25E-08	NA	6.38E-07	2.00E-02	3.86E-06
Manganese	6.02E+02	5.89E-04	2.10E-04	1.25E-02	NA	5.42E-08	5.99E-06	2.14E-06	2.55E-03	NA	6.02E-05	1.18E-05	4.21E-06	8.41E-01	NA	8.56E-01	NA
Total HI				**4.51E-02**					**3.24E-03**					**1.02E+00**		**1.07E+00**	
Total ILCR					**3.19E-06**					**3.41E-08**					**6.38E-07**		**3.86E-06**
SITE-RELATED RISK																	
Inorganics																	
Chromium	1.87E+01	1.83E-05	6.54E-06	1.22E-05	NA	1.68E-09	1.86E-07	6.65E-08	1.24E-05	NA	1.87E-06	3.66E-07	1.31E-07	1.26E-02	5.49E-06	1.26E-02	5.49E-06
Nitroaromatics																	
2,4-Dinitrotoluene	4.00E-01	3.91E-07	1.40E-07	1.96E-04	9.51E-08	3.60E-10	3.98E-08	1.42E-08	1.99E-05	9.67E-09	4.00E-08	7.83E-09	2.80E-09	NA	NA	2.16E-04	1.05E-07
Semivolatile Organics																	
Benzo(a)anthracene	4.00E-01	3.91E-07	1.40E-07	NA	1.02E-07	3.60E-10	3.98E-08	1.42E-08	NA	2.08E-08	4.00E-08	7.83E-09	2.80E-09	NA	8.67E-10	NA	1.24E-07
Benzo(a)pyrene	3.90E-01	3.82E-07	1.36E-07	NA	9.95E-07	3.51E-10	3.88E-08	1.39E-08	NA	2.02E-07	3.90E-08	7.63E-09	2.73E-09	NA	8.45E-09	NA	1.21E-06
Benzo(b)fluoranthene	3.00E-01	2.94E-07	1.05E-07	NA	7.65E-08	2.70E-10	2.99E-08	1.07E-08	NA	1.56E-08	3.00E-08	5.87E-09	2.10E-09	NA	6.50E-10	NA	9.27E-08
Indeno(1,2,3-cd)pyrene	2.30E-01	2.25E-07	8.04E-08	NA	5.87E-08	2.07E-10	2.29E-08	8.17E-09	NA	1.19E-08	2.30E-08	4.50E-09	1.61E-09	NA	4.98E-10	NA	7.11E-08
Total HI				**2.08E-04**					**3.23E-05**					**1.26E-02**		**1.29E-02**	
Total ILCR					**1.33E-06**					**2.60E-07**					**6.50E-06**		**7.09E-06**

HQ - Hazard quotient; HI - Hazard index; ILCR - Incremental lifetime cancer risk.
DA - Dose absorbed (per unit body surface area per day).
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm² - Milligrams per square centimeter.
mg/m³ - Milligrams per cubic meter.

Table 5-21

Cancer Risk and Noncancer Hazard Index: Indoor Worker Exposure to Surface Soil, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR
TOTAL RISK					
Inorganics					
Aluminum	1.30E+04	1.84E-02	1.32E-04	1.84E-02	NA
Arsenic	6.08E+00	8.60E-06	6.16E-08	2.87E-02	9.24E-08
Chromium	1.87E+01	2.65E-05	1.90E-07	1.76E-05	NA
Manganese	6.02E+02	8.51E-04	6.10E-06	1.81E-02	NA
Nitroaromatics					
2,4-Dinitrotoluene	4.00E-01	5.66E-07	4.05E-09	2.83E-04	2.76E-09
Semivolatile Organics					
Benzo(a)anthracene	4.00E-01	5.66E-07	4.05E-09	NA	2.96E-09
Benzo(a)pyrene	3.90E-01	5.52E-07	3.95E-09	NA	2.89E-08
Benzo(b)fluoranthene	3.00E-01	4.24E-07	3.04E-09	NA	2.22E-09
Indeno(1,2,3-cd)pyrene	2.30E-01	3.25E-07	2.33E-09	NA	1.70E-09
Total HI				**6.55E-02**	
Total ILCR					**1.31E-07**
BACKGROUND RISK					
Inorganics					
Aluminum	1.30E+04	1.84E-02	1.32E-04	1.84E-02	NA
Arsenic	6.08E+00	8.60E-06	6.16E-08	2.87E-02	9.24E-08
Manganese	6.02E+02	8.51E-04	6.10E-06	1.81E-02	NA
Total HI				**6.52E-02**	
Total ILCR					**9.24E-08**
SITE-RELATED RISK					
Inorganics					
Chromium	1.87E+01	2.65E-05	1.90E-07	1.76E-05	NA
Nitroaromatics					
2,4-Dinitrotoluene	4.00E-01	5.66E-07	4.05E-09	2.83E-04	2.76E-09
Semivolatile Organics					
Benzo(a)anthracene	4.00E-01	5.66E-07	4.05E-09	NA	2.96E-09
Benzo(a)pyrene	3.90E-01	5.52E-07	3.95E-09	NA	2.89E-08
Benzo(b)fluoranthene	3.00E-01	4.24E-07	3.04E-09	NA	2.22E-09
Indeno(1,2,3-cd)pyrene	2.30E-01	3.25E-07	2.33E-09	NA	1.70E-09
Total HI				**2.83E-04**	
Total ILCR					**3.85E-08**

HQ - Hazard quotient; HI - Hazard index; ILCR - Incremental lifetime cancer risk.
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.

Table 5-22

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soil, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm²-day	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration In Air (mg/m³)	Inhalation Noncancer Dose (mg/kg-day)	Inhalation Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK																	
Inorganics																	
Aluminum	1.30E+04	3.69E-02	2.64E-04	3.69E-02	NA	1.04E-05	1.15E-03	8.23E-06	4.26E-03	NA	4.56E-03	8.90E-04	6.38E-06	6.36E-01	NA	6.77E-01	NA
Antimony	3.51E+00	9.94E-06	7.12E-08	2.48E-02	NA	2.81E-09	3.10E-07	2.22E-09	7.74E-03	NA	1.23E-06	2.40E-07	1.72E-09	NA	NA	3.26E-02	NA
Arsenic	8.03E+00	2.27E-05	1.63E-07	7.57E-02	2.44E-07	6.42E-09	7.08E-07	5.07E-09	2.48E-03	8.01E-09	2.81E-06	5.48E-07	3.93E-09	NA	5.89E-08	7.82E-02	3.11E-07
Chromium	1.87E+01	5.29E-05	3.79E-07	3.53E-05	NA	1.50E-08	1.65E-06	1.18E-08	1.10E-04	NA	6.55E-06	1.28E-06	9.15E-09	4.40E-02	3.84E-07	4.42E-02	3.84E-07
Manganese	6.02E+02	1.70E-03	1.22E-05	3.62E-02	NA	4.81E-07	5.31E-05	3.80E-07	2.26E-02	NA	2.11E-04	4.11E-05	2.94E-07	2.94E+00	NA	2.99E+00	NA
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	5.00E-01	1.41E-06	1.01E-08	2.36E-02	NA	4.00E-09	4.41E-07	3.16E-09	1.23E-02	NA	1.75E-07	3.42E-08	2.45E-10	NA	NA	3.58E-02	NA
4-Amino-2,6-dinitrotoluene	6.00E-01	1.70E-06	1.22E-08	2.83E-02	NA	4.80E-09	5.29E-07	3.79E-09	1.47E-02	NA	2.10E-07	4.10E-08	2.94E-10	NA	NA	4.30E-02	NA
1,3-Dinitrobenzene	2.12E+00	6.00E-06	4.30E-08	6.00E-02	NA	1.70E-08	1.87E-06	1.34E-08	2.34E-02	NA	7.42E-07	1.45E-07	1.04E-09	NA	NA	8.34E-02	NA
2,4-Dinitrotoluene	3.09E+00	8.74E-06	6.26E-08	4.37E-03	4.25E-08	2.47E-08	2.72E-06	1.95E-08	1.36E-03	1.33E-08	1.08E-06	2.11E-07	1.51E-09	NA	NA	5.73E-03	5.58E-08
2,6-Dinitrotoluene	1.50E+00	4.24E-06	3.04E-08	4.24E-03	2.07E-08	1.20E-08	1.32E-06	9.48E-09	1.32E-03	6.44E-09	5.25E-07	1.02E-07	7.34E-10	NA	NA	5.57E-03	2.71E-08
3,4-Dinitrotoluene	5.00E-01	1.41E-06	1.01E-08	7.07E-04	NA	4.00E-09	4.41E-07	3.16E-09	2.21E-04	NA	1.75E-07	3.42E-08	2.45E-10	NA	NA	9.28E-04	NA
Semivolatile Organics																	
Benzo(a)anthracene	4.00E-01	1.13E-06	8.11E-09	NA	5.92E-09	3.20E-09	3.53E-07	2.53E-09	NA	3.69E-09	1.40E-07	2.73E-08	1.96E-10	NA	6.07E-11	NA	9.67E-09
Benzo(a)pyrene	3.90E-01	1.10E-08	7.90E-09	NA	5.77E-08	3.12E-09	3.44E-07	2.46E-09	NA	3.60E-08	1.37E-07	2.66E-08	1.91E-10	NA	5.91E-10	NA	9.43E-08
Benzo(b)fluoranthene	3.00E-01	8.49E-07	6.08E-09	NA	4.44E-09	2.40E-09	2.65E-07	1.90E-09	NA	2.77E-09	1.05E-07	2.05E-08	1.47E-10	NA	4.55E-11	NA	7.25E-09
Indeno(1,2,3-cd)pyrene	2.30E-01	6.51E-07	4.66E-09	NA	3.40E-09	1.84E-09	2.03E-07	1.45E-09	NA	2.12E-09	8.05E-08	1.57E-08	1.13E-10	NA	3.49E-11	NA	5.56E-09
Total HI				**2.95E-01**					**9.04E-02**					**3.62E+00**		**4.00E+00**	
Total ILCR					**3.79E-07**					**7.23E-08**					**4.44E-07**		**8.95E-07**
BACKGROUND RISK																	
Inorganics																	
Aluminum	1.30E+04	3.69E-02	2.64E-04	3.69E-02	NA	1.04E-05	1.15E-03	8.23E-06	4.26E-03	NA	4.56E-03	8.90E-04	6.36E-06	6.36E-01	NA	6.77E-01	NA
Antimony	3.51E+00	9.94E-06	7.12E-08	2.48E-02	NA	2.81E-09	3.10E-07	2.22E-09	7.74E-03	NA	1.23E-08	2.40E-07	1.72E-09	NA	NA	3.26E-02	NA
Arsenic	8.03E+00	2.27E-05	1.63E-07	7.57E-02	2.44E-07	6.42E-09	7.08E-07	5.07E-09	2.48E-03	8.01E-09	2.81E-06	5.48E-07	3.93E-09	NA	5.89E-08	7.82E-02	3.11E-07
Manganese	6.02E+02	1.70E-03	1.22E-05	3.62E-02	NA	4.81E-07	5.31E-05	3.80E-07	2.26E-02	NA	2.11E-04	4.11E-05	2.94E-07	2.94E+00	NA	2.99E+00	NA
Total HI				**1.74E-01**					**3.71E-02**					**3.57E+00**		**3.78E+00**	
Total ILCR					**2.44E-07**					**8.01E-09**					**5.89E-08**		**3.11E-07**
SITE-RELATED RISK																	
Inorganics																	
Chromium	1.87E+01	5.29E-05	3.79E-07	3.53E-05	NA	1.50E-08	1.65E-06	1.18E-08	1.10E-04	NA	6.55E-08	1.28E-06	9.15E-09	4.40E-02	3.84E-07	4.42E-02	3.84E-07
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	5.00E-01	1.41E-06	1.01E-08	2.36E-02	NA	4.00E-09	4.41E-07	3.16E-09	1.23E-02	NA	1.75E-07	3.42E-08	2.45E-10	NA	NA	3.58E-02	NA
4-Amino-2,6-dinitrotoluene	6.00E-01	1.70E-08	1.22E-08	2.83E-02	NA	4.80E-09	5.29E-07	3.79E-09	1.47E-02	NA	2.10E-07	4.10E-08	2.94E-10	NA	NA	4.30E-02	NA
1,3-Dinitrobenzene	2.12E+00	6.00E-06	4.30E-08	6.00E-02	NA	1.70E-08	1.87E-08	1.34E-08	2.34E-02	NA	7.42E-07	1.45E-07	1.04E-09	NA	NA	8.34E-02	NA
2,4-Dinitrotoluene	3.09E+00	8.74E-06	6.26E-08	4.37E-03	4.25E-08	2.47E-08	2.72E-06	1.95E-08	1.36E-03	1.33E-08	1.08E-06	2.11E-07	1.51E-09	NA	NA	5.73E-03	5.58E-08
2,6-Dinitrotoluene	1.50E+00	4.24E-06	3.04E-08	4.24E-03	2.07E-08	1.20E-08	1.32E-06	9.48E-09	1.32E-03	6.44E-09	5.25E-07	1.02E-07	7.34E-10	NA	NA	5.57E-03	2.71E-08
3,4-Dinitrotoluene	5.00E-01	1.41E-06	1.01E-08	7.07E-04	NA	4.00E-09	4.41E-07	3.16E-09	2.21E-04	NA	1.75E-07	3.42E-08	2.45E-10	NA	NA	9.28E-04	NA
Semivolatile Organics																	
Benzo(a)anthracene	4.00E-01	1.13E-06	8.11E-09	NA	5.92E-09	3.20E-09	3.53E-07	2.53E-09	NA	3.69E-09	1.40E-07	2.73E-08	1.96E-10	NA	6.07E-11	NA	9.67E-09
Benzo(a)pyrene	3.90E-01	1.10E-06	7.90E-09	NA	5.77E-08	3.12E-09	3.44E-07	2.46E-09	NA	3.60E-08	1.37E-07	2.66E-08	1.91E-10	NA	5.91E-10	NA	9.43E-08
Benzo(b)fluoranthene	3.00E-01	8.49E-07	6.08E-09	NA	4.44E-09	2.40E-09	2.65E-07	1.90E-09	NA	2.77E-09	1.05E-07	2.05E-08	1.47E-10	NA	4.55E-11	NA	7.25E-09
Indeno(1,2,3-cd)pyrene	2.30E-01	6.51E-07	4.66E-09	NA	3.40E-09	1.84E-09	2.03E-07	1.45E-09	NA	2.12E-09	8.05E-08	1.57E-08	1.13E-10	NA	3.49E-11	NA	5.56E-09
Total HI				**1.21E-01**					**5.33E-02**					**4.40E-02**		**2.19E-01**	
Total ILCR					**1.35E-07**					**6.43E-08**					**3.85E-07**		**5.84E-07**

HQ = Hazard quotient; HI = Hazard Index; ILCR = Incremental lifetime cancer risk.
DA = dose absorbed (per unit body surface area per day).
NA = not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm²-day - Milligrams per square centimeter per day.
mg/m³ - Milligrams per cubic meter.

Table 5-23

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Surface Water, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/L)	DA (mg/cm^2-day)	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR
TOTAL RISK						
Inorganics						
Arsenic	1.50E-02	6.00E-08	1.81E-06	1.30E-08	6.37E-03	2.05E-08
Lead	7.70E-02	1.23E-09	3.73E-08	2.67E-10	NA	NA
Manganese	1.60E+00	6.40E-06	1.94E-04	1.39E-06	8.24E-02	NA
Nitroaromatics						
2,4-Dinitrotoluene	5.00E-04	7.60E-09	2.30E-07	1.65E-09	1.15E-04	1.12E-09
2,6-Dinitrotoluene	8.00E-04	8.00E-09	2.42E-07	1.73E-09	2.42E-04	1.18E-09
3,4-Dinitrotoluene	6.00E-04	9.31E-09	2.82E-07	2.02E-09	1.41E-04	NA
Total HI					**8.92E-02**	
Total ILCR						**2.28E-08**
BACKGROUND RISK						
NA	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE-RELATED RISK						
Inorganics						
Arsenic	1.50E-02	6.00E-08	1.81E-06	1.30E-08	6.37E-03	2.05E-08
Lead	7.70E-02	1.23E-09	3.73E-08	2.67E-10	NA	NA
Manganese	1.60E+00	6.40E-06	1.94E-04	1.39E-06	8.24E-02	NA
Nitroaromatics						
2,4-Dinitrotoluene	5.00E-04	7.60E-09	2.30E-07	1.65E-09	1.15E-04	1.12E-09
2,6-Dinitrotoluene	8.00E-04	8.00E-09	2.42E-07	1.73E-09	2.42E-04	1.18E-09
3,4-Dinitrotoluene	6.00E-04	9.31E-09	2.82E-07	2.02E-09	1.41E-04	NA
Total HI					**8.92E-02**	
Total ILCR						**2.28E-08**

DA -Dose absorbed (per unit body surface area per day).
ILCR - Incremental lifetime cancer risk; HQ - Hazard quotient; HI - Hazard index.
NA - Not applicable.
mg/L - Milligrams per liter.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/kg-day - Milligrams per kilogram per day.

Table 5-24

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Sediment, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK												
Inorganics												
Arsenic	8.38E+00	1.96E-05	1.41E-07	6.54E-02	2.11E-07	1.01E-08	3.04E-07	2.18E-09	1.07E-03	3.44E-09	6.65E-02	2.14E-07
Total HI				**6.54E-02**					**1.07E-03**		**6.65E-02**	
Total ILCR					**2.11E-07**					**3.44E-09**		**2.14E-07**
BACKGROUND RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE-RELATED RISK												
Inorganics												
Arsenic	8.38E+00	1.96E-05	1.41E-07	6.54E-02	2.11E-07	1.01E-08	3.04E-07	2.18E-09	1.07E-03	3.44E-09	6.65E-02	2.14E-07
Total HI				**6.54E-02**					**1.07E-03**		**6.65E-02**	
Total ILCR					**2.11E-07**					**3.44E-09**		**2.14E-07**

ILCR - Incremental lifetime cancer risk.
HQ - Hazard quotient; HI - Hazard index.
DA -Dose absorbed (per unit body surface area per day).
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.

Table 5-25

Cancer Risk: On-Site Resident Exposure to Total Soil, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
TOTAL RISK													
Inorganics													
Aluminum	1.30E+04	5.51E-03	1.29E-02	NA	2.35E-05	5.01E-04	2.25E-04	NA	8.35E-06	7.84E-07	4.57E-07	NA	NA
Antimony	3.51E+00	1.48E-06	3.46E-06	NA	6.32E-09	1.35E-07	6.06E-08	NA	2.25E-09	2.11E-10	1.23E-10	NA	NA
Arsenic	8.03E+00	3.39E-06	7.92E-06	1.70E-05	1.45E-08	3.09E-07	1.39E-07	7.06E-07	5.14E-09	4.83E-10	2.82E-10	1.15E-08	1.77E-05
Chromium	1.87E+01	7.91E-06	1.84E-05	NA	3.37E-08	7.19E-07	3.23E-07	NA	1.20E-08	1.13E-09	6.56E-10	7.48E-08	7.48E-08
Manganese	6.02E+02	2.54E-04	5.93E-04	NA	1.08E-06	2.31E-05	1.04E-05	NA	3.85E-07	3.62E-08	2.11E-08	NA	NA
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	5.00E-01	2.11E-07	4.93E-07	NA	9.00E-09	1.92E-07	8.63E-08	NA	3.20E-10	3.01E-11	1.75E-11	NA	NA
4-Amino-2,6-dinitrotoluene	6.00E-01	2.54E-07	5.92E-07	NA	1.08E-08	2.31E-07	1.04E-07	NA	3.84E-10	3.61E-11	2.11E-11	NA	NA
1,3-Dinitrobenzene	2.12E+00	8.96E-07	2.09E-06	NA	3.82E-08	8.15E-07	3.66E-07	NA	1.36E-09	1.28E-10	7.44E-11	NA	NA
2,4-Dinitrotoluene	3.09E+00	1.30E-06	3.04E-06	2.96E-06	5.56E-08	1.19E-06	5.33E-07	1.17E-06	1.98E-09	1.86E-10	1.08E-10	NA	4.13E-06
2,6-Dinitrotoluene	1.50E+00	6.34E-07	1.48E-06	1.44E-06	2.70E-08	5.77E-07	2.59E-07	5.68E-07	9.61E-10	9.02E-11	5.26E-11	NA	2.01E-06
3,4-Dinitrotoluene	5.00E-01	2.11E-07	4.93E-07	NA	9.00E-09	1.92E-07	8.63E-08	NA	3.20E-10	3.01E-11	1.75E-11	NA	NA
Semivolatile Organics													
Benzo(a)anthracene	4.00E-01	1.69E-07	3.95E-07	4.11E-07	7.20E-09	1.54E-07	6.90E-08	3.25E-07	2.56E-10	2.41E-11	1.40E-11	1.18E-11	7.37E-07
Benzo(a)pyrene	3.90E-01	1.65E-07	3.85E-07	4.01E-06	7.02E-09	1.50E-07	6.73E-08	3.17E-06	2.50E-10	2.35E-11	1.37E-11	1.15E-10	7.18E-06
Benzo(b)fluoranthene	3.00E-01	1.27E-07	2.96E-07	3.09E-07	5.40E-09	1.15E-07	5.18E-08	2.44E-07	1.92E-10	1.80E-11	1.05E-11	8.86E-12	5.53E-07
Indeno(1,2,3-cd)pyrene	2.30E-01	9.72E-08	2.27E-07	2.37E-07	4.14E-09	8.85E-08	3.97E-08	1.87E-07	1.47E-10	1.38E-11	8.07E-12	6.79E-12	4.24E-07
Total ILCR				**2.63E-05**				**6.37E-06**				**8.64E-08**	**3.28E-05**
BACKGROUND RISK													
Inorganics													
Aluminum	1.30E+04	5.51E-03	1.29E-02	NA	2.35E-05	5.01E-04	2.25E-04	NA	8.35E-06	7.84E-07	4.57E-07	NA	NA
Antimony	3.51E+00	1.48E-06	3.46E-06	NA	6.32E-09	1.35E-07	6.06E-08	NA	2.25E-09	2.11E-10	1.23E-10	NA	NA
Arsenic	8.03E+00	3.39E-06	7.92E-06	1.70E-05	1.45E-08	3.09E-07	1.39E-07	7.06E-07	5.14E-09	4.83E-10	2.82E-10	1.15E-08	1.77E-05
Manganese	6.02E+02	2.54E-04	5.93E-04	NA	1.08E-06	2.31E-05	1.04E-05	NA	3.85E-07	3.62E-08	2.11E-08	NA	NA
Total ILCR				**1.70E-05**				**7.06E-07**				**1.15E-08**	**1.77E-05**
SITE-RELATED RISK													
Inorganics													
Chromium	1.87E+01	7.91E-06	1.84E-05	NA	3.37E-08	7.19E-07	3.23E-07	NA	1.20E-08	1.13E-09	6.56E-10	7.48E-08	7.48E-08
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	5.00E-01	2.11E-07	4.93E-07	NA	9.00E-09	1.92E-07	8.63E-08	NA	3.20E-10	3.01E-11	1.75E-11	NA	NA
4-Amino-2,6-dinitrotoluene	6.00E-01	2.54E-07	5.92E-07	NA	1.08E-08	2.31E-07	1.04E-07	NA	3.84E-10	3.61E-11	2.11E-11	NA	NA
1,3-Dinitrobenzene	2.12E+00	8.96E-07	2.09E-06	NA	3.82E-08	8.15E-07	3.66E-07	NA	1.36E-09	1.28E-10	7.44E-11	NA	NA
2,4-Dinitrotoluene	3.09E+00	1.30E-06	3.04E-06	2.96E-06	5.56E-08	1.19E-06	5.33E-07	1.17E-06	1.98E-09	1.86E-10	1.08E-10	NA	4.13E-06
2,6-Dinitrotoluene	1.50E+00	6.34E-07	1.48E-06	1.44E-06	2.70E-08	5.77E-07	2.59E-07	5.68E-07	9.61E-10	9.02E-11	5.26E-11	NA	2.01E-06
3,4-Dinitrotoluene	5.00E-01	2.11E-07	4.93E-07	NA	9.00E-09	1.92E-07	8.63E-08	NA	3.20E-10	3.01E-11	1.75E-11	NA	NA
Semivolatile Organics													
Benzo(a)anthracene	4.00E-01	1.69E-07	3.95E-07	4.11E-07	7.20E-09	1.54E-07	6.90E-08	3.25E-07	2.56E-10	2.41E-11	1.40E-11	1.18E-11	7.37E-07
Benzo(a)pyrene	3.90E-01	1.65E-07	3.85E-07	4.01E-06	7.02E-09	1.50E-07	6.73E-08	3.17E-06	2.50E-10	2.35E-11	1.37E-11	1.15E-10	7.18E-06
Benzo(b)fluoranthene	3.00E-01	1.27E-07	2.96E-07	3.09E-07	5.40E-09	1.15E-07	5.18E-08	2.44E-07	1.92E-10	1.80E-11	1.05E-11	8.86E-12	5.53E-07
Indeno(1,2,3-cd)pyrene	2.30E-01	9.72E-08	2.27E-07	2.37E-07	4.14E-09	8.85E-08	3.97E-08	1.87E-07	1.47E-10	1.38E-11	8.07E-12	6.79E-12	4.24E-07
Total ILCR				**9.36E-06**				**5.67E-06**				**7.50E-08**	**1.51E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-26

Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
TOTAL RISK										
Inorganics										
Aluminum	1.30E+04	1.50E-01	1.50E-01	2.35E-05	2.62E-03	9.72E-03	8.35E-06	5.34E-06	3.81E-03	1.64E-01
Antimony	3.51E+00	4.04E-05	1.01E-01	6.32E-09	7.07E-07	1.77E-02	2.25E-09	1.44E-09	NA	1.19E-01
Arsenic	8.03E+00	9.24E-05	3.08E-01	1.45E-08	1.62E-06	5.67E-03	5.14E-09	3.29E-09	NA	3.14E-01
Chromium	1.87E+01	2.15E-04	1.43E-04	3.37E-08	3.77E-06	2.51E-04	1.20E-08	7.66E-09	2.64E-04	6.59E-04
Manganese	6.02E+02	6.92E-03	1.47E-01	1.08E-06	1.21E-04	5.16E-02	3.85E-07	2.46E-07	1.76E-02	2.16E-01
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	5.00E-01	5.75E-06	9.59E-02	9.00E-09	1.01E-06	2.80E-02	3.20E-10	2.05E-10	NA	1.24E-01
4-Amino-2,6-dinitrotoluene	6.00E-01	8.90E-06	1.15E-01	1.08E-08	1.21E-06	3.36E-02	3.84E-10	2.46E-10	NA	1.49E-01
1,3-Dinitrobenzene	2.12E+00	2.44E-05	2.44E-01	3.82E-08	4.27E-06	5.34E-02	1.36E-09	8.68E-10	NA	2.97E-01
2,4-Dinitrotoluene	3.09E+00	3.55E-05	1.78E-02	5.56E-08	6.22E-06	3.11E-03	1.98E-09	1.26E-09	NA	2.09E-02
2,6-Dinitrotoluene	1.50E+00	1.73E-05	1.73E-02	2.70E-08	3.02E-06	3.02E-03	9.61E-10	6.14E-10	NA	2.03E-02
3,4-Dinitrotoluene	5.00E-01	5.75E-06	2.88E-03	9.00E-09	1.01E-06	5.03E-04	3.20E-10	2.05E-10	NA	3.38E-03
Semivolatile Organics										
Benzo(a)anthracene	4.00E-01	4.60E-06	NA	7.20E-09	8.05E-07	NA	2.56E-10	1.64E-10	NA	NA
Benzo(a)pyrene	3.90E-01	4.49E-06	NA	7.02E-09	7.85E-07	NA	2.50E-10	1.60E-10	NA	NA
Benzo(b)fluoranthene	3.00E-01	3.45E-06	NA	5.40E-09	6.04E-07	NA	1.92E-10	1.23E-10	NA	NA
Indeno(1,2,3-cd)pyrene	2.30E-01	2.65E-06	NA	4.14E-09	4.63E-07	NA	1.47E-10	9.42E-11	NA	NA
Total HI			**1.20E+00**			**2.06E-01**			**2.17E-02**	**1.43E+00**
BACKGROUND RISK										
Inorganics										
Aluminum	1.30E+04	1.50E-01	1.50E-01	2.35E-05	2.62E-03	9.72E-03	8.35E-06	5.34E-06	3.81E-03	1.64E-01
Antimony	3.51E+00	4.04E-05	1.01E-01	6.32E-09	7.07E-07	1.77E-02	2.25E-09	1.44E-09	NA	1.19E-01
Arsenic	8.03E+00	9.24E-05	3.08E-01	1.45E-08	1.62E-06	5.67E-03	5.14E-09	3.29E-09	NA	3.14E-01
Manganese	6.02E+02	6.92E-03	1.47E-01	1.08E-06	1.21E-04	5.16E-02	3.85E-07	2.46E-07	1.76E-02	2.16E-01
Total HI			**7.06E-01**			**8.46E-02**			**2.14E-02**	**8.12E-01**
SITE-RELATED RISK										
Inorganics										
Chromium	1.87E+01	2.15E-04	1.43E-04	3.37E-08	3.77E-06	2.51E-04	1.20E-08	7.66E-09	2.64E-04	6.59E-04
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	5.00E-01	5.75E-06	9.59E-02	9.00E-09	1.01E-08	2.80E-02	3.20E-10	2.05E-10	NA	1.24E-01
4-Amino-2,8-dinitrotoluene	6.00E-01	8.90E-06	1.15E-01	1.08E-08	1.21E-06	3.36E-02	3.84E-10	2.46E-10	NA	1.49E-01
1,3-Dinitrobenzene	2.12E+00	2.44E-05	2.44E-01	3.82E-08	4.27E-06	5.34E-02	1.36E-09	8.68E-10	NA	2.97E-01
2,4-Dinitrotoluene	3.09E+00	3.55E-05	1.78E-02	5.58E-08	6.22E-06	3.11E-03	1.98E-09	1.26E-09	NA	2.09E-02
2,6-Dinitrotoluene	1.50E+00	1.73E-05	1.73E-02	2.70E-08	3.02E-06	3.02E-03	9.81E-10	6.14E-10	NA	2.03E-02
3,4-Dinitrotoluene	5.00E-01	5.75E-06	2.88E-03	9.00E-09	1.01E-06	5.03E-04	3.20E-10	2.05E-10	NA	3.38E-03
Semivolatile Organics										
Benzo(a)anthracene	4.00E-01	4.60E-06	NA	7.20E-09	8.05E-07	NA	2.56E-10	1.64E-10	NA	NA
Benzo(a)pyrene	3.90E-01	4.49E-08	NA	7.02E-09	7.85E-07	NA	2.50E-10	1.60E-10	NA	NA
Benzo(b)fluoranthene	3.00E-01	3.45E-06	NA	5.40E-09	6.04E-07	NA	1.92E-10	1.23E-10	NA	NA
Indeno(1,2,3-cd)pyrene	2.30E-01	2.65E-06	NA	4.14E-09	4.63E-07	NA	1.47E-10	9.42E-11	NA	NA
Total HI			**4.93E-01**			**1.22E-01**			**2.64E-04**	**6.15E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-27

Cancer Risk: On-Site Resident Exposure to Surface Water, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

	Source Term Concentration (mg/L)	DA (mg/cm^2-day)	Adult Resident: Dermally Absorbed Dose (mg/kg-day)	Adult Resident: Dermal ILCR	Child Resident: Dermally Absorbed Dose (mg/kg-day)	Child Resident: Dermal ILCR	On-Site Resident Total ILCR
TOTAL RISK							
Inorganics							
Arsenic	1.50E-02	4.50E-08	1.71E-07	2.70E-07	7.69E-08	1.21E-07	3.92E-07
Lead	7.70E-02	9.24E-10	3.51E-09	NA	1.58E-09	NA	NA
Manganese	1.60E+00	4.80E-06	1.83E-05	NA	8.21E-06	NA	NA
Nitroaromatics							
2,4-Dinitrotoluene	5.00E-04	5.70E-09	2.17E-08	1.47E-08	9.74E-09	6.63E-09	2.14E-08
2,6-Dinitrotoluene	8.00E-04	6.00E-09	2.28E-08	1.55E-08	1.03E-08	6.98E-09	2.25E-08
3,4-Dinitrotoluene	6.00E-04	6.98E-09	2.66E-08	NA	1.19E-08	NA	NA
Total ILCR				**3.00E-07**		**1.35E-07**	**4.36E-07**
BACKGROUND RISK							
NA	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	
SITE-RELATED RISK							
Inorganics							
Arsenic	1.50E-02	4.50E-08	1.71E-07	2.70E-07	7.69E-08	1.21E-07	3.92E-07
Lead	7.70E-02	9.24E-10	3.51E-09	NA	1.58E-09	NA	NA
Manganese	1.60E+00	4.80E-06	1.83E-05	NA	8.21E-06	NA	NA
Nitroaromatics							
2,4-Dinitrotoluene	5.00E-04	5.70E-09	2.17E-08	1.47E-08	9.74E-09	6.63E-09	2.14E-08
2,6-Dinitrotoluene	8.00E-04	6.00E-09	2.28E-08	1.55E-08	1.03E-08	6.98E-09	2.25E-08
3,4-Dinitrotoluene	6.00E-04	6.98E-09	2.66E-08	NA	1.19E-08	NA	NA
Total ILCR				**3.00E-07**		**1.35E-07**	**4.36E-07**

DA - Dose absorbed (per unit body surface area per day).
ILCR - Incremental lifetime cancer risk.
NA - Not applicable.

Table 5-28

Noncancer Hazard Index: On-Site Resident Child Exposure to Surface Water, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/L)	DA (mg/cm^2-day)	Dermally Absorbed Dose (mg/kg-day)	Dermal HQ
TOTAL RISK				
Inorganics				
Arsenic	1.50E-02	4.50E-08	8.98E-07	3.15E-03
Lead	7.70E-02	9.24E-10	1.84E-08	NA
Manganese	1.60E+00	4.80E-06	9.57E-05	4.07E-02
Nitroaromatics				
2,4-Dinitrotoluene	5.00E-04	5.70E-09	1.14E-07	5.68E-05
2,6-Dinitrotoluene	8.00E-04	6.00E-09	1.20E-07	1.20E-04
3,4-Dinitrotoluene	6.00E-04	6.98E-09	1.39E-07	6.96E-05
Total HI				**4.41E-02**
BACKGROUND RISK				
NA	**NA**	**NA**	**NA**	**NA**
SITE-RELATED RISK				
Inorganics				
Arsenic	1.50E-02	4.50E-08	8.98E-07	3.15E-03
Lead	7.70E-02	9.24E-10	1.84E-08	NA
Manganese	1.60E+00	4.80E-06	9.57E-05	4.07E-02
Nitroaromatics				
2,4-Dinitrotoluene	5.00E-04	5.70E-09	1.14E-07	5.68E-05
2,6-Dinitrotoluene	8.00E-04	6.00E-09	1.20E-07	1.20E-04
3,4-Dinitrotoluene	6.00E-04	6.98E-09	1.39E-07	6.96E-05
Total HI				**4.41E-02**

DA - Dose absorbed (per unit body surface area per day).
HQ - Hazard quotient; HI - Hazard index.
NA - Not applicable.
mg/L - Milligrams per liter.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/kg-day - Milligrams per kilogram per day.

Table 5-29

Cancer Risk: On-Site Resident Exposure to Sediment, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Adult Ingested Dose (mg/kg-day)	Child Ingested Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Dermally Absorbed Dose (mg/kg-day)	Child Dermally Absorbed Dose (mg/kg-day)	On-Site Resident Dermal ILCR	On-Site Resident Total All Pathways ILCR
TOTAL RISK									
Inorganics									
Arsenic	8.38E+00	5.85E-08	1.36E-07	2.92E-07	1.68E-09	5.32E-09	2.39E-09	1.22E-08	3.05E-07
Total ILCR				**2.92E-07**				**1.22E-08**	**3.05E-07**
BACKGROUND RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE-RELATED RISK									
Inorganics									
Arsenic	8.38E+00	5.85E-08	1.36E-07	2.92E-07	1.68E-09	5.32E-09	2.39E-09	1.22E-08	3.05E-07
Total ILCR				**2.92E-07**				**1.22E-08**	**3.05E-07**

ILCR - Incremental lifetime cancer risk.
DA -Dose absorbed (per unit body surface area per day).
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.

Table 5-30
Noncancer Hazard Index: On-Site Resident Child Exposure to Sediment, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Child Ingested Dose (mg/kg-day)	Child Resident Oral HQ	DA (mg/cm^2-day)	Child Dermally Absorbed Dose (mg/kg-day)	Child Resident Dermal HQ	Child Resident Total All Pathways HI
TOTAL RISK							
Inorganics							
Arsenic	8.38E+00	1.59E-06	5.31E-03	1.68E-09	2.79E-08	9.78E-05	5.41E-03
Total HI			**5.31E-03**			**9.78E-05**	**5.41E-03**
BACKGROUND RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
SITE-RELATED RISK							
Inorganics							
Arsenic	8.38E+00	1.59E-06	5.31E-03	1.68E-09	2.79E-08	9.78E-05	5.41E-03
Total HI			**5.31E-03**			**9.78E-05**	**5.41E-03**

ILCR - Incremental lifetime cancer risk.
HQ - Hazard quotient; HI - Hazard index.
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.

Table 5-31

Summary of Total Hazard Index and Total Cancer Risk from Site-Related Chemicals of Potential Concern, West Area Red Water Ponds, PBOW, Sandusky, Ohio

	Groundskeeper		Indoor Worker		Construction Worker		On-Site Resident	
Contaminant Source	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR
Surface Soil	1.29E-02	7.09E-06	2.83E-04	3.85E-08	NA	NA	NA	NA
Total Soil	NA	NA	NA	NA	2.19E-01	5.84E-07	6.15E-01	1.51E-05
Surface Water	NA	NA	NA	NA	8.92E-02	2.28E-08	4.41E-02	4.36E-07
Sediment	NA	NA	NA	NA	6.65E-02	2.14E-07	5.41E-03	3.05E-07
Total across all media	**1.29E-02**	**7.09E-06**	**2.83E-04**	**3.85E-08**	**3.74E-01**	**8.21E-07**	**6.65E-01**	**1.58E-05**

HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
NA = Not applicable.

Table 5-32

Exposure Unit Values[a] for Sample Location DP13, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 2 ft bgs Surface Soil		4 - 6 ft bgs Subsurface Soil		8 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Inorganics							
CHROMIUM	2.03E+01		1.03E+01		2.22E+01		2.22E+01
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	6.00E-01	c	6.00E-01
1,3-DINITROBENZENE	1.25E-01	c	1.25E-01	c	6.00E-01	c	6.00E-01
2,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	6.30E+00		6.30E+00
2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	6.00E-01	c	6.00E-01
Semivolatile Organics							
BENZO(A)ANTHRACENE	4.00E-01		NA		NA		4.00E-01
BENZO(A)PYRENE	3.90E-01		NA		NA		3.90E-01
BENZO(B)FLUORANTHENE	3.00E-01		NA		NA		3.00E-01
INDENO(1,2,3-CD)PYRENE	2.30E-01		NA		NA		2.30E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.
NA - Not analyzed.
[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-33

Site-Related Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soil
Sample Location DP13, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion					Dermal Absorption					Inhalation					
Chemical	Source-Term Concentration (mg/kg)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA (mg/cm^2-day)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration In Air (mg/m^3)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
Inorganics																	
Chromium	2.22E+01	6.28E-05	4.50E-07	4.19E-05	NA	1.78E-08	1.96E-06	1.40E-08	1.31E-04	NA	7.77E-06	1.52E-06	1.09E-08	5.23E-02	4.56E-07	5.25E-02	4.56E-07
Nitroaromatics																	
4-Amino-2,6-dinitrotoluene	6.00E-01	1.70E-06	1.22E-08	2.83E-02	NA	4.80E-09	5.29E-07	3.79E-09	1.47E-02	NA	2.10E-07	4.10E-08	2.94E-10	NA	NA	4.30E-02	NA
1,3-Dinitrobenzene	6.00E-01	1.70E-06	1.22E-08	1.70E-02	NA	4.80E-09	5.29E-07	3.79E-09	6.62E-03	NA	2.10E-07	4.10E-08	2.94E-10	NA	NA	2.36E-02	NA
2,4-Dinitrotoluene	6.30E+00	1.78E-05	1.28E-07	8.91E-03	8.68E-08	5.04E-08	5.56E-06	3.98E-08	2.78E-03	2.71E-08	2.21E-06	4.30E-07	3.08E-09	NA	NA	1.17E-02	1.14E-07
2,6-Dinitrotoluene	6.00E-01	1.70E-06	1.22E-08	1.70E-03	8.27E-09	4.80E-09	5.29E-07	3.79E-09	5.29E-04	2.58E-09	2.10E-07	4.10E-08	2.94E-10	NA	NA	2.23E-03	1.08E-08
Semivolatile Organics																	
Benzo(a)anthracene	4.00E-01	1.13E-06	8.11E-09	NA	5.92E-09	3.20E-09	3.53E-07	2.53E-09	NA	3.69E-09	1.40E-07	2.73E-08	1.96E-10	NA	6.07E-11	NA	9.67E-09
Benzo(a)pyrene	3.90E-01	1.10E-06	7.90E-09	NA	5.77E-08	3.12E-09	3.44E-07	2.46E-09	NA	3.60E-08	1.37E-07	2.66E-08	1.91E-10	NA	5.91E-10	NA	9.43E-08
Benzo(b)fluoranthene	3.00E-01	8.49E-07	6.08E-09	NA	4.44E-09	2.40E-09	2.65E-07	1.90E-09	NA	2.77E-09	1.05E-07	2.05E-08	1.47E-10	NA	4.55E-11	NA	7.25E-09
Indeno(1,2,3-cd)pyrene	2.30E-01	6.51E-07	4.66E-09	NA	3.40E-09	1.84E-09	2.03E-07	1.45E-09	NA	2.12E-09	8.05E-08	1.57E-08	1.13E-10	NA	3.49E-11	NA	5.56E-09
Total HI				**5.59E-02**					**2.48E-02**					**5.23E-02**		**1.33E-01**	
Total ILCR					**1.67E-07**					**7.42E-08**					**4.57E-07**		**6.98E-07**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-34

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location DP13, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Inorganics													
Chromium	2.22E+01	9.38E-06	2.19E-05	NA	4.00E-08	8.54E-07	3.83E-07	NA	1.42E-08	1.34E-09	7.79E-10	8.88E-08	8.88E-08
Nitroaromatics													
4-Amino-2,6-dinitrotoluene	6.00E-01	2.54E-07	5.92E-07	NA	1.08E-08	2.31E-07	1.04E-07	NA	3.84E-10	3.61E-11	2.11E-11	NA	NA
1,3-Dinitrobenzene	6.00E-01	2.54E-07	5.92E-07	NA	1.08E-08	2.31E-07	1.04E-07	NA	3.84E-10	3.61E-11	2.11E-11	NA	NA
2,4-Dinitrotoluene	6.30E+00	2.66E-06	6.21E-06	6.04E-06	1.13E-07	2.42E-06	1.09E-06	2.39E-06	4.04E-09	3.79E-10	2.21E-10	NA	8.42E-06
2,6-Dinitrotoluene	6.00E-01	2.54E-07	5.92E-07	5.75E-07	1.08E-08	2.31E-07	1.04E-07	2.27E-07	3.84E-10	3.61E-11	2.11E-11	NA	8.02E-07
Semivolatile Organics													
Benzo(a)anthracene	4.00E-01	1.69E-07	3.95E-07	4.11E-07	7.20E-09	1.54E-07	6.90E-08	3.25E-07	2.56E-10	2.41E-11	1.40E-11	1.18E-11	7.37E-07
Benzo(a)pyrene	3.90E-01	1.65E-07	3.85E-07	4.01E-06	7.02E-09	1.50E-07	6.73E-08	3.17E-06	2.50E-10	2.35E-11	1.37E-11	1.15E-10	7.18E-06
Benzo(b)fluoranthene	3.00E-01	1.27E-07	2.96E-07	3.09E-07	5.40E-09	1.15E-07	5.18E-08	2.44E-07	1.92E-10	1.80E-11	1.05E-11	8.86E-12	5.53E-07
Indeno(1,2,3-cd)pyrene	2.30E-01	9.72E-08	2.27E-07	2.37E-07	4.14E-09	8.85E-08	3.97E-08	1.87E-07	1.47E-10	1.38E-11	8.07E-12	6.79E-12	4.24E-07
Total ILCR				**1.16E-05**				**6.54E-06**				**8.90E-08**	**1.82E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-35

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location DP13, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Inorganics										
Chromium	2.22E+01	2.55E-04	1.70E-04	4.00E-08	4.47E-06	2.98E-04	1.42E-08	9.09E-09	3.13E-04	7.82E-04
Nitroaromatics										
4-Amino-2,6-dinitrotoluene	6.00E-01	6.90E-06	1.15E-01	1.08E-08	1.21E-06	3.36E-02	3.84E-10	2.46E-10	NA	1.49E-01
1,3-Dinitrobenzene	6.00E-01	6.90E-06	6.90E-02	1.08E-08	1.21E-06	1.51E-02	3.84E-10	2.46E-10	NA	8.41E-02
2,4-Dinitrotoluene	6.30E+00	7.25E-05	3.62E-02	1.13E-07	1.27E-05	6.34E-03	4.04E-09	2.58E-09	NA	4.26E-02
2,6-Dinitrotoluene	6.00E-01	6.90E-06	6.90E-03	1.08E-08	1.21E-06	1.21E-03	3.84E-10	2.46E-10	NA	8.11E-03
Semivolatile Organics										
Benzo(a)anthracene	4.00E-01	4.60E-06	NA	7.20E-09	8.05E-07	NA	2.56E-10	1.64E-10	NA	NA
Benzo(a)pyrene	3.90E-01	4.49E-06	NA	7.02E-09	7.85E-07	NA	2.50E-10	1.60E-10	NA	NA
Benzo(b)fluoranthene	3.00E-01	3.45E-06	NA	5.40E-09	6.04E-07	NA	1.92E-10	1.23E-10	NA	NA
Indeno(1,2,3-cd)pyrene	2.30E-01	2.65E-06	NA	4.14E-09	4.63E-07	NA	1.47E-10	9.42E-11	NA	NA
Total HI			**2.27E-01**			**5.65E-02**			**3.13E-04**	**2.84E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-36

Exposure Unit Values for Sample Location PB-RWP-DS-S6, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	Surface Soil [a]	Subsurface Soil [b]	Source Term Concentration
Inorganics			
CHROMIUM	1.60E+01	1.27E+01	1.60E+01
Nitroaromatics			
2-AMINO-4,6-DINITROTOLUENE	1.25E-01	1.25E-01	1.25E-01
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	6.00E-01	6.00E-01
1,3-DINITROBENZENE	1.25E-01	2.40E+00	2.40E+00
2,4-DINITROTOLUENE	1.25E-01	3.00E+00	3.00E+00
2,6-DINITROTOLUENE	1.30E-01	1.30E-01	1.30E-01
3,4-DINITROTOLUENE	1.25E-01	1.25E-01	1.25E-01

mg/kg - Milligrams per kilogram.

[a] This sample is from location PB-RWP-DS-S6 depth 0 - 2 feet below ground surface.
[b] This sample is from location PB-RWP-DS-S6 depth 2 - 5 feet below ground surface.

Table 5-37

Site-Related Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Soil, DS-S6 at West Area Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion					Dermal Absorption					Inhalation					
Chemical	Source-Term Concentration (mg/kg)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm²-day	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration In Air (mg/m³)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
Inorganics																	
Chromium	1.60E+01	4.53E-05	3.24E-07	3.02E-05	NA	1.28E-08	1.41E-06	1.01E-08	9.41E-05	NA	5.60E-06	1.09E-06	7.83E-09	3.77E-02	3.29E-07	3.78E-02	3.29E-07
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	1.25E-01	3.54E-07	2.53E-09	5.90E-03	NA	1.00E-09	1.10E-07	7.90E-10	3.06E-03	NA	4.38E-08	8.54E-09	6.12E-11	NA	NA	8.96E-03	NA
4-Amino-2,6-dinitrotoluene	6.00E-01	1.70E-06	1.22E-08	2.83E-02	NA	4.80E-09	5.29E-07	3.79E-09	1.47E-02	NA	2.10E-07	4.10E-08	2.94E-10	NA	NA	4.30E-02	NA
1,3-Dinitrobenzene	2.40E+00	6.79E-06	4.86E-08	6.79E-02	NA	1.92E-08	2.12E-06	1.52E-08	2.65E-02	NA	8.40E-07	1.64E-07	1.17E-09	NA	NA	9.44E-02	NA
2,4-Dinitrotoluene	3.00E+00	8.49E-06	6.08E-08	4.24E-03	4.13E-08	2.40E-08	2.65E-06	1.90E-08	1.32E-03	1.29E-08	1.05E-06	2.05E-07	1.47E-09	NA	NA	5.57E-03	5.42E-08
2,6-Dinitrotoluene	1.30E-01	3.68E-07	2.63E-09	3.68E-04	1.79E-09	1.04E-09	1.15E-07	8.21E-10	1.15E-04	5.59E-10	4.55E-08	8.88E-09	6.36E-11	NA	NA	4.83E-04	2.35E-09
3,4-Dinitrotoluene	1.25E-01	3.54E-07	2.53E-09	1.77E-04	NA	1.00E-09	1.10E-07	7.90E-10	5.51E-05	NA	4.38E-08	8.54E-09	6.12E-11	NA	NA	2.32E-04	NA
Total HI				**1.07E-01**					**4.58E-02**					**3.77E-02**		**1.90E-01**	
Total ILCR					**4.31E-08**					**1.34E-08**					**3.29E-07**		**3.85E-07**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm²-day - Milligrams per square centimeter per day.
mg/m3 - Milligrams per cubic meter.

Table 5-38

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil, DS-S6 at West Area
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Inorganics													
Chromium	1.60E+01	6.76E-06	1.58E-05	NA	2.88E-08	6.15E-07	2.76E-07	NA	1.02E-08	9.63E-10	5.62E-10	6.40E-08	6.40E-08
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
4-Amino-2,6-dinitrotoluene	6.00E-01	2.54E-07	5.92E-07	NA	1.08E-08	2.31E-07	1.04E-07	NA	3.84E-10	3.61E-11	2.11E-11	NA	NA
1,3-Dinitrobenzene	2.40E+00	1.01E-06	2.37E-06	NA	4.32E-08	9.23E-07	4.14E-07	NA	1.54E-09	1.44E-10	8.42E-11	NA	NA
2,4-Dinitrotoluene	3.00E+00	1.27E-06	2.96E-06	2.87E-06	5.40E-08	1.15E-06	5.18E-07	1.14E-06	1.92E-09	1.80E-10	1.05E-10	NA	4.01E-06
2,6-Dinitrotoluene	1.30E-01	5.50E-08	1.28E-07	1.25E-07	2.34E-09	5.00E-08	2.24E-08	4.93E-08	8.33E-11	7.82E-12	4.56E-12	NA	1.74E-07
3,4-Dinitrotoluene	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
Total ILCR				**3.00E-06**				**1.19E-06**				**6.40E-08**	**4.25E-06**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.
NA = Not applicable.

Table 5-39

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil, DS-S6 at West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Inorganics										
Chromium	1.60E+01	1.84E-04	1.23E-04	2.88E-08	3.22E-06	2.15E-04	1.02E-08	6.55E-09	2.26E-04	5.63E-04
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	1.25E-01	1.44E-06	2.40E-02	2.25E-09	2.52E-07	6.99E-03	8.01E-11	5.12E-11	NA	3.10E-02
4-Amino-2,6-dinitrotoluene	6.00E-01	6.90E-06	1.15E-01	1.08E-08	1.21E-06	3.36E-02	3.84E-10	2.46E-10	NA	1.49E-01
1,3-Dinitrobenzene	2.40E+00	2.76E-05	2.76E-01	4.32E-08	4.83E-06	6.04E-02	1.54E-09	9.83E-10	NA	3.37E-01
2,4-Dinitrotoluene	3.00E+00	3.45E-05	1.73E-02	5.40E-08	6.04E-06	3.02E-03	1.92E-09	1.23E-09	NA	2.03E-02
2,6-Dinitrotoluene	1.30E-01	1.50E-06	1.50E-03	2.34E-09	2.62E-07	2.62E-04	8.33E-11	5.32E-11	NA	1.76E-03
3,4-Dinitrotoluene	1.25E-01	1.44E-06	7.19E-04	2.25E-09	2.52E-07	1.26E-04	8.01E-11	5.12E-11	NA	8.45E-04
Total HI			**4.35E-01**			**1.05E-01**			**2.26E-04**	**5.40E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-40

Exposure Unit Values[a] for Sample Location S10, West Area Red Water Ponds, PBOW, Sandusky, Ohio'

Chemical Name (mg/kg)	3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Inorganics					
CHROMIUM	2.60E+01		2.50E+01		2.60E+01
Nitroaromatics					
2-AMINO-4,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01
4-AMINO-2,6-DINITROTOLUENE	7.00E-01		1.25E-01	c	7.00E-01
1,3-DINITROBENZENE	2.30E+00		5.00E-01		2.30E+00
2,4-DINITROTOLUENE	5.10E+00		1.25E-01	c	5.10E+00
2,6-DINITROTOLUENE	3.00E-01		1.30E-01	c	3.00E-01
3,4-DINITROTOLUENE	1.25E-01	c	3.00E-01		3.00E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One half reporting limit used as surrogate value for nondetects.

Table 5-41

Site-Related Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soil
Sample Location S10, West Area
Red Water Ponds, PBOW, Sandusky Ohio

		Incidental Ingestion					Dermal Absorption					Inhalation					
Chemical	Source-Term Concentration (mg/kg)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm^2-day	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration in Air (mg/m^3)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
Inorganics																	
Chromium	2.60E+01	7.36E-05	5.27E-07	4.91E-05	NA	2.08E-08	2.29E-06	1.64E-06	1.53E-04	NA	9.10E-06	1.78E-08	1.27E-08	6.12E-02	5.34E-07	6.14E-02	5.34E-07
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	1.25E-01	3.54E-07	2.53E-09	5.90E-03	NA	1.00E-09	1.10E-07	7.90E-10	3.06E-03	NA	4.38E-08	8.54E-09	6.12E-11	NA	NA	8.96E-03	NA
4-Amino-2,6-dinitrotoluene	7.00E-01	1.98E-06	1.42E-08	3.30E-02	NA	5.60E-09	6.17E-07	4.42E-09	1.72E-02	NA	2.45E-07	4.78E-08	3.42E-10	NA	NA	5.02E-02	NA
1,3-Dinitrobenzene	2.30E+00	6.51E-06	4.66E-08	6.51E-02	NA	1.84E-08	2.03E-06	1.45E-08	2.54E-02	NA	8.05E-07	1.57E-07	1.13E-09	NA	NA	9.04E-02	NA
2,4-Dinitrotoluene	5.10E+00	1.44E-05	1.03E-07	7.22E-03	7.03E-08	4.08E-08	4.50E-06	3.22E-08	2.25E-03	2.19E-08	1.79E-06	3.48E-07	2.50E-09	NA	NA	9.47E-03	9.22E-08
2,6-Dinitrotoluene	3.00E-01	8.49E-07	6.08E-09	8.49E-04	4.13E-09	2.40E-09	2.65E-07	1.90E-09	2.65E-04	1.29E-09	1.05E-07	2.05E-08	1.47E-10	NA	NA	1.11E-03	5.42E-09
3,4-Dinitrotoluene	3.00E-01	8.49E-07	6.08E-09	4.24E-04	NA	2.40E-09	2.65E-07	1.90E-09	1.32E-04	NA	1.05E-07	2.05E-08	1.47E-10	NA	NA	5.57E-04	NA
Total HI				**1.13E-01**					**4.84E-02**					**6.12E-02**		**2.22E-01**	
Total ILCR					**7.44E-08**					**2.32E-08**					**5.34E-07**		**6.32E-07**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-42

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S10, West Area
Red Water Ponds, PBOW, Sandusky Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Inorganics													
Chromium	2.60E+01	1.10E-05	2.56E-05	NA	4.68E-08	1.00E-06	4.49E-07	NA	1.67E-08	1.56E-09	9.13E-10	1.04E-07	1.04E-07
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
4-Amino-2,6-dinitrotoluene	7.00E-01	2.96E-07	6.90E-07	NA	1.26E-08	2.69E-07	1.21E-07	NA	4.48E-10	4.21E-11	2.46E-11	NA	NA
1,3-Dinitrobenzene	2.30E+00	9.72E-07	2.27E-06	NA	4.14E-08	8.85E-07	3.97E-07	NA	1.47E-09	1.38E-10	8.07E-11	NA	NA
2,4-Dinitrotoluene	5.10E+00	2.16E-06	5.03E-06	4.89E-06	9.18E-08	1.96E-06	8.80E-07	1.93E-06	3.27E-09	3.07E-10	1.79E-10	NA	6.82E-06
2,6-Dinitrotoluene	3.00E-01	1.27E-07	2.96E-07	2.87E-07	5.40E-09	1.15E-07	5.18E-08	1.14E-07	1.92E-10	1.80E-11	1.05E-11	NA	4.01E-07
3,4-Dinitrotoluene	3.00E-01	1.27E-07	2.96E-07	NA	5.40E-09	1.15E-07	5.18E-08	NA	1.92E-10	1.80E-11	1.05E-11	NA	NA
Total ILCR				**5.17E-06**				**2.05E-06**				**1.04E-07**	**7.32E-06**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-43

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S10, West Area
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
TOTAL RISK										
Inorganics										
Chromium	2.60E+01	2.99E-04	1.99E-04	4.68E-08	5.24E-06	3.49E-04	1.67E-08	1.06E-08	3.67E-04	9.16E-04
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	1.25E-01	1.44E-06	2.40E-02	2.25E-09	2.52E-07	6.99E-03	8.01E-11	5.12E-11	NA	3.10E-02
4-Amino-2,6-dinitrotoluene	7.00E-01	8.05E-06	1.34E-01	1.26E-08	1.41E-06	3.92E-02	4.48E-10	2.87E-10	NA	1.73E-01
1,3-Dinitrobenzene	2.30E+00	2.65E-05	2.65E-01	4.14E-08	4.63E-06	5.79E-02	1.47E-09	9.42E-10	NA	3.23E-01
2,4-Dinitrotoluene	5.10E+00	5.87E-05	2.93E-02	9.18E-08	1.03E-05	5.13E-03	3.27E-09	2.09E-09	NA	3.45E-02
2,6-Dinitrotoluene	3.00E-01	3.45E-06	3.45E-03	5.40E-09	6.04E-07	6.04E-04	1.92E-10	1.23E-10	NA	4.06E-03
3,4-Dinitrotoluene	3.00E-01	3.45E-06	1.73E-03	5.40E-09	6.04E-07	3.02E-04	1.92E-10	1.23E-10	NA	2.03E-03
Total HI			**4.58E-01**			**1.10E-01**			**3.67E-04**	**5.68E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-44

Exposure Unit Values for Sample Location DS-S17, West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 0.5 ft bgs Surface Soil	0 - 3 ft bgs Surface Soil	3 - 5 ft bgs Subsurface Soil	5 - 10 ft bgs Subsurface Soil	Source Term Concentration
Inorganics					
CHROMIUM	1.90E+01	1.70E+01	1.60E+01	1.12E+01	1.90E+01
Nitroaromatics					
2-AMINO-4,6-DINITROTOLUENE	1.25E-01	1.25E-01	1.25E-01	5.00E-01	5.00E-01
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	3.00E-01	1.25E-01	1.25E-01	3.00E-01
1,3-DINITROBENZENE	1.25E-01	1.25E-01	1.25E-01	1.90E+00	1.90E+00
2,4-DINITROTOLUENE	1.25E-01	1.25E-01	1.25E-01	3.30E+00	3.30E+00
2,6-DINITROTOLUENE	1.30E-01	1.30E-01	1.30E-01	3.00E-01	3.00E-01
3,4-DINITROTOLUENE	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.25E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

Table 5-45

Site-Related Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soil, DS-S17 at West Area Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion					Dermal Absorption					Inhalation					
Chemical	Source-Term Concentration (mg/kg)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm^2-day	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration In Air (mg/m^3)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
Inorganics																	
Chromium	1.90E+01	5.38E-05	3.85E-07	3.58E-05	NA	1.52E-08	1.68E-08	1.20E-08	1.12E-04	NA	6.65E-06	1.30E-06	9.30E-09	4.48E-02	3.90E-07	4.49E-02	3.90E-07
Nitroaromatics																	
2-Amino-4,6-dinitrotoluene	5.00E-01	1.41E-06	1.01E-08	2.36E-02	NA	4.00E-09	4.41E-07	3.16E-09	1.23E-02	NA	1.75E-07	3.42E-08	2.45E-10	NA	NA	3.56E-02	NA
4-Amino-2,6-dinitrotoluene	3.00E-01	8.49E-07	6.08E-09	1.41E-02	NA	2.40E-09	2.65E-07	1.90E-09	7.35E-03	NA	1.05E-07	2.05E-08	1.47E-10	NA	NA	2.15E-02	NA
1,3-Dinitrobenzene	1.90E+00	5.38E-06	3.85E-08	5.38E-02	NA	1.52E-08	1.68E-06	1.20E-08	2.10E-02	NA	6.65E-07	1.30E-07	9.30E-10	NA	NA	7.47E-02	NA
2,4-Dinitrotoluene	3.30E+00	9.34E-06	6.69E-08	4.67E-03	4.55E-08	2.64E-06	2.91E-06	2.08E-08	1.46E-03	1.42E-08	1.16E-06	2.25E-07	1.61E-09	NA	NA	6.12E-03	5.97E-08
2,6-Dinitrotoluene	3.00E-01	8.49E-07	6.08E-09	8.49E-04	4.13E-09	2.40E-09	2.65E-07	1.90E-09	2.65E-04	1.29E-09	1.05E-07	2.05E-08	1.47E-10	NA	NA	1.11E-03	5.42E-09
3,4-Dinitrotoluene	1.25E-01	3.54E-07	2.53E-09	1.77E-04	NA	1.00E-09	1.10E-07	7.90E-10	5.51E-05	NA	4.38E-08	8.54E-09	6.12E-11	NA	NA	2.32E-04	NA
Total HI				**9.72E-02**					**4.24E-02**					**4.48E-02**		**1.84E-01**	
Total ILCR					**4.96E-08**					**1.55E-08**					**3.90E-07**		**4.55E-07**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-46

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil, DS-S17 at West Area
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Inorganics													
Chromium	1.90E+01	8.03E-06	1.87E-05	NA	3.42E-08	7.31E-07	3.28E-07	NA	1.22E-08	1.14E-09	6.67E-10	7.60E-08	7.60E-08
Nitroaromatics													
2-Amino-4,6-dinitrotoluene	5.00E-01	2.11E-07	4.93E-07	NA	9.00E-09	1.92E-07	8.63E-08	NA	3.20E-10	3.01E-11	1.75E-11	NA	NA
4-Amino-2,6-dinitrotoluene	3.00E-01	1.27E-07	2.96E-07	NA	5.40E-09	1.15E-07	5.18E-08	NA	1.92E-10	1.80E-11	1.05E-11	NA	NA
1,3-Dinitrobenzene	1.90E+00	8.03E-07	1.87E-06	NA	3.42E-08	7.31E-07	3.28E-07	NA	1.22E-09	1.14E-10	6.67E-11	NA	NA
2,4-Dinitrotoluene	3.30E+00	1.39E-06	3.25E-06	3.16E-06	5.94E-08	1.27E-06	5.70E-07	1.25E-06	2.11E-09	1.99E-10	1.16E-10	NA	4.41E-06
2,6-Dinitrotoluene	3.00E-01	1.27E-07	2.96E-07	2.87E-07	5.40E-09	1.15E-07	5.18E-08	1.14E-07	1.92E-10	1.80E-11	1.05E-11	NA	4.01E-07
3,4-Dinitrotoluene	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
Total ILCR				**3.45E-06**				**1.36E-06**				**7.60E-08**	**4.89E-06**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-47

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil, DS-S17 at West Area Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
TOTAL RISK										
Inorganics										
Chromium	1.90E+01	2.19E-04	1.46E-04	3.42E-08	3.83E-06	2.55E-04	1.22E-08	7.78E-09	2.68E-04	6.69E-04
Nitroaromatics										
2-Amino-4,6-dinitrotoluene	5.00E-01	5.75E-06	9.59E-02	9.00E-09	1.01E-06	2.80E-02	3.20E-10	2.05E-10	NA	1.24E-01
4-Amino-2,6-dinitrotoluene	3.00E-01	3.45E-06	5.75E-02	5.40E-09	6.04E-07	1.68E-02	1.92E-10	1.23E-10	NA	7.43E-02
1,3-Dinitrobenzene	1.90E+00	2.19E-05	2.19E-01	3.42E-08	3.83E-06	4.78E-02	1.22E-09	7.78E-10	NA	2.66E-01
2,4-Dinitrotoluene	3.30E+00	3.80E-05	1.90E-02	5.94E-08	6.65E-06	3.32E-03	2.11E-09	1.35E-09	NA	2.23E-02
2,6-Dinitrotoluene	3.00E-01	3.45E-06	3.45E-03	5.40E-09	6.04E-07	6.04E-04	1.92E-10	1.23E-10	NA	4.06E-03
3,4-Dinitrotoluene	1.25E-01	1.44E-06	7.19E-04	2.25E-09	2.52E-07	1.26E-04	8.01E-11	5.12E-11	NA	8.45E-04
Total HI			**3.95E-01**			**9.69E-02**			**2.68E-04**	**4.93E-01**

HQ = Hazard quotient; HI = Hazard index
DA = Dose absorbed per unit body surface area per day
NA = Not applicable
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-48

Cancer Risk and Noncancer Hazard Index: Groundskeeper Exposure to Surface Soil, Pentolite Road Area
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion					Dermal Absorption					Inhalation					
Chemical	Source-Term Concentration (mg/kg)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm^2-day	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration in Air (mg/m^3)	Noncancer Dose (mg/kg-day)	Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK																	
Inorganics																	
Aluminum	7.99E+03	7.81E-03	2.79E-03	7.81E-03	NA	7.19E-07	7.95E-05	2.84E-05	2.94E-04	NA	7.99E-04	1.56E-04	5.58E-05	1.12E-01	NA	1.20E-01	NA
Arsenic	5.80E+00	5.68E-06	2.03E-08	1.89E-02	3.04E-06	5.22E-10	5.77E-08	2.06E-08	2.03E-04	3.25E-08	5.80E-07	1.14E-07	4.05E-08	NA	6.08E-07	1.91E-02	3.68E-06
Manganese	2.74E+02	2.68E-04	9.58E-05	5.71E-03	NA	2.47E-08	2.73E-06	9.74E-07	1.16E-03	NA	2.74E-05	5.36E-06	1.92E-06	3.83E-01	NA	3.90E-01	NA
Nitroaromatics																	
4-Amino-2,6-dinitrotoluene	2.70E+00	2.64E-06	9.44E-07	4.40E-02	NA	2.43E-09	2.69E-07	9.60E-08	7.46E-03	NA	2.70E-07	5.28E-08	1.89E-08	NA	NA	5.15E-02	NA
1,3-Dinitrobenzene	8.97E-01	8.78E-07	3.13E-07	8.78E-03	NA	8.07E-10	8.93E-08	3.19E-08	1.12E-03	NA	8.97E-08	1.76E-08	6.27E-09	NA	NA	9.89E-03	NA
2,4-Dinitrotoluene	1.57E+00	1.54E-06	5.50E-07	7.70E-04	3.74E-07	1.42E-09	1.57E-07	5.59E-06	7.83E-05	3.80E-08	1.57E-07	3.08E-08	1.10E-08	NA	NA	8.48E-04	4.12E-07
2,6-Dinitrotoluene	8.00E-01	7.83E-07	2.80E-07	7.83E-04	1.90E-07	7.20E-10	7.96E-08	2.84E-08	7.96E-05	1.93E-08	8.00E-08	1.57E-08	5.59E-09	NA	NA	8.62E-04	2.09E-07
3,4-Dinitrotoluene	3.00E-01	2.94E-07	1.05E-07	1.47E-04	NA	2.70E-10	2.99E-08	1.07E-08	1.49E-05	NA	3.00E-08	5.87E-09	2.10E-09	NA	NA	1.62E-04	NA
Total HI				**8.69E-02**					**1.04E-02**					**4.95E-01**		**5.92E-01**	
Total ILCR					**3.60E-06**					**8.99E-08**					**6.08E-07**		**4.30E-06**
BACKGROUND RISK																	
Inorganics																	
Aluminum	7.99E+03	7.81E-03	2.79E-03	7.81E-03	NA	7.19E-07	7.95E-05	2.84E-05	2.94E-04	NA	7.99E-04	1.56E-04	5.58E-05	1.12E-01	NA	1.20E-01	NA
Arsenic	5.80E+00	5.68E-06	2.03E-06	1.89E-02	3.04E-06	5.22E-10	5.77E-08	2.06E-08	2.03E-04	3.25E-08	5.80E-07	1.14E-07	4.05E-08	NA	6.08E-07	1.91E-02	3.68E-06
Manganese	2.74E+02	2.68E-04	9.58E-05	5.71E-03	NA	2.47E-08	2.73E-06	9.74E-07	1.16E-03	NA	2.74E-05	5.36E-06	1.92E-06	3.83E-01	NA	3.90E-01	NA
Total HI				**3.24E-02**					**1.66E-03**					**4.95E-01**		**5.29E-01**	
Total ILCR					**3.04E-06**					**3.25E-08**					**6.08E-07**		**3.68E-06**
SITE-RELATED RISK																	
Nitroaromatics																	
4-Amino-2,6-dinitrotoluene	2.70E+00	2.64E-06	9.44E-07	4.40E-02	NA	2.43E-09	2.69E-07	9.60E-08	7.46E-03	NA	2.70E-07	5.28E-08	1.89E-08	NA	NA	5.15E-02	NA
1,3-Dinitrobenzene	8.97E-01	8.78E-07	3.13E-07	8.78E-03	NA	8.07E-10	8.93E-08	3.19E-08	1.12E-03	NA	8.97E-08	1.76E-08	6.27E-09	NA	NA	9.89E-03	NA
2,4-Dinitrotoluene	1.57E+00	1.54E-06	5.50E-07	7.70E-04	3.74E-07	1.42E-09	1.57E-07	5.59E-08	7.83E-05	3.80E-08	1.57E-07	3.08E-08	1.10E-08	NA	NA	8.48E-04	4.12E-07
2,6-Dinitrotoluene	8.00E-01	7.83E-07	2.80E-07	7.83E-04	1.90E-07	7.20E-10	7.96E-08	2.84E-08	7.96E-05	1.93E-08	8.00E-08	1.57E-08	5.59E-09	NA	NA	8.62E-04	2.09E-07
3,4-Dinitrotoluene	3.00E-01	2.94E-07	1.05E-07	1.47E-04	NA	2.70E-10	2.99E-08	1.07E-08	1.49E-05	NA	3.00E-08	5.87E-09	2.10E-09	NA	NA	1.62E-04	NA
Total HI				**5.45E-02**					**8.75E-03**					**NA**		**6.33E-02**	
Total ILCR					**5.64E-07**					**5.73E-08**					**NA**		**6.21E-07**

DA = Dose absorbed (per unit body surface area per day).
HQ - Hazard quotient; HI - Hazard index; ILCR - Incremental lifetime cancer risk.
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-49

Cancer Risk and Noncancer Hazard Index: Indoor Worker Exposure to Surface Soil, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR
TOTAL RISK					
Inorganics					
Aluminum	7.99E+03	3.91E-03	1.40E-03	3.91E-03	NA
Arsenic	5.80E+00	2.84E-06	1.01E-06	9.46E-03	1.52E-06
Manganese	2.74E+02	1.34E-04	4.79E-05	2.85E-03	NA
Nitroaromatics					
4-Amino-2,6-dinitrotoluene	2.70E+00	1.32E-06	4.72E-07	2.20E-02	NA
1,3-Dinitrobenzene	8.97E-01	4.39E-07	1.57E-07	4.39E-03	NA
2,4-Dinitrotoluene	1.57E+00	7.70E-07	2.75E-07	3.85E-04	1.87E-07
2,6-Dinitrotoluene	8.00E-01	3.91E-07	1.40E-07	3.91E-04	9.51E-08
3,4-Dinitrotoluene	3.00E-01	1.47E-07	5.24E-08	7.34E-05	NA
Total HI				**4.35E-02**	
Total ILCR					**1.80E-06**
BACKGROUND RISK					
Inorganics					
Aluminum	7.99E+03	3.91E-03	1.40E-03	3.91E-03	NA
Arsenic	5.80E+00	2.84E-06	1.01E-06	9.46E-03	1.52E-06
Manganese	2.74E+02	1.34E-04	4.79E-05	2.85E-03	NA
Total HI				**1.62E-02**	
Total ILCR					**1.52E-06**
SITE-RELATED RISK					
Nitroaromatics					
4-Amino-2,6-dinitrotoluene	2.70E+00	1.32E-06	4.72E-07	2.20E-02	NA
1,3-Dinitrobenzene	8.97E-01	4.39E-07	1.57E-07	4.39E-03	NA
2,4-Dinitrotoluene	1.57E+00	7.70E-07	2.75E-07	3.85E-04	1.87E-07
2,6-Dinitrotoluene	8.00E-01	3.91E-07	1.40E-07	3.91E-04	9.51E-08
3,4-Dinitrotoluene	3.00E-01	1.47E-07	5.24E-08	7.34E-05	NA
Total HI				**2.73E-02**	
Total ILCR					**2.82E-07**

HQ - Hazard quotient; HI - Hazard index; ILCR - Incremental lifetime cancer risk.
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.

Table 5-50

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Total Soil, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA mg/cm²-day	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Concentration in Air (mg/m³)	Inhalation Noncancer Dose (mg/kg-day)	Inhalation Cancer Dose (mg/kg-day)	Inhalation HQ	Inhalation ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK																	
Inorganics																	
ALUMINUM	9.25E+03	2.62E-02	1.87E-04	2.62E-02	NA	7.40E-06	8.16E-04	5.84E-06	3.02E-03	NA	3.24E-03	6.32E-04	4.53E-06	4.51E-01	NA	4.81E-01	NA
ANTIMONY	6.80E+00	1.92E-05	1.38E-07	4.81E-02	NA	5.44E-09	6.00E-07	4.30E-09	1.50E-02	NA	2.36E-06	4.64E-07	3.33E-09	NA	NA	6.31E-02	NA
ARSENIC	1.01E+01	2.86E-05	2.05E-07	9.53E-02	3.07E-07	8.08E-09	8.91E-07	6.38E-09	3.13E-03	1.01E-08	3.54E-06	6.90E-07	4.94E-09	NA	7.41E-08	9.84E-02	3.91E-07
CHROMIUM	1.58E+01	4.48E-05	3.21E-07	2.99E-05	NA	1.27E-08	1.40E-06	1.00E-08	9.31E-05	NA	5.54E-06	1.08E-06	7.75E-09	3.73E-02	3.25E-07	3.74E-02	3.25E-07
MANGANESE	5.63E+02	1.59E-03	1.14E-05	3.39E-02	NA	4.51E-07	4.97E-05	3.56E-07	2.11E-02	NA	1.97E-04	3.85E-05	2.76E-07	2.75E+00	NA	2.80E+00	NA
Nitroaromatics																	
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	7.64E-06	5.47E-08	1.27E-01	NA	2.16E-08	2.38E-06	1.71E-08	6.62E-02	NA	9.45E-07	1.84E-07	1.32E-09	NA	NA	1.94E-01	NA
1,3-DINITROBENZENE	2.20E+00	6.21E-06	4.45E-08	6.21E-02	NA	1.76E-08	1.94E-06	1.39E-08	2.42E-02	NA	7.69E-07	1.50E-07	1.07E-09	NA	NA	8.64E-02	NA
2,4-DINITROTOLUENE	5.34E+00	1.51E-05	1.08E-07	7.55E-03	7.36E-08	4.27E-08	4.71E-06	3.37E-08	2.35E-03	2.29E-08	1.87E-06	3.65E-07	2.61E-09	NA	NA	9.91E-03	9.65E-08
2,6-DINITROTOLUENE	9.51E-01	2.69E-06	1.93E-08	2.69E-03	1.31E-08	7.61E-09	8.39E-07	6.01E-09	8.39E-04	4.09E-09	3.33E-07	6.50E-08	4.65E-10	NA	NA	3.53E-03	1.72E-08
3,4-DINITROTOLUENE	3.68E+00	1.04E-05	7.47E-08	5.21E-03	NA	2.95E-08	3.25E-06	2.33E-08	1.62E-03	NA	1.29E-06	2.52E-07	1.80E-09	NA	NA	6.84E-03	NA
2,4,6-TRINITROTOLUENE	1.20E+04	3.40E-02	2.43E-04	6.79E+01	7.30E-06	9.60E-05	1.06E-02	7.58E-05	3.53E+01	3.79E-06	4.20E-03	8.20E-04	5.87E-06	NA	NA	1.03E+02	1.11E-05
Total HI				**6.83E+01**					**3.54E+01**					**3.24E+00**		**1.07E+02**	
Total ILCR					**7.69E-06**					**3.83E-06**					**4.00E-07**		**1.19E-05**
BACKGROUND RISK																	
Inorganics																	
ALUMINUM	9.25E+03	2.62E-02	1.87E-04	2.62E-02	NA	7.40E-06	8.16E-04	5.84E-06	3.02E-03	NA	3.24E-03	6.32E-04	4.53E-06	4.51E-01	NA	4.81E-01	NA
ANTIMONY	6.80E+00	1.92E-05	1.38E-07	4.81E-02	NA	5.44E-09	6.00E-07	4.30E-09	1.50E-02	NA	2.36E-06	4.64E-07	3.33E-09	NA	NA	6.31E-02	NA
ARSENIC	1.01E+01	2.86E-05	2.05E-07	9.53E-02	3.07E-07	8.08E-09	8.91E-07	6.38E-09	3.13E-03	1.01E-08	3.54E-06	6.90E-07	4.94E-09	NA	7.41E-08	9.84E-02	3.91E-07
CHROMIUM	1.58E+01	4.48E-05	3.21E-07	2.99E-05	NA	1.27E-08	1.40E-06	1.00E-08	9.31E-05	NA	5.54E-06	1.08E-06	7.75E-09	3.73E-02	3.25E-07	3.74E-02	3.25E-07
MANGANESE	5.63E+02	1.59E-03	1.14E-05	3.39E-02	NA	4.51E-07	4.97E-05	3.56E-07	2.11E-02	NA	1.97E-04	3.85E-05	2.76E-07	2.75E+00	NA	2.80E+00	NA
Total HI				**2.04E-01**					**4.24E-02**					**3.24E+00**		**3.48E+00**	
Total ILCR					**3.07E-07**					**1.01E-08**					**4.00E-07**		**7.17E-07**
SITE-RELATED RISK																	
Nitroaromatics																	
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	7.64E-06	5.47E-08	1.27E-01	NA	2.16E-08	2.38E-06	1.71E-08	6.62E-02	NA	9.45E-07	1.64E-07	1.32E-09	NA	NA	1.94E-01	NA
1,3-DINITROBENZENE	2.20E+00	6.21E-06	4.45E-08	6.21E-02	NA	1.76E-08	1.94E-06	1.39E-08	2.42E-02	NA	7.69E-07	1.50E-07	1.07E-09	NA	NA	8.64E-02	NA
2,4-DINITROTOLUENE	5.34E+00	1.51E-05	1.08E-07	7.55E-03	7.36E-08	4.27E-08	4.71E-06	3.37E-08	2.35E-03	2.29E-08	1.87E-06	3.65E-07	2.61E-09	NA	NA	9.91E-03	9.65E-08
2,6-DINITROTOLUENE	9.51E-01	2.69E-06	1.93E-08	2.69E-03	1.31E-08	7.61E-09	8.39E-07	6.01E-09	8.39E-04	4.09E-09	3.33E-07	6.50E-08	4.65E-10	NA	NA	3.53E-03	1.72E-08
3,4-DINITROTOLUENE	3.68E+00	1.04E-05	7.47E-08	5.21E-03	NA	2.95E-08	3.25E-06	2.33E-08	1.62E-03	NA	1.29E-06	2.52E-07	1.80E-09	NA	NA	6.84E-03	NA
2,4,6-TRINITROTOLUENE	1.20E+04	3.40E-02	2.43E-04	6.79E+01	7.30E-06	9.60E-05	1.06E-02	7.58E-05	3.53E+01	3.79E-06	4.20E-03	8.20E-04	5.87E-06	NA	NA	1.03E+02	1.11E-05
Total HI				**6.81E+01**					**3.54E+01**					**NA**		**1.04E+02**	
Total ILCR					**7.38E-06**					**3.82E-06**					**NA**		**1.12E-05**

HQ = Hazard quotient; HI = Hazard index; ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm²-day - Milligrams per square centimeter per day.
mg/m³ - Milligrams per cubic meter.

Table 5-51

Cancer Risk and Noncancer Hazard Index: Construction Worker Exposure to Sediment, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion Noncancer Dose (mg/kg-day)	Incidental Ingestion Cancer Dose (mg/kg-day)	Oral HQ	Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption Noncancer Dose (mg/kg-day)	Dermal Absorption Cancer Dose (mg/kg-day)	Dermal HQ	Dermal ILCR	Total HI All Pathways	Total ILCR All Pathways
TOTAL RISK												
Inorganics												
Arsenic	5.10E+00	1.19E-05	8.55E-08	3.98E-02	1.28E-07	6.12E-09	1.85E-07	1.33E-09	6.50E-04	2.09E-09	4.05E-02	1.30E-07
Total HI				**3.98E-02**					**6.50E-04**		**4.05E-02**	
Total ILCR					**1.28E-07**					**2.09E-09**		**1.30E-07**
BACKGROUND RISK												
Inorganics												
Arsenic	5.10E+00	1.19E-05	8.55E-08	3.98E-02	1.28E-07	6.12E-09	1.85E-07	1.33E-09	6.50E-04	2.09E-09	4.05E-02	1.30E-07
Total HI				**3.98E-02**					**6.50E-04**		**4.05E-02**	
Total ILCR					**1.28E-07**					**2.09E-09**		**1.30E-07**
SITE-RELATED RISK	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

ILCR - Incremental lifetime cancer risk
HQ - Hazard quotient; HI - Hazard index
DA -Dose absorbed (per unit body surface area per day).
NA - Not applicable
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/cm^3 - Milligrams per cubic meter.

Table 5-52

Cancer Risk: On-Site Resident Exposure to Total Soil, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion Adult Cancer Dose (mg/kg-day)	Incidental Ingestion Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption Adult Cancer Dose (mg/kg-day)	Dermal Absorption Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust Adult Cancer Dose (mg/kg-day)	Inhalation of Dust Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
TOTAL RISK													
Inorganics													
ALUMINUM	9.25E+03	3.91E-03	9.12E-03	NA	1.67E-05	3.56E-04	1.60E-04	NA	5.93E-06	5.57E-07	3.25E-07	NA	NA
ANTIMONY	6.80E+00	2.87E-06	6.71E-06	NA	1.22E-08	2.62E-07	1.17E-07	NA	4.36E-09	4.09E-10	2.39E-10	NA	NA
ARSENIC	1.01E+01	4.27E-06	9.96E-06	2.14E-05	1.82E-08	3.89E-07	1.74E-07	8.89E-07	6.47E-09	6.08E-10	3.55E-10	1.44E-08	2.23E-05
CHROMIUM	1.58E+01	6.70E-06	1.56E-05	NA	2.85E-08	6.09E-07	2.73E-07	NA	1.01E-08	9.53E-10	5.56E-10	6.34E-08	6.34E-08
MANGANESE	5.63E+02	2.38E-04	5.55E-04	NA	1.01E-06	2.17E-05	9.72E-06	NA	3.61E-07	3.39E-08	1.98E-08	NA	NA
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	1.14E-06	2.66E-06	NA	4.86E-08	1.04E-06	4.66E-07	NA	1.73E-09	1.62E-10	9.48E-11	NA	NA
1,3-DINITROBENZENE	2.20E+00	9.28E-07	2.17E-06	NA	3.95E-08	8.45E-07	3.79E-07	NA	1.41E-09	1.32E-10	7.71E-11	NA	NA
2,4-DINITROTOLUENE	5.34E+00	2.26E-06	5.26E-06	5.11E-06	9.61E-08	2.05E-06	9.21E-07	2.02E-06	3.42E-09	3.21E-10	1.87E-10	NA	7.14E-06
2,6-DINITROTOLUENE	9.51E-01	4.02E-07	9.38E-07	9.11E-07	1.71E-08	3.66E-07	1.64E-07	3.60E-07	6.09E-10	5.72E-11	3.34E-11	NA	1.27E-06
3,4-DINITROTOLUENE	3.68E+00	1.56E-06	3.63E-06	NA	6.63E-08	1.42E-06	6.36E-07	NA	2.36E-09	2.22E-10	1.29E-10	NA	NA
2,4,6-TRINITROTOLUENE	1.20E+04	5.07E-03	1.18E-02	5.07E-04	2.16E-04	4.62E-03	2.07E-03	3.34E-04	7.69E-06	7.22E-07	4.21E-07	NA	8.42E-04
Total ILCR				**5.35E-04**				**3.38E-04**				**7.78E-08**	**8.72E-04**
BACKGROUND RISK													
Inorganics													
ALUMINUM	9.25E+03	3.91E-03	9.12E-03	NA	1.67E-05	3.56E-04	1.60E-04	NA	5.93E-06	5.57E-07	3.25E-07	NA	NA
ANTIMONY	6.80E+00	2.87E-06	6.71E-06	NA	1.22E-08	2.62E-07	1.17E-07	NA	4.36E-09	4.09E-10	2.39E-10	NA	NA
ARSENIC	1.01E+01	4.27E-06	9.96E-06	2.14E-05	1.82E-08	3.89E-07	1.74E-07	8.89E-07	6.47E-09	6.08E-10	3.55E-10	1.44E-08	2.23E-05
CHROMIUM	1.58E+01	6.70E-06	1.56E-05	NA	2.85E-08	6.09E-07	2.73E-07	NA	1.01E-08	9.53E-10	5.56E-10	6.34E-08	6.34E-08
MANGANESE	5.63E+02	2.38E-04	5.55E-04	NA	1.01E-06	2.17E-05	9.72E-06	NA	3.61E-07	3.39E-08	1.98E-08	NA	NA
Total ILCR				**2.14E-05**				**8.89E-07**				**7.78E-08**	**2.23E-05**
SITE-RELATED RISK													
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	1.14E-06	2.66E-06	NA	4.86E-08	1.04E-06	4.66E-07	NA	1.73E-09	1.62E-10	9.48E-11	NA	NA
1,3-DINITROBENZENE	2.20E+00	9.28E-07	2.17E-06	NA	3.95E-08	8.45E-07	3.79E-07	NA	1.41E-09	1.32E-10	7.71E-11	NA	NA
2,4-DINITROTOLUENE	5.34E+00	2.26E-06	5.26E-06	5.11E-06	9.61E-08	2.05E-06	9.21E-07	2.02E-06	3.42E-09	3.21E-10	1.87E-10	NA	7.14E-06
2,6-DINITROTOLUENE	9.51E-01	4.02E-07	9.38E-07	9.11E-07	1.71E-08	3.66E-07	1.64E-07	3.60E-07	6.09E-10	5.72E-11	3.34E-11	NA	1.27E-06
3,4-DINITROTOLUENE	3.68E+00	1.56E-06	3.63E-06	NA	6.63E-08	1.42E-06	6.36E-07	NA	2.36E-09	2.22E-10	1.29E-10	NA	NA
2,4,6-TRINITROTOLUENE	1.20E+04	5.07E-03	1.18E-02	5.07E-04	2.16E-04	4.62E-03	2.07E-03	3.34E-04	7.69E-06	7.22E-07	4.21E-07	NA	8.42E-04
Total ILCR				**5.13E-04**				**3.37E-04**				**NA**	**8.50E-04**

ILCR - Incremental lifetime cancer risk.
DA -Dose absorbed (per unit body surface area per day).
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/cm^3 - Milligrams per cubic meter.

Table 5-53

Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
TOTAL RISK										
Inorganics										
ALUMINUM	9.25E+03	1.06E-01	1.06E-01	1.67E-05	1.86E-03	6.90E-03	5.93E-06	3.79E-06	2.71E-03	1.16E-01
ANTIMONY	6.80E+00	7.82E-05	1.96E-01	1.22E-08	1.37E-06	3.42E-02	4.36E-09	2.78E-09	NA	2.30E-01
ARSENIC	1.01E+01	1.16E-04	3.87E-01	1.82E-08	2.03E-06	7.14E-03	6.47E-09	4.14E-09	NA	3.95E-01
CHROMIUM	1.58E+01	1.82E-04	1.22E-04	2.85E-08	3.19E-06	2.13E-04	1.01E-08	6.49E-09	2.24E-04	5.58E-04
MANGANESE	5.63E+02	6.48E-03	1.38E-01	1.01E-06	1.13E-04	4.83E-02	3.61E-07	2.31E-07	1.65E-02	2.03E-01
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	3.11E-05	5.18E-01	4.86E-08	5.44E-06	1.51E-01	1.73E-09	1.11E-09	NA	6.69E-01
1,3-DINITROBENZENE	2.20E+00	2.53E-05	2.53E-01	3.95E-08	4.42E-06	5.53E-02	1.41E-09	8.99E-10	NA	3.08E-01
2,4-DINITROTOLUENE	5.34E+00	6.14E-05	3.07E-02	9.61E-08	1.07E-05	5.37E-03	3.42E-09	2.19E-09	NA	3.61E-02
2,6-DINITROTOLUENE	9.51E-01	1.09E-05	1.09E-02	1.71E-08	1.91E-06	1.91E-03	6.09E-10	3.89E-10	NA	1.29E-02
3,4-DINITROTOLUENE	3.68E+00	4.24E-05	2.12E-02	6.63E-08	7.42E-06	3.71E-03	2.36E-09	1.51E-09	NA	2.49E-02
2,4,6-TRINITROTOLUENE	1.20E+04	1.38E-01	2.76E+02	2.16E-04	2.42E-02	8.05E+01	7.69E-06	4.91E-06	NA	3.57E+02
Total HI			**2.78E+02**			**8.09E+01**			**1.94E-02**	**3.59E+02**
BACKGROUND RISK										
Inorganics										
ALUMINUM	9.25E+03	1.06E-01	1.06E-01	1.67E-05	1.86E-03	6.90E-03	5.93E-06	3.79E-06	2.71E-03	1.16E-01
ANTIMONY	6.80E+00	7.82E-05	1.96E-01	1.22E-08	1.37E-06	3.42E-02	4.36E-09	2.78E-09	NA	2.30E-01
ARSENIC	1.01E+01	1.16E-04	3.87E-01	1.82E-08	2.03E-06	7.14E-03	6.47E-09	4.14E-09	NA	3.95E-01
CHROMIUM	1.58E+01	1.82E-04	1.22E-04	2.85E-08	3.19E-06	2.13E-04	1.01E-08	6.49E-09	2.24E-04	5.58E-04
MANGANESE	5.63E+02	6.48E-03	1.38E-01	1.01E-06	1.13E-04	4.83E-02	3.61E-07	2.31E-07	1.65E-02	2.03E-01
Total HI			**8.28E-01**			**9.67E-02**			**1.94E-02**	**9.44E-01**
SITE-RELATED RISK										
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	3.11E-05	5.18E-01	4.86E-08	5.44E-06	1.51E-01	1.73E-09	1.11E-09	NA	6.69E-01
1,3-DINITROBENZENE	2.20E+00	2.53E-05	2.53E-01	3.95E-08	4.42E-06	5.53E-02	1.41E-09	8.99E-10	NA	3.08E-01
2,4-DINITROTOLUENE	5.34E+00	6.14E-05	3.07E-02	9.61E-08	1.07E-05	5.37E-03	3.42E-09	2.19E-09	NA	3.61E-02
2,6-DINITROTOLUENE	9.51E-01	1.09E-05	1.09E-02	1.71E-08	1.91E-06	1.91E-03	6.09E-10	3.89E-10	NA	1.29E-02
3,4-DINITROTOLUENE	3.68E+00	4.24E-05	2.12E-02	6.63E-08	7.42E-06	3.71E-03	2.36E-09	1.51E-09	NA	2.49E-02
2,4,6-TRINITROTOLUENE	1.20E+04	1.38E-01	2.76E+02	2.16E-04	2.42E-02	8.05E+01	7.69E-06	4.91E-06	NA	3.57E+02
Total HI			**2.77E+02**			**8.08E+01**			**NA**	**3.58E+02**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/cm^3 - Milligrams per cubic meter.

Table 5-54

Cancer Risk: On-Site Resident Exposure to Sediment, Pentolite Road Red Water Ponds Area, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Adult Ingested Dose (mg/kg-day)	Child Ingested Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Dermally Absorbed Dose (mg/kg-day)	Child Dermally Absorbed Dose (mg/kg-day)	On-Site Resident Dermal ILCR	On-Site Resident Total All Pathways ILCR
TOTAL RISK									
Inorganics									
Arsenic	5.10E+00	3.56E-08	8.30E-08	1.78E-07	1.02E-09	3.24E-09	1.45E-09	7.41E-09	1.85E-07
Total ILCR				**1.78E-07**				**7.41E-09**	**1.85E-07**
BACKGROUND RISK									
Inorganics									
Arsenic	5.10E+00	3.56E-08	8.30E-08	1.78E-07	1.02E-09	3.24E-09	1.45E-09	7.41E-09	1.85E-07
Total ILCR				**1.78E-07**				**7.41E-09**	**1.85E-07**
SITE-RELATED RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

ILCR - Incremental lifetime cancer risk.
DA -Dose absorbed (per unit body surface area per day).
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/cm^3 - Milligrams per cubic meter.

Table 5-55

Noncancer Hazard Index: Resident Child Exposure to Sediment, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Child Ingested Dose (mg/kg-day)	Child Resident Oral HQ	DA (mg/cm^2-day)	Child Dermally Absorbed Dose (mg/kg-day)	Child Resident Dermal HQ	Child Resident Total All Pathways HI
TOTAL RISK							
Inorganics							
Arsenic	5.10E+00	9.69E-07	3.23E-03	1.02E-09	1.70E-08	5.95E-05	3.29E-03
Total HI			**3.23E-03**			**5.95E-05**	**3.29E-03**
BACKGROUND RISK							
Inorganics							
Arsenic	5.10E+00	9.69E-07	3.23E-03	1.02E-09	1.70E-08	5.95E-05	3.29E-03
Total HI			**3.23E-03**			**5.95E-05**	**3.29E-03**
SITE-RELATED RISK	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

HI - Hazard index; HQ - Hazard quotient.
DA -Dose absorbed (per unit body surface area per day).
NA - Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.

Table 5-56

Summary of Total Hazard Index and Total Cancer Risk from Site-Related Chemicals of Potential Concern
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

	Groundskeeper		Indoor Worker		Construction Worker		On-Site Resident	
Contaminant Source	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR
Surface Soil	6.33E-02	6.21E-07	2.73E-02	2.82E-07	NA	NA	NA	NA
Total Soil	NA	NA	NA	NA	1.04E+02	1.12E-05	3.58E+02	8.50E-04
Surface Water	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	NA	NA	NA	NA	NA	NA	NA	NA
Total across all media	**6.33E-02**	**6.21E-07**	**2.73E-02**	**2.82E-07**	**1.04E+02**	**1.12E-05**	**3.58E+02**	**8.50E-04**

HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
NA = Not applicable.

Table 5-57

Exposure Unit Values[a] for Sample Location DP03, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 2 ft bgs Surface Soil		4 - 5 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics					
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E+00	c	1.25E+00
1,3-DINITROBENZENE	1.25E-01	c	9.30E+00		9.30E+00
2,4-DINITROTOLUENE	1.20E+00		2.50E+01		2.50E+01
2,6-DINITROTOLUENE	1.25E-01	c	1.25E+00	c	1.25E+00
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E+00	c	1.25E+00

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-58

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location DP03, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.25E+00	5.28E-07	1.23E-06	NA	2.25E-08	4.81E-07	2.16E-07	NA	8.01E-10	7.52E-11	4.39E-11	NA	NA
1,3-DINITROBENZENE	9.30E+00	3.93E-06	9.17E-06	NA	1.67E-07	3.58E-06	1.61E-06	NA	5.96E-09	5.60E-10	3.26E-10	NA	NA
2,4-DINITROTOLUENE	2.50E+01	1.06E-05	2.47E-05	2.40E-05	4.50E-07	9.62E-06	4.32E-06	9.47E-06	1.60E-08	1.50E-09	8.77E-10	NA	3.34E-05
2,6-DINITROTOLUENE	1.25E+00	5.28E-07	1.23E-06	1.20E-06	2.25E-08	4.81E-07	2.16E-07	4.74E-07	8.01E-10	7.52E-11	4.39E-11	NA	1.67E-06
2,4,6-TRINITROTOLUENE	1.25E+00	5.28E-07	1.23E-06	5.28E-08	2.25E-08	4.81E-07	2.16E-07	3.48E-08	8.01E-10	7.52E-11	4.39E-11	NA	8.77E-08
Total ILCR				**2.52E-05**				**9.98E-06**				**NA**	**3.52E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-59

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location DP03, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.25E+00	1.44E-05	2.40E-01	2.25E-08	2.52E-06	6.99E-02	8.01E-10	5.12E-10	NA	3.10E-01
1,3-DINITROBENZENE	9.30E+00	1.07E-04	1.07E+00	1.67E-07	1.87E-05	2.34E-01	5.96E-09	3.81E-09	NA	1.30E+00
2,4-DINITROTOLUENE	2.50E+01	2.88E-04	1.44E-01	4.50E-07	5.03E-05	2.52E-02	1.60E-08	1.02E-08	NA	1.69E-01
2,6-DINITROTOLUENE	1.25E+00	1.44E-05	1.44E-02	2.25E-08	2.52E-06	2.52E-03	8.01E-10	5.12E-10	NA	1.69E-02
2,4,6-TRINITROTOLUENE	1.25E+00	1.44E-05	2.88E-02	2.25E-08	2.52E-06	8.39E-03	8.01E-10	5.12E-10	NA	3.72E-02
Total HI			**1.50E+00**			**3.40E-01**			**NA**	**1.84E+00**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-60

Exposure Unit Values[a] for Sample Location DP10, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 1 ft bgs Surface Soil		4 - 5 ft bgs Subsurface Soil		9 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.10E+00	c	1.10E+00
1,3-DINITROBENZENE	1.25E-01	c	1.25E-01	c	5.20E+00		5.20E+00
2,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.50E+01		1.50E+01
2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.70E+00		1.70E+00
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	6.00E-01	c	6.00E-01

mg/kg - Milligrams per killogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-61

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location DP10, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.10E+00	4.65E-07	1.08E-06	NA	1.98E-08	4.23E-07	1.90E-07	NA	7.05E-10	6.62E-11	3.86E-11	NA	NA
1,3-DINITROBENZENE	5.20E+00	2.20E-06	5.13E-06	NA	9.36E-08	2.00E-06	8.98E-07	NA	3.33E-09	3.13E-10	1.83E-10	NA	NA
2,4-DINITROTOLUENE	1.50E+01	6.34E-06	1.48E-05	1.44E-05	2.70E-07	5.77E-06	2.59E-06	5.68E-06	9.61E-09	9.02E-10	5.26E-10	NA	2.01E-05
2,6-DINITROTOLUENE	1.70E+00	7.19E-07	1.68E-06	1.63E-06	3.06E-08	6.54E-07	2.93E-07	6.44E-07	1.09E-09	1.02E-10	5.97E-11	NA	2.27E-06
2,4,6-TRINITROTOLUENE	6.00E-01	2.54E-07	5.92E-07	2.54E-08	1.08E-08	2.31E-07	1.04E-07	1.67E-08	3.84E-10	3.61E-11	2.11E-11	NA	4.21E-08
Total ILCR				**1.60E-05**				**6.34E-06**				**NA**	**2.24E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.

Table 5-62

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location DP10, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.10E+00	1.27E-05	2.11E-01	1.98E-08	2.22E-06	6.15E-02	7.05E-10	4.50E-10	NA	2.72E-01
1,3-DINITROBENZENE	5.20E+00	5.98E-05	5.98E-01	9.36E-08	1.05E-05	1.31E-01	3.33E-09	2.13E-09	NA	7.29E-01
2,4-DINITROTOLUENE	1.50E+01	1.73E-04	8.63E-02	2.70E-07	3.02E-05	1.51E-02	9.61E-09	6.14E-09	NA	1.01E-01
2,6-DINITROTOLUENE	1.70E+00	1.96E-05	1.96E-02	3.06E-08	3.42E-06	3.42E-03	1.09E-09	6.96E-10	NA	2.30E-02
2,4,6-TRINITROTOLUENE	6.00E-01	6.90E-06	1.38E-02	1.08E-08	1.21E-06	4.03E-03	3.84E-10	2.46E-10	NA	1.78E-02
Total HI			**9.29E-01**			**2.15E-01**			**NA**	**1.14E+00**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-63

Exposure Unit Values[a] for Sample Location DP11, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 2 ft bgs Surface Soil		4 - 6 ft bgs Subsurface Soil		8 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	2.70E+00		1.25E-01	c	1.25E-01	c	2.70E+00
1,3-DINITROBENZENE	1.25E-01	c	4.30E-01		5.80E+00		5.80E+00
2,4-DINITROTOLUENE	3.20E-01		1.60E+00		1.20E+00		1.60E+00
2,6-DINITROTOLUENE	1.25E-01	c	2.90E-01		3.00E-01		3.00E-01
2,4,6-TRINITROTOLUENE	2.70E-01		1.25E-01	c	1.25E-01	c	2.70E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-64

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location DP11, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	1.14E-06	2.66E-06	NA	4.86E-08	1.04E-06	4.66E-07	NA	1.73E-09	1.62E-10	9.48E-11	NA	NA
1,3-DINITROBENZENE	5.80E+00	2.45E-06	5.72E-06	NA	1.04E-07	2.23E-06	1.00E-06	NA	3.72E-09	3.49E-10	2.04E-10	NA	NA
2,4-DINITROTOLUENE	1.60E+00	6.76E-07	1.58E-06	1.53E-06	2.88E-08	6.15E-07	2.76E-07	6.06E-07	1.02E-09	9.63E-11	5.62E-11	NA	2.14E-06
2,6-DINITROTOLUENE	3.00E-01	1.27E-07	2.96E-07	2.87E-07	5.40E-09	1.15E-07	5.18E-08	1.14E-07	1.92E-10	1.80E-11	1.05E-11	NA	4.01E-07
2,4,6-TRINITROTOLUENE	2.70E-01	1.14E-07	2.66E-07	1.14E-08	4.86E-09	1.04E-07	4.66E-08	7.52E-09	1.73E-10	1.62E-11	9.48E-12	NA	1.89E-08
Total ILCR				**1.83E-06**				**7.28E-07**				**NA**	**2.56E-06**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-65

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location DP11, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	3.11E-05	5.18E-01	4.86E-08	5.44E-06	1.51E-01	1.73E-09	1.11E-09	NA	6.69E-01
1,3-DINITROBENZENE	5.80E+00	6.67E-05	6.67E-01	1.04E-07	1.17E-05	1.46E-01	3.72E-09	2.37E-09	NA	8.13E-01
2,4-DINITROTOLUENE	1.60E+00	1.84E-05	9.21E-03	2.88E-08	3.22E-06	1.61E-03	1.02E-09	6.55E-10	NA	1.08E-02
2,6-DINITROTOLUENE	3.00E-01	3.45E-06	3.45E-03	5.40E-09	6.04E-07	6.04E-04	1.92E-10	1.23E-10	NA	4.06E-03
2,4,6-TRINITROTOLUENE	2.70E-01	3.11E-06	6.21E-03	4.86E-09	5.44E-07	1.81E-03	1.73E-10	1.11E-10	NA	8.03E-03
Total HI			**1.20E+00**			**3.01E-01**			**NA**	**1.51E+00**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-66

Exposure Unit Values[a] for Sample Location S4, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
1,3-DINITROBENZENE	8.00E-01		3.20E+00		2.10E+00		3.20E+00
2,4-DINITROTOLUENE	1.10E+00		5.70E+00		2.80E+00		5.70E+00
2,6-DINITROTOLUENE	1.30E-01	c	5.00E-01		1.30E-01	c	5.00E-01
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-67

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S4, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathway
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
1,3-DINITROBENZENE	3.20E+00	1.35E-06	3.16E-06	NA	5.76E-08	1.23E-06	5.52E-07	NA	2.05E-09	1.93E-10	1.12E-10	NA	NA
2,4-DINITROTOLUENE	5.70E+00	2.41E-06	5.62E-06	5.46E-06	1.03E-07	2.19E-06	9.84E-07	2.16E-06	3.65E-09	3.43E-10	2.00E-10	NA	#####
2,6-DINITROTOLUENE	5.00E-01	2.11E-07	4.93E-07	4.79E-07	9.00E-09	1.92E-07	8.63E-08	1.89E-07	3.20E-10	3.01E-11	1.75E-11	NA	#####
3,4-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
2,4,6-TRINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	5.28E-09	2.25E-09	4.81E-08	2.16E-08	3.48E-09	8.01E-11	7.52E-12	4.39E-12	NA	#####
Total ILCR				**5.95E-06**				**2.35E-06**				**NA**	#####

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed per unit body surface area per day.
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-68

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S4, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	1.44E-06	2.40E-02	2.25E-09	2.52E-07	6.99E-03	8.01E-11	5.12E-11	NA	3.10E-02
1,3-DINITROBENZENE	3.20E+00	3.68E-05	3.68E-01	5.76E-08	6.44E-06	8.05E-02	2.05E-09	1.31E-09	NA	4.49E-01
2,4-DINITROTOLUENE	5.70E+00	6.56E-05	3.28E-02	1.03E-07	1.15E-05	5.74E-03	3.65E-09	2.33E-09	NA	3.85E-02
2,6-DINITROTOLUENE	5.00E-01	5.75E-06	5.75E-03	9.00E-09	1.01E-06	1.01E-03	3.20E-10	2.05E-10	NA	6.76E-03
3,4-DINITROTOLUENE	1.25E-01	1.44E-06	7.19E-04	2.25E-09	2.52E-07	1.26E-04	8.01E-11	5.12E-11	NA	8.45E-04
2,4,6-TRINITROTOLUENE	1.25E-01	1.44E-06	2.88E-03	2.25E-09	2.52E-07	8.39E-04	8.01E-11	5.12E-11	NA	3.72E-03
Total HI			**4.34E-01**			**9.53E-02**			**NA**	**5.30E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-69

Exposure Unit Values[a] for Sample Location S6, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	3.00E-01		1.00E+00		1.00E+00
1,3-DINITROBENZENE	9.00E-01		3.40E+00		3.80E+00		3.80E+00
2,4-DINITROTOLUENE	2.10E+00		8.70E+00		7.60E+00		8.70E+00
2,6-DINITROTOLUENE	4.00E-01		3.60E+00		5.00E-01		3.60E+00
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-70

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S6, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.00E+00	4.23E-07	9.86E-07	NA	1.80E-08	3.85E-07	1.73E-07	NA	6.41E-10	6.02E-11	3.51E-11	NA	NA
1,3-DINITROBENZENE	3.80E+00	1.61E-06	3.75E-06	NA	6.84E-08	1.46E-06	6.56E-07	NA	2.43E-09	2.29E-10	1.33E-10	NA	NA
2,4-DINITROTOLUENE	8.70E+00	3.68E-06	8.58E-06	8.34E-06	1.57E-07	3.35E-06	1.50E-06	3.30E-06	5.57E-09	5.23E-10	3.05E-10	NA	1.16E-05
2,6-DINITROTOLUENE	3.60E+00	1.52E-06	3.55E-06	3.45E-06	6.48E-08	1.38E-06	6.21E-07	1.36E-06	2.31E-09	2.17E-10	1.26E-10	NA	4.81E-06
3,4-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
2,4,6-TRINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	5.28E-09	2.25E-09	4.81E-08	2.16E-08	3.48E-09	8.01E-11	7.52E-12	4.39E-12	NA	8.77E-09
Total ILCR				**1.18E-05**				**4.66E-06**				**NA**	**1.65E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-71

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S6, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.00E+00	1.15E-05	1.92E-01	1.80E-08	2.01E-06	5.59E-02	6.41E-10	4.09E-10	NA	2.48E-01
1,3-DINITROBENZENE	3.80E+00	4.37E-05	4.37E-01	6.84E-08	7.65E-06	9.57E-02	2.43E-09	1.56E-09	NA	5.33E-01
2,4-DINITROTOLUENE	8.70E+00	1.00E-04	5.01E-02	1.57E-07	1.75E-05	8.76E-03	5.57E-09	3.56E-09	NA	5.88E-02
2,6-DINITROTOLUENE	3.60E+00	4.14E-05	4.14E-02	6.48E-08	7.25E-06	7.25E-03	2.31E-09	1.47E-09	NA	4.87E-02
3,4-DINITROTOLUENE	1.25E-01	1.44E-06	7.19E-04	2.25E-09	2.52E-07	1.26E-04	8.01E-11	5.12E-11	NA	8.45E-04
2,4,6-TRINITROTOLUENE	1.25E-01	1.44E-06	2.88E-03	2.25E-09	2.52E-07	8.39E-04	8.01E-11	5.12E-11	NA	3.72E-03
Total HI			**7.24E-01**			**1.69E-01**			**NA**	**8.93E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-72

Exposure Unit Values[a] for Sample Location S10, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
1,3-DINITROBENZENE	1.25E-01	c	1.60E+00		2.50E+00		2.50E+00
2,4-DINITROTOLUENE	1.25E-01	c	2.60E+00		2.20E+00		2.60E+00
2,6-DINITROTOLUENE	1.30E-01	c	1.30E-01	c	1.30E-01	c	1.30E-01
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-73

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S10, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
1,3-DINITROBENZENE	2.50E+00	1.06E-06	2.47E-06	NA	4.50E-08	9.62E-07	4.32E-07	NA	1.60E-09	1.50E-10	8.77E-11	NA	NA
2,4-DINITROTOLUENE	2.60E+00	1.10E-06	2.56E-06	2.49E-06	4.68E-08	1.00E-06	4.49E-07	9.85E-07	1.67E-09	1.56E-10	9.13E-11	NA	3.48E-06
2,6-DINITROTOLUENE	1.30E-01	5.50E-08	1.28E-07	1.25E-07	2.34E-09	5.00E-08	2.24E-08	4.93E-08	8.33E-11	7.82E-12	4.56E-12	NA	1.74E-07
3,4-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
2,4,6-TRINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	5.28E-09	2.25E-09	4.81E-08	2.16E-08	3.48E-09	8.01E-11	7.52E-12	4.39E-12	NA	8.77E-09
Total ILCR				**2.62E-06**				**1.04E-06**				**NA**	**3.66E-06**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-74

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S10, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	1.44E-06	2.40E-02	2.25E-09	2.52E-07	6.99E-03	8.01E-11	5.12E-11	NA	3.10E-02
1,3-DINITROBENZENE	2.50E+00	2.88E-05	2.88E-01	4.50E-08	5.03E-06	6.29E-02	1.60E-09	1.02E-09	NA	3.51E-01
2,4-DINITROTOLUENE	2.60E+00	2.99E-05	1.50E-02	4.68E-08	5.24E-06	2.62E-03	1.67E-09	1.06E-09	NA	1.76E-02
2,6-DINITROTOLUENE	1.30E-01	1.50E-06	1.50E-03	2.34E-09	2.62E-07	2.62E-04	8.33E-11	5.32E-11	NA	1.76E-03
3,4-DINITROTOLUENE	1.25E-01	1.44E-06	7.19E-04	2.25E-09	2.52E-07	1.26E-04	8.01E-11	5.12E-11	NA	8.45E-04
2,4,6-TRINITROTOLUENE	1.25E-01	1.44E-06	2.88E-03	2.25E-09	2.52E-07	8.39E-04	8.01E-11	5.12E-11	NA	3.72E-03
Total HI			**3.32E-01**			**7.38E-02**			**NA**	**4.05E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-75

Exposure Unit Values[a] for Sample Location S13, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 0.5 ft bgs Surface Soil		0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		3 - 10 ft bgs Subsurface Soil	Source Term Concentration[b]
Nitroaromatics								
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	7.00E-01	7.00E-01
1,3-DINITROBENZENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	3.20E+00	3.20E+00
2,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	4.00E-01		5.20E+00	5.20E+00
2,6-DINITROTOLUENE	1.30E-01	c	1.30E-01	c	1.30E-01	c	5.00E-01	5.00E-01
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	5.00E-01	5.00E-01
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	5.00E-01	5.00E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-76

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S13, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	7.00E-01	2.96E-07	6.90E-07	NA	1.26E-08	2.69E-07	1.21E-07	NA	4.48E-10	4.21E-11	2.46E-11	NA	NA
1,3-DINITROBENZENE	3.20E+00	1.35E-06	3.16E-06	NA	5.76E-08	1.23E-06	5.52E-07	NA	2.05E-09	1.93E-10	1.12E-10	NA	NA
2,4-DINITROTOLUENE	5.20E+00	2.20E-06	5.13E-06	4.98E-06	9.36E-08	2.00E-06	8.98E-07	1.97E-06	3.33E-09	3.13E-10	1.83E-10	NA	6.95E-06
2,6-DINITROTOLUENE	5.00E-01	2.11E-07	4.93E-07	4.79E-07	9.00E-09	1.92E-07	8.63E-08	1.89E-07	3.20E-10	3.01E-11	1.75E-11	NA	6.69E-07
3,4-DINITROTOLUENE	5.00E-01	2.11E-07	4.93E-07	NA	9.00E-09	1.92E-07	8.63E-08	NA	3.20E-10	3.01E-11	1.75E-11	NA	NA
2,4,6-TRINITROTOLUENE	5.00E-01	2.11E-07	4.93E-07	2.11E-08	9.00E-09	1.92E-07	8.63E-08	1.39E-08	3.20E-10	3.01E-11	1.75E-11	NA	3.51E-08
Total ILCR				**5.48E-06**				**2.17E-06**				**NA**	**7.66E-06**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-77

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S13, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	7.00E-01	8.05E-06	1.34E-01	1.26E-08	1.41E-06	3.92E-02	4.48E-10	2.87E-10	NA	1.73E-01
1,3-DINITROBENZENE	3.20E+00	3.68E-05	3.68E-01	5.76E-08	6.44E-06	8.05E-02	2.05E-09	1.31E-09	NA	4.49E-01
2,4-DINITROTOLUENE	5.20E+00	5.98E-05	2.99E-02	9.36E-08	1.05E-05	5.24E-03	3.33E-09	2.13E-09	NA	3.52E-02
2,6-DINITROTOLUENE	5.00E-01	5.75E-06	5.75E-03	9.00E-09	1.01E-06	1.01E-03	3.20E-10	2.05E-10	NA	6.76E-03
3,4-DINITROTOLUENE	5.00E-01	5.75E-06	2.88E-03	9.00E-09	1.01E-06	5.03E-04	3.20E-10	2.05E-10	NA	3.38E-03
2,4,6-TRINITROTOLUENE	5.00E-01	5.75E-06	1.15E-02	9.00E-09	1.01E-06	3.36E-03	3.20E-10	2.05E-10	NA	1.49E-02
Total HI			**5.53E-01**			**1.30E-01**			**NA**	**6.82E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-78

Exposure Unit Values[a] for Sample Location S14, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 0.5 ft bgs Surface Soil		0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil	Source Term Concentration[b]
Nitroaromatics								
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	9.50E+00		2.00E+00	9.50E+00
1,3-DINITROBENZENE	1.25E-01	c	1.25E-01	c	6.40E+00		6.70E+00	6.70E+00
2,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E+00	c	1.90E+01	1.90E+01
2,6-DINITROTOLUENE	1.30E-01	c	1.30E-01	c	1.30E+00	c	2.90E+00	2.90E+00
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	4.50E+00		1.70E+00	4.50E+00
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.20E+04		3.40E+02	1.20E+04

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-79

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S14, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	9.50E+00	4.02E-06	9.37E-06	NA	1.71E-07	3.65E-06	1.64E-06	NA	6.08E-09	5.72E-10	3.33E-10	NA	NA
1,3-DINITROBENZENE	6.70E+00	2.83E-06	6.61E-06	NA	1.21E-07	2.58E-06	1.16E-06	NA	4.29E-09	4.03E-10	2.35E-10	NA	NA
2,4-DINITROTOLUENE	1.90E+01	8.03E-06	1.87E-05	1.82E-05	3.42E-07	7.31E-06	3.28E-06	7.20E-06	1.22E-08	1.14E-09	6.67E-10	NA	2.54E-05
2,6-DINITROTOLUENE	2.90E+00	1.23E-06	2.86E-06	2.78E-06	5.22E-08	1.12E-06	5.01E-07	1.10E-06	1.86E-09	1.74E-10	1.02E-10	NA	3.88E-06
3,4-DINITROTOLUENE	4.50E+00	1.90E-06	4.44E-06	NA	8.10E-08	1.73E-06	7.77E-07	NA	2.88E-09	2.71E-10	1.58E-10	NA	NA
2,4,6-TRINITROTOLUENE	1.20E+04	5.07E-03	1.18E-02	5.07E-04	2.16E-04	4.62E-03	2.07E-03	3.34E-04	7.69E-06	7.22E-07	4.21E-07	NA	8.42E-04
Total ILCR				**5.28E-04**				**3.43E-04**				**NA**	**8.71E-04**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-80

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S14, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	9.50E+00	1.09E-04	1.82E+00	1.71E-07	1.91E-05	5.31E-01	6.08E-09	3.89E-09	NA	2.35E+00
1,3-DINITROBENZENE	6.70E+00	7.71E-05	7.71E-01	1.21E-07	1.35E-05	1.69E-01	4.29E-09	2.74E-09	NA	9.40E-01
2,4-DINITROTOLUENE	1.90E+01	2.19E-04	1.09E-01	3.42E-07	3.83E-05	1.91E-02	1.22E-08	7.78E-09	NA	1.28E-01
2,6-DINITROTOLUENE	2.90E+00	3.34E-05	3.34E-02	5.22E-08	5.84E-06	5.84E-03	1.86E-09	1.19E-09	NA	3.92E-02
3,4-DINITROTOLUENE	4.50E+00	5.18E-05	2.59E-02	8.10E-08	9.06E-06	4.53E-03	2.88E-09	1.84E-09	NA	3.04E-02
2,4,6-TRINITROTOLUENE	1.20E+04	1.38E-01	2.76E+02	2.16E-04	2.42E-02	8.05E+01	7.69E-06	4.91E-06	NA	3.57E+02
Total HI			**2.79E+02**			**8.13E+01**			**NA**	**3.60E+02**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-81

Exposure Unit Values[a] for Sample Location S15, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
1,3-DINITROBENZENE	1.25E-01	c	1.25E-01	c	6.60E+00		6.60E+00
2,4-DINITROTOLUENE	6.00E-01		3.00E-01		1.40E+01		1.40E+01
2,6-DINITROTOLUENE	1.30E-01	c	1.30E-01	c	2.00E+00		2.00E+00
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.10E+00		1.10E+00
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-82

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S15, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Incidental Ingestion: Adult Cancer Dose (mg/kg-day)	Incidental Ingestion: Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Dermal Absorption: Adult Cancer Dose (mg/kg-day)	Dermal Absorption: Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Inhalation of Dust: Adult Cancer Dose (mg/kg-day)	Inhalation of Dust: Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
1,3-DINITROBENZENE	6.60E+00	2.79E-06	6.51E-06	NA	1.19E-07	2.54E-06	1.14E-06	NA	4.23E-09	3.97E-10	2.32E-10	NA	NA
2,4-DINITROTOLUENE	1.40E+01	5.92E-06	1.38E-05	1.34E-05	2.52E-07	5.39E-06	2.42E-06	5.31E-06	8.97E-09	8.42E-10	4.91E-10	NA	1.87E-05
2,6-DINITROTOLUENE	2.00E+00	8.45E-07	1.97E-06	1.92E-06	3.60E-08	7.69E-07	3.45E-07	7.58E-07	1.28E-09	1.20E-10	7.02E-11	NA	2.67E-06
3,4-DINITROTOLUENE	1.10E+00	4.65E-07	1.08E-06	NA	1.98E-08	4.23E-07	1.90E-07	NA	7.05E-10	6.62E-11	3.86E-11	NA	NA
2,4,6-TRINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	5.28E-09	2.25E-09	4.81E-08	2.16E-08	3.48E-09	8.01E-11	7.52E-12	4.39E-12	NA	8.77E-09
Total ILCR				**1.53E-05**				**6.07E-06**				**NA**	**2.14E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-83

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S15, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	1.44E-06	2.40E-02	2.25E-09	2.52E-07	6.99E-03	8.01E-11	5.12E-11	NA	3.10E-02
1,3-DINITROBENZENE	6.60E+00	7.59E-05	7.59E-01	1.19E-07	1.33E-05	1.66E-01	4.23E-09	2.70E-09	NA	9.26E-01
2,4-DINITROTOLUENE	1.40E+01	1.61E-04	8.05E-02	2.52E-07	2.82E-05	1.41E-02	8.97E-09	5.73E-09	NA	9.46E-02
2,6-DINITROTOLUENE	2.00E+00	2.30E-05	2.30E-02	3.60E-08	4.03E-06	4.03E-03	1.28E-09	8.19E-10	NA	2.70E-02
3,4-DINITROTOLUENE	1.10E+00	1.27E-05	6.33E-03	1.98E-08	2.22E-06	1.11E-03	7.05E-10	4.50E-10	NA	7.44E-03
2,4,6-TRINITROTOLUENE	1.25E-01	1.44E-06	2.88E-03	2.25E-09	2.52E-07	8.39E-04	8.01E-11	5.12E-11	NA	3.72E-03
Total HI			**8.96E-01**			**1.93E-01**			**NA**	**1.09E+00**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-84

Exposure Unit Values[a] for Sample Location S16, Pentolite Road Red Water Ponds, PBOW, Sandusky, Ohio

Chemical Name (mg/kg)	0 - 3 ft bgs Surface Soil		3 - 5 ft bgs Subsurface Soil		5 - 10 ft bgs Subsurface Soil		Source Term Concentration[b]
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01
1,3-DINITROBENZENE	1.25E-01	c	1.25E-01	c	4.30E+00		4.30E+00
2,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	8.90E+00		8.90E+00
2,6-DINITROTOLUENE	1.30E-01	c	1.30E-01	c	1.00E+00		1.00E+00
3,4-DINITROTOLUENE	1.25E-01	c	1.25E-01	c	8.00E-01		8.00E-01
2,4,6-TRINITROTOLUENE	1.25E-01	c	1.25E-01	c	1.25E-01	c	1.25E-01

mg/kg - Milligrams per kilogram.
ft bgs - Feet below ground surface.

[a] Analytical concentrations unless otherwise specified.
[b] Maximum value from previous columns.
[c] One-half reporting limit used as surrogate value for nondetects.

Table 5-85

Site-Related Cancer Risk: On-Site Resident Exposure to Total Soil
Sample Location S16, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

		Incidental Ingestion				Dermal Absorption				Inhalation of Dust			
Chemical	Source Term Concentration (mg/kg)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Oral ILCR	DA (mg/cm^2-day)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Dermal ILCR	Concentration In Air (mg/m^3)	Adult Cancer Dose (mg/kg-day)	Child Cancer Dose (mg/kg-day)	On-Site Resident Inhalation ILCR	Total ILCR All Pathways
Nitroaromatics													
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	NA	2.25E-09	4.81E-08	2.16E-08	NA	8.01E-11	7.52E-12	4.39E-12	NA	NA
1,3-DINITROBENZENE	4.30E+00	1.82E-06	4.24E-06	NA	7.74E-08	1.65E-06	7.42E-07	NA	2.75E-09	2.59E-10	1.51E-10	NA	NA
2,4-DINITROTOLUENE	8.90E+00	3.76E-06	8.78E-06	8.53E-06	1.60E-07	3.42E-06	1.54E-06	3.37E-06	5.70E-09	5.35E-10	3.12E-10	NA	1.19E-05
2,6-DINITROTOLUENE	1.00E+00	4.23E-07	9.86E-07	9.58E-07	1.80E-08	3.85E-07	1.73E-07	3.79E-07	6.41E-10	6.02E-11	3.51E-11	NA	1.34E-06
3,4-DINITROTOLUENE	8.00E-01	3.38E-07	7.89E-07	NA	1.44E-08	3.08E-07	1.38E-07	NA	5.12E-10	4.81E-11	2.81E-11	NA	NA
2,4,6-TRINITROTOLUENE	1.25E-01	5.28E-08	1.23E-07	5.28E-09	2.25E-09	4.81E-08	2.16E-08	3.48E-09	8.01E-11	7.52E-12	4.39E-12	NA	8.77E-09
Total ILCR				**9.49E-06**				**3.75E-06**				**NA**	**1.32E-05**

ILCR = Incremental lifetime cancer risk.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-86

Site-Related Noncancer Hazard Index: On-Site Resident Child Exposure to Total Soil
Sample Location S16, Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source Term Concentration (mg/kg)	Ingested Noncancer Dose (mg/kg-day)	Oral HQ	DA (mg/cm^2-day)	Dermally Absorbed Noncancer Dose (mg/kg-day)	Dermal HQ	Concentration In Air (mg/m^3)	Inhalation of Dust Noncancer Dose (mg/kg-day)	Inhalation HQ	Total HI All Pathways
Nitroaromatics										
4-AMINO-2,6-DINITROTOLUENE	1.25E-01	1.44E-06	2.40E-02	2.25E-09	2.52E-07	6.99E-03	8.01E-11	5.12E-11	NA	3.10E-02
1,3-DINITROBENZENE	4.30E+00	4.95E-05	4.95E-01	7.74E-08	8.66E-06	1.08E-01	2.75E-09	1.76E-09	NA	6.03E-01
2,4-DINITROTOLUENE	8.90E+00	1.02E-04	5.12E-02	1.60E-07	1.79E-05	8.96E-03	5.70E-09	3.64E-09	NA	6.02E-02
2,6-DINITROTOLUENE	1.00E+00	1.15E-05	1.15E-02	1.80E-08	2.01E-06	2.01E-03	6.41E-10	4.09E-10	NA	1.35E-02
3,4-DINITROTOLUENE	8.00E-01	9.21E-06	4.60E-03	1.44E-08	1.61E-06	8.05E-04	5.12E-10	3.28E-10	NA	5.41E-03
2,4,6-TRINITROTOLUENE	1.25E-01	1.44E-06	2.88E-03	2.25E-09	2.52E-07	8.39E-04	8.01E-11	5.12E-11	NA	3.72E-03
Total HI			**5.89E-01**			**1.28E-01**			**NA**	**7.17E-01**

HQ = Hazard quotient; HI = Hazard index.
DA = Dose absorbed (per unit body surface area per day).
NA = Not applicable.
mg/kg - Milligrams per kilogram.
mg/kg-day - mg/kg per day.
mg/cm^2-day - Milligrams per square centimeter per day.
mg/m^3 - Milligrams per cubic meter.

Table 5-87

Risk-Based Remedial Criteria for Chemicals of Concern
Groundskeeper Exposure to Surface Soil
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 1.0	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 0.1	Total ILCR All Pathways	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-06	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-05
Inorganics							
Chromium	1.87E+01	NA	NA	NA	5.49E-06	3.41E+00	3.41E+01
Semivolatile Organics							
Benzo(a)pyrene	3.90E-01	NA	NA	NA	1.21E-06	3.23E-01	3.23E+00

RBRC = Risk-based remedial criterion.
HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
NA = Not applicable.
mg/kg - Milligrams per kilogram.

Table 5-88

Risk-Based Remedial Criteria for Chemicals of Concern
Construction Worker Exposure to Total Soil
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 1.0	0.1	Total ILCR All Pathways	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-06	1.00E-05
Nitroaromatics							
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	1.94E-01	1.40E+01	1.40E+00	NA	NA	NA
2,4,6-TRINITROTOLUENE	1.20E+04	1.03E+02	1.16E+02	1.16E+01	1.11E-05	1.08E+03	1.08E+04

RBRC = Risk-based remedial criterion.
HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
NA = Not applicable.
mg/kg - Milligrams per kilogram.

Table 5-89

Risk-Based Remedial Criteria for Chemicals of Concern
On-Site Resident Exposure to Total Soil
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Source-Term Concentration (mg/kg)	Total HI All Pathways	RBRC (mg/kg) for On-Site Child Resident Target Hazard Index: 1.0	0.1	Total ILCR All Pathways	RBRC (mg/kg) for On-Site Resident Target Risk Level: 1.00E-06	1.00E-05
Semivolatile Organics							
BENZO(A)PYRENE	3.90E-01	NA	NA	NA	7.18E-06	5.43E-02	5.43E-01
Nitroaromatics							
2-AMINO-4,6-DINITROTOLUENE	5.00E-01	1.24E-01	4.04E+00	4.04E-01	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	2.70E+00	6.69E-01	4.04E+00	4.04E-01	NA	NA	NA
1,3-DINITROBENZENE	2.20E+00	3.08E-01	7.13E+00	7.13E-01	NA	NA	NA
2,4-DINITROTOLUENE	5.34E+00	3.61E-02	1.48E+02	1.48E+01	7.14E-06	7.48E-01	7.48E+00
2,6-DINITROTOLUENE	9.51E-01	NA	NA	NA	1.27E-06	7.48E-01	7.48E+00
2,4,6-TRINITROTOLUENE	1.20E+04	3.57E+02	3.36E+01	3.36E+00	8.42E-04	1.43E+01	1.43E+02

RBRC = Risk-based remedial criterion.
HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
NA = Not applicable.
mg/kg - Milligrams per kilogram.

Table 6-1

Vegetative Communities
PBOW, Sandusky, Ohio

Community Type	Definition
AGRI	Agricultural areas including crop fields, pastures, and fallow fields
DEV	Developed and disturbed areas including residential, commercial, industrial
OFE	Early old field (herbaceous vegetation only)
OFM	Moderate old filed (some shrubs/saplings)
OFL	Late old field (up to 50 percent shrub/sapling cover)
ESU	Early successional/shrub thicket (mostly shrubs, few saplings)
MSU	Moderate successional/shrub thicket (shrubs and saplings dominant)
LSU	Late successional/shrub thicket (saplings most abundant with some trees)
FRE	Early forest (young trees with early successional species, red maple, ashes, elms, etc., most dominant)
FRM	Moderate forest (larger trees regardless of species or younger trees with late successional species)
FRL	Late forest (mature forest with climax species such as sugar maple, beech, oaks, etc., with established subcanopy and understory)
OW	Open water
PEM	Palustrine, emergent wetlands (marshes and wet meadows)
PSS	Palustrine, scrub/shrub wetlands (wetlands dominated by shrubs and saplings)
PFO	Palustrine, forested wetlands (all wooded wetlands)

Table 6-2

Common and/or Frequent Vascular Plant Species Observed at the Red Water Ponds PBOW, Sandusky, Ohio

(Page 1 of 3)

Plant Species	West Red Water Ponds Area	Pentolite Road Red Water Ponds Area
Red maple	common	common
Yarrow	frequent	frequent
southern agrimony	frequent	frequent
Quack grass		frequent
Garlic mustard	common	frequent
Field garlic	frequent	-
Dogbane		common
Common milkweed	frequent	frequent
Sedge (*Carex lanuginosa*)		frequent
Sedge (*C. rosea*)	frequent	
Sedge (*C. scoparia*)		frequent
Sedge (*C. vulpinoidea*)		common
Ox-eye daisy	frequent	frequent
Southern enchanter's nightshade	frequent	frequent
Canada thistle	common	common
Bull thistle		frequent
Horse balm	common	frequent
Rough-leaved dogwood	frequent	frequent
Wild carrot	frequent	
Common teasel		frequent
Wild rye	frequent	frequent
Horsetail		frequent
Fleabane	frequent	frequent
Grass-leaved goldenrod		common
Tall fescue	frequent	common

Table 6-2

Common and/or Frequent Vascular Plant Species Observed at the Red Water Ponds PBOW, Sandusky, Ohio

(Page 2 of 3)

Plant Species	West Red Water Ponds Area	Pentolite Road Red Water Ponds Area
Fescue		common
Wild strawberry	frequent	frequent
Green ash	common	frequent
Ground ivy	frequent	
Dotted St. John's wort		frequent
Common rush		frequent
White grass	frequent	
Moneywort	frequent	
Sensitive fern		frequent
Sorrel		frequent
Hairy panic-grass		frequent
Tall white beard-tongue	frequent	frequent
Reed canary grass	common	common
Timothy		frequent
Reed grass		frequent
English plantain		frequent
Broad-leaved plantain	frequent	
Virginia knotweed	frequent	frequent
Cottonwood	frequent	frequent
Wild black cherry	frequent	frequent
Narrow-leaved mountain-mint		frequent
Pin oak	common	
Dewberry	frequent	frequent
Black willow		common
Dark green bulrush		frequent

Table 6-2

Common and/or Frequent Vascular Plant Species Observed at the Red Water Ponds PBOW, Sandusky, Ohio

(Page 3 of 3)

Plant Species	West Red Water Ponds Area	Pentolite Road Red Water Ponds Area
Common blue-eyed-grass		frequent
Broad-leaved cattail		frequent
Common mullein		frequent
Wingstem	frequent	
Common blue violet	common	
Riverbank grape		frequent
Total Species Documented (common, frequent, occasional, and/or rare)	72	85
Total Common or Frequent Species Documented	31	46

Table 6-3

Mammals Observed On Site and Likely to be Found in Erie County, Ohio PBOW, Sandusky, Ohio

(Page 1 of 2)

Family Name	Scientific Name	Common Name	Observed On Site [a]
Didelphidae	*Didelphis virginiana*	Virginia opossum	
Talpidae	*Condylura cristata*	star-nosed mole	
	Parascalops breweri	hairy-tailed mole	
	Scalopus aquaticus	Eastern mole	
Verspertilionidae	*Myotis keenii*	Keen's bat	
	M. lucifugus	little brown bat	
	M. sodalis	Indiana bat **(E)**	
	Eptesicus fuscus	big brown bat	
	Lasionycteris noctivagans	silver-haired bat	
	Lasiurus borealis	red bat	
	L. cinereus	hoary bat	
	Nycticeius humeralis	evening bat	
	Pipistrellus subflavus	Eastern pipistrelle	
Leporidae	*Sylvilagus floridanus*	cottontail rabbit	
Sciuridae	*Glaucomys volans*	Southern flying squirrel	
	Marmota monax	woodchuck	X
	Sciurus carolinensis	gray squirrel	
	S. niger	fox squirrel	
	Spermophilus tridecemlineatus	thirteen-lined ground squirrel	
	Tamias striatus	Eastern chipmunk	
	Tamiasciurus hudsonicus	red squirrel	
	Blarina brevicauda	short-tailed shrew	X
	Cryptotis parva	least shrew	
	Sorex cinereus	masked shrew	X
Castoridae	*Castor canadensis*	beaver	
Cricetidae	*Microtus pennsylvanicus*	meadow vole	
	Mus musculus	house mouse	
	Ondatra zibethicus	muskrat	
	Peromyscus leucopus	white-footed mouse	
	P. maniculatus	deer mouse	
	Rattus norvegicus	Norway rat	
	Synaptomys cooperi	Southern bog lemming	
	Zapus hudsonius	meadow jumping mouse	
Procyonidae	*Procyon lotor*	raccoon	

Table 6-3

Mammals Observed On Site and Likely to be Found in Erie County, Ohio PBOW, Sandusky, Ohio

(Page 2 of 2)

Family Name	Scientific Name	Common Name	Observed On Site [a]
Mustelidae	*Mephitis mephitis*	striped skunk	
	Mustela frenata	long-tailed weasel	
	M. nivalis	least weasel	
	M. vison	mink	
	Taxidea taxus	badger	
Canidae	*Canis latrans*	coyote	
	Urocyon cinereoargenteus	gray fox	
	Vulpes vulpes	red fox	
Cervidae	*Odocoileus virginianus*	white-tailed deer	X

Mammals likely to be found in Erie County based on information presented in:
Gottschang, J. L., 1981, *A Guide to the Mammals of Ohio,* Ohio State University Press, 176 pages.

E = Ohio Endangered species.
[a] IT Site Reconnaissance, April 15-16, 1998, including discussions with USACE and field crews

Table 6-4

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio
PBOW, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Ardeidae	*Ardea herodias*	great blue heron	(1) (2) Regular visitor at ponds, streams, and ditches.
	Bublucus ibis	cattle egret (T)	(1) Rare visitor in short grass areas
	Butorides striatus	green-backed heron	(1) Confirmed breeder, rare at ponds, streams.
	Casmerodius albus	great egret	(1) Regular visitor at ponds, streams, and ditches.
	Nycticorax nycticorax	black-crowned night heron (T)	(1) Regular visitor at ponds, streams, and ditches.
Anserinae	*Branta canadensis*	Canada goose	(1) Confirmed breeder; uncommon around ponds.
Anatinae	*Aix sponsa*	Wood duck	(1) Confirmed breeder, uncommon around ponds.
	Anas discors	blue-winged teal	Confirmed and/or probable breeder in county.
	A. platyrhynchos	mallard	(1) (2) Confirmed breeder, uncommon at ponds, streams.
	A. rubripes	American black duck	(1) Possible breeder, rare at ponds, streams, ditches.
Merginae	*Lophodytes cucullatus*	hooded merganser	Confirmed and/or probable breeder in county.
Accipitrinae	*Accipiter striatus*	sharp-shinned hawk	Confirmed and/or probable breeder in county.
Buteoninae	*Buteo jamaicensis*	red-tailed hawk	Confirmed and/or probable breeder in county.
	B. lineatus	red-shouldered hawk	Confirmed and/or probable breeder in county.
	B. platypterus	broad-winged hawk	Confirmed and/or probable breeder in county.
	Haliaeetus leucocephalus	bald eagle (E)	Confirmed and/or probable breeder in county.
Anatidae	*Cygnus buccinator*	Trumpeter swan (E)	(1) Rare migrant seen flying toward lake.
Falconinae	*Falco sparverius*	American kestrel	Confirmed and/or probable breeder in county.
Phasianidae	*Colinus virginianus*	Northern bobwhite quail	(2) Confirmed and/or probable breeder in county.
	Phasianus colchicus	ring-necked pheasant	Confirmed and/or probable breeder in county.
Rallidae	*Gallinula chloropus*	common moorhen	Confirmed and/or probable breeder in county.
	Porzana carolina	Sora	Confirmed and/or probable breeder in county.
Charadriidae	*Charadrius vociferus*	killdeer	(2) Confirmed and/or probable breeder in county.
Scolopacidae	*Actitis macularia*	spotted sandpiper	Confirmed and/or probable breeder in county.
	Bartramia longicauda	upland sandpiper (T)	(1) Confirmed breeder, rare in grassy areas.
	Gallinago gallinago	common snipe	Confirmed and/or probable breeder in county.
	Scolopax minor	American woodcock	(1) Confirmed breeder, uncommon in moist woodlots.
Larinae	*Larus argentatus*	herring gull	(1) Regular visitor.
	L. delawarensis	ring-billed gull	(1) Regular visitor.
Columbidae	*Columba livia*	rock dove	(1) (2) Confirmed breeder, very common.
	Zenaida macroura	mourning dove	(1) Confirmed breeder, very common.

Table 6-4

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio
PBOW, Sandusky, Ohio

(Page 2 of 5)

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Cuculidae	*Coccyzus americanus*	yellow-billed cuckoo	(1) Confirmed breeder, uncommon in woodlots, shrubs.
	C. erythropthalmus	black-billed cuckoo	(1) Probable breeder, rare in woodlots & shruby areas.
Tytonidae	*Bubo virginianus*	great horned owl	(1) Confirmed breeder, uncommon in woodlots.
	Otus asio	Eastern screech-owl	(1) Confirmed breeder, common in woodlots, shrubs.
	Strix varia	barred owl	Confirmed and/or probable breeder in county.
Caprimulgidae	*Chordeiles minor*	common nighthawk	(1) Possible breeder, rare.
Apodidae	*Chaetura pelagica*	chimney swift	(1) Confirmed breeder, uncommon.
Trochilidae	*Archilochus colubris*	ruby-throated hummingbird	(1) Confirmed breeder, uncommon in woodlots, shrubs.
Alcedinidae	*Ceryle alcyon*	belted kingfisher	(1) Confirmed breeder, rare around ponds, streams.
Picidae	*Colaptes auratus*	Northern flicker	(1) Confirmed breeder, common in woodlots.
	Dryocopus pileatus	pileated woodpecker	Confirmed and/or probable breeder in county.
	Melanerpes carolinus	red-bellied woodpecker	(1) Confirmed breeder, common in mature woods.
	M. erythrocephalus	red-headed woodpecker	(1) Confirmed breeder, uncommon in mature woods.
	Picoides pubescens	downy woodpecker	(1) Confirmed breeder, common in woodlots.
	P. villosus	hairy woodpecker	(1) Confirmed breeder, uncommon in large woodlots.
Tyrannidae	*Contopus virens*	Eastern wood-pewee	(1) Confirmed breeder, very common in large woodlots.
	Empidonax alnorum	alder flycatcher	(1) Possible breeder, rare in shrubby wet areas.
	E. minimus	least flycatcher	(1) Probable breeder, rare in shrubby areas.
	E. traillii	willow flycatcher	(1) Confirmed breeder, very common in shrubby areas.
	E. virescens	Acadian flycatcher	(1) Confirmed breeder, uncommon in mature woodlots.
	Myiarchus crinitus	great crested flycatcher	(1) Confirmed breeder, common in large woodlots.
	Sayornis phoebe	Eastern phoebe	(1) Confirmed breeder, common near stream bridges.
	Tyrannus tyrannus	Eastern kingbird	(1) Confirmed breeder, very common - open shrub area.
Alaudidae	*Eremophila alpestris*	horned lark	(1) Probable breeder, rare in grassland, cultiv. fields.
Hirundinidae	*Hirundo pyrrhonota*	cliff swallow	(2) Confirmed and/or probable breeder in county.
	H. rustica	barn swallow	(1) Confirmed breeder, very common near vacant bldgs.
	Progne subis	purple martin	(1) Probable breeder, rare.
	Riparia riparia	bank swallow	(1) Rare migrant or visitor.
	Stelgidopteryx serripennis	Northern rough-winged swallow	(1) Confirmed breeder, rare along streams, ditches.
	Tachycineta bicolor	tree swallow	(1) Confirmed breeder, rare around ponds.
Corvidae	*Corvus brachyrhynchos*	American crow	(1) Confirmed breeder, very common in woodlots.
	Cyanocitta cristata	blue jay	(1) Confirmed breeder, abundant in woods.

Table 6-4

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio
PBOW, Sandusky, Ohio

(Page 3 of 5)

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Paridae	*Parus atricapillus*	black-capped chickadee	(1) Confirmed breeder, common in woodlots.
	P. bicolor	tufted titmouse	(1) Confirmed breeder, common in woodlots.
Sittidae	*Sitta carolinensis*	white-breasted nuthatch	(1) Confirmed breeder, uncommon in woodlots.
Troglodytidae	*Cistothorus palustris*	marsh wren	(1) Possible breeder, rare in wetlands with cattails.
	C. platensis	sedge wren **(E)**	(1) Confirmed breeder, common in old grassy fields.
	Thryothorus ludovicianus	Carolina wren	(1) Probable breeder, rare in shrubby areas & woodlots.
	Troglodytes aedon	house wren	(1) Confirmed breeder, abundant in shrubby areas.
	T. troglodytes	winter wren **(E)**	(1) Rare migrant.
Mimidae	*Dumetella carolinensis*	gray catbird	(1) Confirmed breeder, abundant in shrubby areas.
	Mimus polyglottos	Northern mockingbird	(1) Confirmed breeder, rare in shrubby areas.
	Toxostoma rufum	brown thrasher	(1) Confirmed breeder, common in shrubby areas.
Turdidae	*Catharus fuscescens*	veery	(1) Confirmed breeder, uncommon in large woodlots.
	Hylocichla mustelina	wood thrush	(1) Confirmed breeder, very common in large woodlots.
	Sialia sialis	Eastern bluebird	(1) Confirmed breeder, common in openfields & edges.
	Turdus migratorius	American robin	(1) (2) Confirmed breeder, abundant everywhere.
Sylviidae	*Polioptila caerulea*	blue-gray gnatcatcher	(1) Confirmed breeder, uncommon in woodlots.
	Regulus calendula	ruby-crowned kinglet	(1) Rare migrant.
Bombycillidae	*Bombycilla cedrorum*	cedar waxwing	(1) Confirmed breeder, very common everywhere.
Sturnidae	*Sturnus vulgaris*	European starling	(1) (2) Confirmed breeder, abundant everywhere.
Vireonidae	*Vireo bellii*	Bell's vireo	Confirmed and/or probable breeder in county.
	V. flavifrons	yellow-throated vireo	(1) Confirmed breeder, uncommon in mature woodlots.
	V. gilvus	warbling vireo	(1) Confirmed breeder, common in large woodlots.
	V. griseus	white-eyed vireo	(1) Confirmed breeder, uncommon in shrubby areas.
	V. olivaceus	red-eyed vireo	(1) Confirmed breeder, very common in woodlots.
Parulidae	*Dendroica cerulea*	cerulean warbler	(1) Possible breeder, rare in mature woodlots.
	D. dominica	yellow-throated warbler	(1) Confirmed and/or probable breeder in county.
	D. pensylvanica	chestnut-sided warbler	(1) Probable breeder, uncommon in shrubby areas.
	D. petechia	yellow warbler	(1) Confirmed breeder, abundant in shrubby areas.
	D. virens	black-throated green warbler	(1) Possible breeder, rare in mature woodlots.
	Geothylpis trichas	common yellowthroat	(1) Confirmed breeder, abundant in shrub areas, fields.
	Icteria virens	yellow-breasted chat	(1) Confirmed breeder, uncommon in shrubby areas.
	Mniotilta varia	black and white warbler	(1) Possible breeder, rare in mature woodlots.

Table 6-4

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio
PBOW, Sandusky, Ohio

(Page 4 of 5)

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Parulidae (continued)	*Oporomis formosus*	Kentucky warbler	(1) Possible breeder, rare in mature woodlots.
	Protonotaria citrea	prothonotary warbler	Confirmed and/or probable breeder in county.
	Seiurus aurocapillus	overbird	(1) Probable breeder, rare in mature woodlots.
	S. motacilla	Louisiana waterthrush	Confirmed and/or probable breeder in county.
	Setophaga ruticilla	American redstart	(1) Probable breeder, rare in shrubby areas & woodlots.
	Vermivora leucobronchialis	Brewster's warbler	(1) Possible breeder, rare in shrubby areas and edges.
	V. pinus	blue-winged warbler	(1) Confirmed breeder, common in shrubby areas.
	Wilsonia citrina	hooded warbler	Confirmed and/or probable breeder in county.
Icteridae	*Agelaius phoeniceus*	red-winged blackbird	(1) (2) Confirmed breeder, abund. in grasslands, streams.
	Dolichonyx oryzivorus	bobolink	(1) Confirmed breeder, uncommon in grasslands.
	Icterus galbula	Northern oriole	(1) Confirmed breeder, uncommon in open woods.
	I. spurius	orchard oriole	(1) Confirmed breeder, common in open woods & edges.
	Molothrus ater	brown-headed cowbird	(1) (2) Confirmed breeder, abundant everywhere.
	Quiscalus quiscula	common grackle	(1) Confirmed breeder, abundant everywhere.
	Sturnella magna	Eastern meadowlark	(1) Confirmed breeder, common in grasslands.
Ploceidae	*Passer domesticus*	house sparrow	(1) Confirmed breeder, uncommon near buildings.
Thraupidae	*Piranga olivacea*	scarlet tanager	(1) Possible breeder, rare on open woods.
	P. ruba ruba	summer tanager	(1) Confirmed breeder, common in mature woodlots.
Fringillidae	*Ammodramus henslowii*	Henslow's sparrow	(1) Probable breeder, rare in old fields.
	A. savannarum	grasshopper sparrow	(1) Confirmed breeder, common in grasslands.
	Cardinalis cardinalis	Northern cardinal	(1) (2) Confirmed breeder, abundant everywhere.
	Carduelis tristis	American goldfinch	(1) (2) Confirmed breeder, abundant in shrubby areas.
	Carpodacus mexicanus	house finch	(1) Confirmed breeder, uncommon around buildings.
	Melospiza georgiana	swamp sparrow	(1) Confirmed breeder, rare in wet fields and ditches.
	M. melodia	song sparrow	(1) Confirmed breeder, abundant everywhere.
	Passerculus sandwichensis	Savannah sparrow	(1) Confirmed breeder, common in grasslands.
	Passerina cyanea	indigo bunting	(1) Confirmed breeder, abundant everywhere.
	Pheucticus ludovicianus	rose-breasted grosbeak	(1) Confirmed breeder, common in woodlots & edges.
	Pipilo erythrophthalmus	rufous-sided towhee	(1) Confirmed breeder, very common in woodlots, edges.

Table 6-4

Birds Observed On Site and/or Likely to be Breeding In Erie County, Ohio
PBOW, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Fringillidae (continued)	*Pooecetes gramineus*	vesper sparrow	(1) Confirmed breeder, uncommon in grassland & fields.
	Spiza amercana	dickcissel	Confirmed and/or probable breeder in county.
	Spizella passerina	chipping sparrow	(1) Confirmed breeder, common in open woods & lawns.
	S. pusilla	field sparrow	(1) (2) Confirmed breeder, abundant in grasslands, shrubs.
	Zonotrichia albicollis	white-throated sparrow	(1) Late migrant, rare.

[a] Family names from: Peterson, R. T., 1947, *A Field Guide to the Birds*, Sponsored by the National Audubon Society, Houghton Mifflin Company, Boston, Massachusetts.
[b] Peterjohn, B. G. and D. L. Rice, 1991, *The Ohio Breeding Bird Atlas*, The Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio, 416 pages.
[c] E = Ohio Endangered species; T = Ohio Threatened species.

Observation References:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1994).
(2) IT site reconnaisance, April 15-16, 1998.

Table 6-5

Reptiles Observed On Site and Likely to be Found[a] in Erie County, Ohio PBOW, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On-site
Chelydridae	*Chelydra serpentina*	snapping turtle	(1) (2)
Kinosternidae	*Sternotherus odoratus*	musk turtle	
Emydidae	*Chrysemys picta*	painted turtle	(1) (2)
	Emys blandingii	Blanding's turtle	(1)
	Terrapene carolina	box turtle	(1)
Colubridae	*Elaphe vulpina*	fox snake	(1)
	Heterodon platyrhinos	hog-nosed snake	
	Nerodia septemvittata	queen snake	
	N. sipedon sipedon	water snake	(1)
	Opheodrys vernalis	green snake	(1)
	Storeria dekayi	Dekay's brown snake	(1)
	Thamnophis butleri	Butler's garter snake	(1)
	T. sauritus	ribbon snake	
	T. sirtalis	common garter snake	(1)

[a] Pfingsten, R.A. (*Biological Inventory of Plum Brook Station*, Ohio Department of Natural Resources, 1995).

References:

Conant, R. and J. T. Collins, 1991, *Reptiles and Amphibians, Eastern/Central North America*, Peterson Field Guide, Third Edition, Houghton Mifflin Company, Boston.

Wright, A. H. and A. A. Wright, 1957, *Handbook of Snakes of the United States and Canada*, Volumes I and II, Comstock Publishing Associates, Ithaca and London, 1105 pages.

Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).
(2) IT Site Reconnaissance, April 15-16, 1998.

Table 6-6

Amphibians Observed On Site and Likely to be Found[a] in Erie County, Ohio PBOW, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On-site
Ambystomatidae	*Ambystoma texanum*	smallmouth salamander	(1)
	Plethodon cinereus	redback salamander	(1)
Bufonidae	*Bufo americanus*	American toad	(1) (2)
Hylidae	*Acris gryllus*	cricket frog	
	Hyla versicolor	gray treefrog	(1)
	Pseudacris crucifer	spring peeper	(1) (2)
	P. triseriata	chorus frog	(1)
Ranidae	*Rana catesbeiana*	bullfrog	(1) (2)
	R. clamitans	green frog	(1) (2)
	R. pipiens	Northern leopard frog	(1)

[a]Pfingsten, R.A. (*Biological Inventory of Plum Brook Station*, Ohio Department of Natural Resources, 1995).

References:

Conant, R. and J. T. Collins, 1991, *Reptiles and Amphibians, Eastern/Central North America*, Peterson Field Guide, Third Edition, Houghton Mifflin Company, Boston.

Pfingsten, R. A. and F. L. Downs (eds.), 1989, *Salamanders of Ohio*, Ohio Biological Survey Bulletin, New Series, Vol. 7, No. 2, 315 pages, 29 pls.

Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).
(2) IT Site Reconnaissance, April 15-16, 1998.

Table 6-7

Fish Observed On Site at Plum Brook Ordnance Works PBOW, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed on-site	Habitat[a]
Catostomidae	*Catostomus commersoni*	white sucker	(1)	lotic
Centrarchidae	*Lepomis cyanellus*	green sunfish	(1)	lentic, lotic
	Lepomis species	green sunfish hybrid	(1)	lentic
	L. gibbosus	pumpkinseed sunfish	(1)	lentic
	L. macrochirus	bluegill	(1)	lentic
	Micropterus salmoides	largemouth bass	(1)	lentic
Cyprinidae	*Campostoma anomalum*	central stoneroller	(1)	lotic
	Carassius auratus	goldfish	(1)	lentic
	Luxilus chrysocephalus	striped shiner	(1)	lotic
	Pimephales notatus	bluntnose minnow	(1)	lotic
	P. promelas	fathead minnow	(1)	lotic
	Semotilus atromaculatus	creek chub	(1)	lotic
Gasterosteidae	*Culaea inconstans*	brook stickleback	(1)	lotic
Ichtaluridae	*Ameiurus melas*	black bullhead	(1)	lentic

[a] lotic = flowing water such as brooks, ditches, and creeks.
lentic = still waters such as ponds and lakes.

Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).

Table 6-8

Background Distributions of Metals in Soil[a] (Values in mg/kg)
PBOW, Sandusky, Ohio

Metal	Number of Samples	Percent Nondetect	Distribution Type	Minimum	Maximum	Mean	Standard Deviation	Median	95th Percentile	95% UTL[b]
Aluminum	12	0	Lognormal	3,520	15,500	8,430	3,687	7,990	NA	26,879
Antimony	25	64.0	Nonparametric	<5.4	9.3	4.68	2.10	<7.4	7.88	NA
Arsenic	26	11.5	Lognormal	<1.2	36.5	10.8	8.62	8.55	NA	70.8
Barium	12	25.0	Nonparametric	<23.2	826	116	226	48	431	NA
Beryllium	25	76.0	Nonparametric	<0.57	<1.2	0.56	0.18	<1.1	0.96	NA
Cadmium	25	100	Nonparametric	<0.57	<1.2	0.45	0.13	<1.1	<1.2	NA
Calcium	12	0	Lognormal	735	52,300	11,330	16,999	3,070	218,208	NA
Chromium	26	3.8	Lognormal	4.4	29	13.4	6.33	13	NA	36.0
Cobalt	12	25.0	Nonparametric	<5.8	116	22.6	30.5	17.5	66.1	NA
Copper	26	11.5	Lognormal	<2.2	56.2	17.0	15.0	14.2	NA	147
Iron	12	0	Lognormal	5,880	23,4000	40,124	62,173	28,100	NA	358,040
Lead	26	0	Lognormal	1.9	48.6	12.8	9.7	11	NA	51.2
Manganese	26	0	Lognormal	21	13,300	729	2,571	153	NA	3,494
Magnesium	12	0	Lognormal	629	10,400	3,260	3,195	1,890	NA	30,765
Mercury	26	92.3	Nonparametric	<0.037	<0.3	0.09	0.059	<0.27	0.149	NA
Nickel	25	0	Lognormal	5.4	55.1	23.4	12.8	22.8	NA	78.205
Potassium	12	8.0	Lognormal	<308.5	3,390	1,238	853	1,054	NA	6,078
Selenium	25	80.0	Nonparametric	<0.57	<4.9	1.55	0.90	<4.3	2.39	NA
Silver	26	96.2	Nonparametric	<1.1	11.1	1.00	2.1	<1.2	<1.97	NA
Sodium	12	100	Nonparametric	<283	<331.5	303	12.9	305	319	NA
Thallium	25	96.0	Nonparametric	<1.1	<6.1	1.91	1.1	<5.4	<6.0	NA
Vanadium	12	8.3	Lognormal	9	<61.7	24.8	10.7	23.15	NA	83.1
Zinc	26	0	Lognormal	6.6	655	73.0	124	45.4	NA	321

[a] From *Site Investigation of Acid Areas* (IT, 1998)
[b] UTL - Upper tolerance limit.

Table 6-9

Selection of Constituents of Potential Ecological Concern at West Area - Surface Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
INORGANICS										
ALUMINUM	19/19 (100)	11,194	4,720 - 20,600	NA	N	13,033	26,879	A	N	-
ANTIMONY	2/40 (5.0)	3.4	7.4	5.4 - 8.3	U	< 6.8	7.88	A, B	N	-
ARSENIC	36/40 (90)	5.2	2 - 11.5	3.4 - 3.7	N	5.9	70.80	A	N	-
BARIUM	16/19 (84)	64.5	24.8 - 130	22.4 - 23.2	N	79	431.00	A	N	-
BERYLLIUM	10/40 (25)	0.57	0.59 - 1.2	0.56 - 1.4	U	< 1.2	0.96	-	Y	0.6
CADMIUM	1/40 (2.5)	0.46	0.59	0.56 - 1.4	U	< 1.2	1.2	A, B	N	-
CALCIUM	19/19 (100)	9,642	757 - 58,600	NA	L	20,541	218,208	A	N	-
CHROMIUM	40/40 (100)	16.7	5.4 - 35	NA	L	18.7	36.00	A	N	-
COBALT	13/19 (68)	9.8	8.5 - 17.9	5.6 - 6.9	N	12	66.10	A	N	-
COPPER	36/40 (90)	9.6	2.4 - 30.9	2.3 - 2.5	L	14.4	147.00	A	N	-
IRON	19/19 (100)	19,061	7,190 - 36,000	NA	N	22,187	358,040	A	N	-
LEAD	40/40 (100)	12.0	2.2 -23	NA	N	13.3	51.20	A	N	-
MAGNESIUM	18/19 (95)	3,888	684 - 12,200	579	L	7,419	30,765	A	N	-
MANGANESE	40/40 (100)	469	89.6 - 1,340	NA	L	602	3,494	A	N	-
MERCURY	4/40 (10)	0.092	0.04 - 0.1	0.037 - 0.36	U	< 0.3	0.15	A	N	-
NICKEL	40/40 (100)	21.4	7.1 - 46.9	NA	L	25.1	78.21	A	N	-
POTASSIUM	14/19 (74)	1,431	742 - 2,970	559 - 693	N	1,803	6,078	A	N	-
SELENIUM	1/40 (2.5)	1.4	0.65	0.56 - 5.8	U	< 4.7	2.39	A	N	-
SODIUM	1/19 (5.3)	313	681	559 - 693	U	< 597	319	-	Y	298.5
VANADIUM	19/19 (100)	25.3	10.1 - 40.5	NA	L	29.8	83.10	A	N	-
ZINC	39/40 (98)	58.7	15.9 - 111	2.5	N	65.4	321.00	A	N	-
VOLATILE ORGANIC COMPOUNDS										
ACETONE	1/10 (10)	0.014	0.035	0.022 - 0.024	U	< 0.024	NA	-	Y	0.012
METHYLENE CHLORIDE	10/10 (100)	0.0015	0.0009 - 0.0023	NA	L	0.0019	NA	-	Y	0.0019
TOLUENE	3/10 (30)	0.0028	0.0018 - 0.0032	0.0056 - 0.006	U	0.0023	NA	-	Y	0.0023
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	1/40 (2.5)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	3/40 (7.5)	0.16	0.3 - 0.7	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	4/50 (8.0)	0.15	0.043 - 0.4	0.25 - 0.4	U	< 0.25	NA	-	Y	0.125
2,4,6-TRINITROTOLUENE	1/42 (2.4)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DITROTOLUENE	1/40 (2.5)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
ACENAPHTHYLENE	1/10 (10)	0.18	0.041	0.37 - 0.4	U	< 0.4	0.005	-	Y	0.041
ANTHRACENE	1/10 (10)	0.20	0.23	0.37 - 0.4	U	< 0.4	0.011 - 0.013	-	Y	0.2

Table 6-9

Selection of Constituents of Potential Ecological Concern At West Area - Surface Soil[a]
Red Water Ponds, PBOW, Sandusky Ohio

(Page 2 of 2)

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS (Continued)										
BENZO(A)ANTHRACENE	1/10 (10)	0.21	0.40	0.37 - 0.4	U	< 0.4	0.056 - 0.11	-	Y	0.2
BENZO(A)PYRENE	1/10 (10)	0.21	0.39	0.37 - 0.4	U	< 0.4	0.0046 - 0.9	-	N	-
BENZO(B)FLUORANTHENE	1/10 (10)	0.20	0.3	0.37 - 0.4	U	< 0.4	0.058 - 0.22	-	Y	0.2
BENZO(GHI)PERYLENE	1/10 (10)	0.19	0.22	0.37 - 0.4	U	< 0.4	0.066	-	Y	0.2
BENZO(K)FLUORANTHENE	1/10 (10)	0.21	0.35	0.37 - 0.4	U	< 0.4	0.058 - 0.25	-	Y	0.2
CHRYSENE	1/10 (10)	0.21	0.42	0.37 - 0.4	U	< 0.4	0.078 - 0.12	-	Y	0.2
FLUORANTHENE	1/10 (10)	0.25	0.76	0.37 - 0.4	U	< 0.4	0.12 - 0.21	-	Y	0.2
INDENO(1,2,3-CD)PYRENE	1/10 (10)	0.20	0.23	0.37 - 0.4	U	< 0.4	0.063 - 0.1	-	Y	0.2
PHENANTHRENE	1/10 (10)	0.21	0.36	0.37 - 0.4	U	< 0.4	0.048 - 0.14	-	Y	0.2
PYRENE	1/10 (10)	0.23	0.55	0.37 - 0.4	U	< 0.4	0.099 - 0.15	-	Y	0.2

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = Distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background UTL concentration for inorganic constituents are based on site data. PAHs from ATSDR (agricultural soil).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-10

Selection of Constituents of Potential Ecological Concern at Pentolite Road Area - Surface Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean (mg/kg)	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	20/20 (100)	7,053	2,370 - 12,700	NA	N	7,985	26,879	A	N	-
ARSENIC	36/50 (72)	4.6	2.3 - 22	3.1 - 3.6	L	5.4	71	A	N	-
BARIUM	13/20 (65)	33	24.3 - 84.3	21.3 - 23.8	L	48	431	A	N	-
BERYLLIUM	3/50 (6.0)	0.48	0.68 - 0.69	0.53 - 1.3	U	< 1.1	0.96	A	N	-
CALCIUM	19/20 (95)	6,246	817 - 54,000	556	L	11,864	218,208	A	N	-
CHROMIUM	50/50 (100)	11	4.2 - 21	NA	L	11.5	36	A	N	-
COBALT	9/20 (45)	4.7	5.8 - 11.1	5.3 - 6.2	U	6.2	66.1	A	N	-
COPPER	29/50 (58)	4.8	2.5 - 22.6	2.1 - 2.5	U	4.9	147	A	N	-
IRON	20/20 (100)	14,272	8,330 - 22,900	NA	N	15,600	358,040	A	N	-
LEAD	50/50 (100)	7.7	3.1 - 19	NA	L	8.7	51.2	A	N	-
MAGNESIUM	20/20 (100)	2,322	791 - 11,500	NA	U	2,310	30,765	A	N	-
MANGANESE	50/50 (100)	238	74.5 - 820	NA	L	274	3,494	A	N	-
MERCURY	2/50 (4.0)	0.093	0.04 - 0.043	0.035 - 0.31	U	< 0.28	0.149	A, B	N	-
NICKEL	50/50 (100)	9.6	4.7 - 27.2	NA	L	10.5	78	A	N	-
POTASSIUM	5/20 (25)	441	684 - 1,460	532 - 616	U	< 616	6,078	A	N	-
SELENIUM	2/50 (4.0)	1.5	0.59 - 0.84	0.53 - 5.0	U	< 4.4	2.39	A, B	N	-
SODIUM	2/20 (10)	357	741 - 1,240	532 - 620	U	< 594	319	-	Y	297
VANADIUM	20/20 (100)	22	12.9 - 35.2	NA	L	23.7	83	A	N	-
ZINC	50/50 (100)	30	17 - 78.5	NA	L	32	321	A	N	-
VOLATILE ORGANIC COMPOUNDS										
METHYLENE CHLORIDE	1/10 (10)	0.0028	0.0018	0.0055 - 0.0062	U	< 0.0062	NA	-	Y	0.0018
SEMIVOLATILE ORGANIC COMPOUNDS										
1,3-DINITROBENZENE	6/50 (12)	0.20	0.3 - 1.6	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	5/50 (10)	0.20	0.4 - 1.7	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	13/60 (22)	0.34	0.16 - 2.4	0.25 - 4.1	U	< 0.25	NA	-	Y	0.125
2,6-DINITROTOLUENE	3/60 (5.0)	0.18	0.05 - 0.8	0.25 - 4.1	U	< 0.26	NA	-	Y	0.13
2,4,6-TRINITROTOLUENE	1/50 (2.0)	0.13	0.27	0.25	U	< 0.25	NA	-	Y	0.125
3,4-DINITROTOLUENE	1/30 (3.3)	0.13	0.3	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DINITROTOLUENE	1/50 (2.0)	0.18	2.7	0.25	U	< 0.25	NA	-	Y	0.125

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution. NA = distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background UTL concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-11

Selection of Constituents of Potential Ecological Concern at West Area - Total Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
INORGANICS										
ALUMINUM	38/38 (100)	10,168	4,720 - 20,600	NA	L	11,423	26,879	A	N	-
ANTIMONY	2/74 (2.7)	3.4	7.4 - 7.4	5.3 - 8.3	U	< 6.9	7.88	A,B	N	-
ARSENIC	68/74 (92)	5.7	2.0 - 23.6	3.4 - 3.7	L	6.4	70.8	A	N	-
BARIUM	35/38 (92)	59.4	24.8 - 130	22.4 - 23.2	N	67.7	431	A	N	-
BERYLLIUM	12/74 (16)	0.52	0.59 - 1.2	0.56 - 1.4	U	< 1.2	0.96	-	Y	0.6
CADMIUM	2/74 (2.7)	0.46	0.59 - 1.4	0.56 - 1.4	U	< 1.1	1.2	-	Y	0.55
CALCIUM	38/38 (100)	10,080	757 - 58,600	NA	U	3,760	218,208	A	N	-
CHROMIUM	74/74 (100)	16	5.4 - 35.0	NA	L	17.2	36.0	A	N	-
COBALT	30/38 (79)	9.6	6.0 - 21.0	5.6 - 6.9	N	11.0	66.1	A	N	-
COPPER	68/74 (92)	10.4	2.4 - 30.9	2.3 - 2.9	L	13.7	147	A	N	-
IRON	38/38 (100)	18,917	7,190 - 36,000	NA	N	20,859	358,040	A	N	-
LEAD	74/74 (100)	10.9	2.2 - 23.0	NA	N	11.8	51.2	A	N	-
MAGNESIUM	37/38 (97)	4,470	684 - 23,400	579	L	6,171	30,765	A	N	-
MANGANESE	74/74 (100)	425	83.4 - 1,340	NA	L	498	3,494	A	N	-
MERCURY	4/74 (5.4)	0.084	0.04 - 0.1	0.037 - 0.36	U	< 0.29	0.15	A	N	-
NICKEL	74/74 (100)	21.4	7.1 - 46.9	NA	L	23.7	78.21	A	N	-
POTASSIUM	31/38 (82)	1,326	643 - 2,970	559 - 693	N	1,536	6,078	A	N	-
SELENIUM	1/74 (1.4)	1.3	0.65	0.56 - 5.8	U	< 4.5	2.39	A,B	N	-
SODIUM	3/38 (7.9)	345	681 - 1,270	559 - 693	U	< 598	319	-	Y	299
VANADIUM	38/38 (100)	24.2	10.1 - 40.5	NA	L	26.6	83.1	A	N	-
ZINC	73/74 (99)	56.1	15.9 - 111	2.5	N	60.2	321	A	N	-
VOLATILE ORGANIC COMPOUNDS										
ACETONE	1/18 (5.6)	0.013	0.035	0.022 - 0.025	U	< 0.024	NA	-	Y	0.012
METHYLENE CHLORIDE	11/18 (61)	0.0021	0.0009 - 0.0023	0.0057 - 0.0063	N	0.0024	NA	-	Y	0.0024
TOLUENE	7/18 (39)	0.0026	0.0015 - 0.0032	0.0056 - 0.0062	U	0.0018	NA	-	Y	0.0018

Table 6-11

Selection of Constituents of Potential Ecological Concern At West Area -Total Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution[b]	95% UCL mg/kg[c]	Background mg/kg[d]	Exclusion Rationale[e]	COPEC?[f]	Source-Term Concentration, mg/kg[g]
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	5/74 (6.8)	0.20	0.3 - 2.4	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	13/74 (18)	0.42	0.3 - 5.5	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	11/92 (12)	0.27	0.043 - 5.1	0.25 - 0.41	U	< 0.25	NA	-	Y	0.125
2,6-DINITROTOLUENE	2/92 (2.2)	0.16	0.3 - 1.5	0.25 - 0.41	U	< 0.26	NA	-	Y	0.13
2,4,6-TRINITROTOLUENE	5/74 (6.8)	0.14	0.3 - 0.4	0.25	U	< 0.25	NA	-	Y	0.125
3,4-DINITROTOLUENE	1/36 (2.8)	0.14	0.5	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DITROTOLUENE	6/74 (8.1)	0.15	0.3 - 0.7	0.25	U	< 0.25	NA	-	Y	0.125
ACENAPHTHYLENE	2/18 (11)	0.18	0.04 - 0.041	0.37 - 0.41	U	< 0.4	0.005	-	Y	0.2
ANTHRACENE	2/18 (11)	0.19	0.12 - 0.23	0.37 - 0.41	U	< 0.4	0.011 - 0.013	-	Y	0.2
BENZO(A)ANTHRACENE	2/18 (11)	0.21	0.17 - 0.4	0.37 - 0.41	U	< 0.4	0.056 - 0.11	-	Y	0.2
BENZO(A)PYRENE	2/18 (11)	0.20	0.14 - 0.39	0.37 - 0.41	U	< 0.4	0.0046 - 0.9	A	N	-
BENZO(B)FLUORANTHENE	2/18 (11)	0.20	0.14 - 0.3	0.37 - 0.41	U	< 0.4	0.058 - 0.22	-	Y	0.2
BENZO(GHI)PERYLENE	2/18 (11)	0.19	0.076 - 0.22	0.37 - 0.41	U	< 0.4	0.066	-	Y	0.2
BENZO(K)FLUORANTHENE	2/18 (11)	0.20	0.11 - 0.35	0.37 - 0.41	U	< 0.4	0.058 - 0.25	-	Y	0.2
CHRYSENE	2/18 (11)	0.21	0.17 - 0.42	0.37 - 0.41	U	< 0.4	0.078 - 0.12	-	Y	0.2
FLUORANTHENE	3/18 (17)	0.23	0.058 - 0.76	0.37 - 0.41	U	< 0.4	0.12 - 0.21	-	Y	0.2
INDENO(1,2,3-CD)PYRENE	2/18 (11)	0.19	0.076 - 0.23	0.37 - 0.41	U	< 0.4	0.063 - 0.1	-	Y	0.2
PHENANTHRENE	2/18 (11)	0.21	0.25 - 0.36	0.37 - 0.41	U	< 0.4	0.048 - 0.14	-	Y	0.2
PYRENE	3/18 (17)	0.21	0.043 - 0.55	0.37 - 0.41	U	< 0.4	0.099 - 0.15	-	Y	0.2

[a] Total soil is defined as the interval from 0 to 6 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = Distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background UTL concentration for inorganic constituents are based on site data. Background PAHs from ATSDR (agricultural soil).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-12

Selection of Constituents of Potential Ecological Concern At Pentolite Road Area - Total Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical	Frequency of Detection	Arithmetic Mean (mg/kg)	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution[b]	95% UCL mg/kg[c]	Background mg/kg[d]	Exclusion Rationale[e]	COPEC?[f]	Source-Term Concentration mg/kg[g]
INORGANICS										
ALUMINUM	40/40 (100)	7,869	2,370 - 12,700	NA	N	8,494	26,879	A	N	-
ANTIMONY	11/90 (12)	3.5	3.6 - 9.3	5.2 - 7.7	U	< 6.8	7.8	-	Y	3.4
ARSENIC	74/90 (82)	6.9	2.3 - 42.8	3.1 - 3.6	L	8.0	71	A	N	-
BARIUM	31/40 (78)	54.4	24.3 - 239	21.3 - 24.9	L	73.5	431	A	N	-
BERYLLIUM	9/90 (10)	0.49	0.55 - 0.83	0.53 - 1.3	U	< 1.1	0.96	A	N	-
CALCIUM	39/40 (98)	18,927	817 - 63,200	566	U	10,300	218,208	A	N	-
CHROMIUM	90/90 (100)	12.3	4.2 - 21	NA	N	12.9	36	A	N	-
COBALT	26/40 (65)	8.1	5.8 - 30.3	5.3 - 6.4	L	10.1	66.1	A	N	-
COPPER	64/90 (71)	8.3	2.5 - 34.5	2.1 - 2.5	U	7.5	147	A	N	-
IRON	40/40 (100)	17,923	8,330 - 43,700	NA	L	19,837	358,040	A	N	-
LEAD	90/90 (100)	8.6	2.9 - 19	NA	N	9.2	51.2	A	N	-
MAGNESIUM	40/40 (100)	6,722	791 - 24,600	NA	U	5,150	30,765	A	N	-
MANGANESE	90/90 (100)	374	74.5 - 2,270	NA	L	414	3,494	A	N	-
MERCURY	3/90 (3.3)	0.089	0.04 - 0.045	0.035 - 0.31	U	< 0.28	0.149	A,B	N	-
NICKEL	90/90 (100)	14.9	4.7 - 57.2	NA	L	16.5	78	A	N	-
POTASSIUM	22/40 (55)	856	684 - 2,430	532 - 644	U	968	6,078	A	N	-
SELENIUM	5/90 (5.6)	1.4	0.59 - 0.84	0.53 - 5	U	< 4.5	2.39	A	N	-
SILVER	4/90 (4.4)	0.58	0.6 - 0.65	1.0 - 1.3	U	< 1.2	1.97	A	N	-
SODIUM	7/40 (18)	577	741 - 4,130	532 - 639	U	< 620	319	-	Y	310
THALLIUM	4/90 (4.4)	1.9	0.6 - 1.25	1.1 - 6.3	U	< 5.6	6.0	A	N	-
VANADIUM	40/40 (100)	23.9	12.9 - 38.4	NA	N	25.4	83	A	N	-
ZINC	90/90 (100)	39.2	17.0 - 104	NA	L	42.2	321	A	N	-
VOLATILE ORGANIC COMPOUNDS										
1,1,2,2-TETRACHLOROETHANE	1/14 (7.1)	0.0030	0.0031	0.0055 - 0.0063	U	< 0.0062	NA	-	Y	0.0031
ACETONE	1/10 (10)	0.011	0.0082	0.022 - 0.025	U	< 0.025	NA	-	Y	0.0125
METHYLENE CHLORIDE	1/14 (7.1)	0.0029	0.0018	0.0055 - 0.0063	U	< 0.0062	NA	-	Y	0.0031
TOLUENE	1/14 (7.1)	0.0029	0.0017	0.0055 - 0.0063	U	< 0.0062	NA	-	Y	0.0031
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	15/90 (17)	0.48	0.3 - 9.3	0.25	U	< 0.25	NA	-	Y	0.125
1,3,5-TRINITROBENZENE	17/90 (19)	1.8	0.4 - 58	0.25	U	< 0.25	NA	-	Y	0.125
2,4-DINITROTOLUENE	27/104 (26)	0.85	0.056 - 25	0.25 - 4.1	U	< 0.25	NA	-	Y	0.125
2,6-DINITROTOLUENE	10/104 (9.6)	0.23	0.05 - 3.6	0.25 - 4.1	U	< 0.26	NA	-	Y	0.13
2,4,6-TRINITROTOLUENE	3/90 (3.3)	133	0.27 - 12,000	0.25 - 2.5	U	< 0.25	NA	-	Y	0.125
3,4-DINITROTOLUENE	2/50 (4.0)	0.22	0.3 - 4.5	0.25	U	< 0.25	NA	-	Y	0.125
4-AMINO-2,6-DINITROTOLUENE	4/90 (4.4)	0.28	0.3 - 9.5	0.25 - 2.5	U	< 0.25	NA	-	Y	0.125
NITROBENZENE	1/104 (0.96)	0.20	1.1	0.25 - 4.2	U	< 0.26	NA	-	Y	0.13
MISCELLANEOUS										
TOTAL ORGANIC CARBON							NA			

Table 6-12

Selection of Constituents of Potential Ecological Concern At Pentolite Road Area - Total Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

[a] Total soil is defined as the interval from 0 to 6 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = distribution not determined if sample size is less than 5.
[c] 95% Upper Confidence Limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Background UTL concentrations for inorganic constituents are based on site-specific data. Background PAH values from ATSDR (Agricultural).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-13

Selection of Constituents of Potential Ecological Concern at West Area - Surface Water[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/L	Range of values, mg/L Detected	Range of values, mg/L Nondetected	Statistical Distribution[b]	95% UCL mg/L[c]	Background mg/L[d]	Exclusion Rationale[e]	COPEC?[f]	Source-Term Concentration mg/L[g]
INORGANICS										
ALUMINUM	3/4 (75)	6.6	0.3 - 13.8	0.20	L	1.4E+12	<0.20 - 0.631	-	Y	13.8
ARSENIC	2/9 (22)	0.014	0.0202 - 0.0218	0.010 - 0.030	N	0.0177	<0.010	-	Y	0.0177
CALCIUM	4/4 (100)	89	31.1 - 115	NA	N	135	106 - 107	A	N	-
CHROMIUM	3/9 (33)	0.009	0.010 - 0.0233	0.01	U	0.0233	<0.010	-	Y	0.0233
IRON	4/4 (100)	10.4	0.646 - 21.1	NA	N	23.6	0.126 - 1.3	-	Y	21.1
LEAD	3/9 (33)	0.021	0.025 - 0.077	0.003 - 0.025	L	0.168	<0.003	-	Y	0.077
MAGNESIUM	4/4 (100)	37	25.8 - 50.7	NA	N	52.8	26 - 26.5	-	Y	50.7
MANGANESE	9/9 (100)	0.63	0.126 - 1.60	NA	L	1.95	0.0306 - 0.89	-	Y	1.6
NICKEL	1/9 (11)	0.016	0.02	0.020 - 0.040	U	0.02	<0.040	A	N	-
POTASSIUM	4/4 (100)	7.6	5.18 - 9.91	NA	L	14.1	9.4 - 9.73	A	N	-
SODIUM	4/4 (100)	72	38.3 - 107	NA	N	117.5	38.2 - 39.3	-	Y	107
VANADIUM	1/4 (25)	0.032	0.0522	0.05	U	0.0522	<0.050	-	Y	0.0522
ZINC	5/9 (56)	0.042	0.043 - 0.0925	0.02	N	0.0629	<0.020 - 0.027	-	Y	0.0629
VOLATILE ORGANIC COMPOUNDS										
BROMOMETHANE	4/4 (100)	0.00018	0.00016 - 0.00021	NA	L	0.00023	NA	-	Y	0.00021
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
1,3-DINITROBENZENE	1/9 (11)	0.00011	0.0003	0.00015 - 0.0002	U	0.0003	NA	-	Y	0.0003
2,4-DINITROTOLUENE	1/9 (11)	0.00012	0.0005	0.0001 - 0.0002	U	0.0005	NA	-	Y	0.0005
2,6-DINITROTOLUENE	1/9 (11)	0.00016	0.0008	0.0001 - 0.0002	U	0.0008	NA	-	Y	0.0008
3,4-DINITROTOLUENE	4/5 (80)	0.00048	0.0005 - 0.0006	0.00021	U	0.0006	NA	-	Y	0.0006
3-NITROTOLUENE	4/9 (44)	0.0069	0.0023 - 0.054	0.0002 - 0.0014	L	1.007	NA	-	Y	0.054
4-AMINO-2-NITROTOLUENE	1/5 (20)	0.00034	0.0006	0.00055	U	0.0006	NA	-	Y	0.0006
DI-n-OCTYLPHTHALATE	1/4 (25)	0.0057	0.0078	0.01	U	0.0078	NA	-	Y	0.0078
MISCELLANEOUS										
HARDNESS	4/4 (100)	446	372 - 592	NA	NA	NA	360 - 408	--	--	--

[a] Surface water results from totals. Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NP = Nonparametric distribution for data sets with greater than 50% nondetects.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-14

Selection of Constituents of Potential Ecological Concern at Pentolite Road Area - Surface Water[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/L	Range of values, mg/L Detected	Range of values, mg/L Nondetected	Statistical Distribution [b]	95% UCL mg/L [c]	Background mg/L [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/L [g]
INORGANICS										
ALUMINUM	2/2 (100)	1.8	0.53 - 3.04	NA	NA	NA	<0.20 - 0.778	-	Y	3.04
CALCIUM	2/2 (100)	95	71.7 - 118	NA	NA	NA	74.2 - 98.1	A	N	-
IRON	2/2 (100)	3.4	0.972 - 5.79	NA	NA	NA	0.948 - 1.42	-	Y	5.79
LEAD	1/2 (50)	0.0051	0.0087	0.003	NA	NA	<0.003	-	Y	0.0087
MAGNESIUM	2/2 (100)	27	15.8 - 37.3	NA	NA	NA	16.0 - 36.9	A	N	-
MANGANESE	2/2 (100)	0.33	0.261 - 0.404	NA	NA	NA	0.0671 - 0.245	-	Y	0.404
SODIUM	2/2 (100)	19	13.7 - 24.7	NA	NA	NA	14.8 - 25.7	A	N	-
ZINC	1/2 (50)	0.034	0.058	0.02	NA	NA	<0.020 - 0.0202	-	Y	0.058
VOLATILE ORGANIC COMPOUNDS										
BROMOMETHANE	1/2 (50)	0.00056	0.00011	0.002	NA	NA	NA	-	Y	0.00011
MISCELLANEOUS										
HARDNESS	2/2 (100)	386	284 - 488	NA	NA	NA	328 - 432	--	--	--

[a] Surface water results from totals. Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-15

Selection of Constituents of Potential Ecological Concern at West Area - Sediment[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	4/4 (100)	5,993	3,230 - 9,600	NA	L	16,929	2,450 - 3,170	-	Y	9,600
ARSENIC	9/17 (53)	4.6	4.0 - 11.3	3.8 - 4.8	L	6.5	3.5 - 5.4	-	Y	6.5
BARIUM	3/4 (75)	46	34.8 - 65	98.5	L	74.6	<24.1 -26.6	-	Y	65
CALCIUM	4/4 (100)	27,428	6,710 - 74,700	NA	L	1,716,875	10,800 - 13,900	-	Y	74,700
CHROMIUM	17/17 (100)	15	7.4 - 28.7	NA	L	18.1	5.3 - 6.7	-	Y	18.1
COBALT	2/4 (50)	10	10.6 - 10.8	13.3 - 24.6	N	12.9	6.4 - 10.9	A	N	-
COPPER	7/17 (41)	5.2	3.2 - 24.5	2.4 - 3.2	U	24.5	8.8 - 13.7	-	Y	24.5
IRON	4/4 (100)	18,700	16,000 - 24,300	NA	L	24,565	9,900 - 14,900	-	Y	24,300
LEAD	17/17 (100)	16	8.1 - 32.1	NA	L	18.8	6.5 - 9.7	-	Y	18.8
MAGNESIUM	4/4 (100)	3,843	2,520 - 6,770	NA	L	9,227	2,110 - 2,720	-	Y	6,770
MANGANESE	17/17 (100)	249	149 - 726	NA	L	299	231 - 305	-	Y	299
NICKEL	17/17 (100)	18	8.8 - 24.5	NA	N	19.8	13.7 - 23	A	N	-
POTASSIUM	2/5 (40)	904	821 - 1,500	606 - 2,460	N	1,353	<603 - <623	-	Y	1,353
VANADIUM	1/4 (25)	9.5	25	6.1 - 13.3	L	372	<6.0 - <6.2	-	Y	25
ZINC	17/17 (100)	61	36 - 94	NA	L	68	35.1 - 48	-	Y	68
VOLATILE ORGANIC COMPOUNDS										
ACETONE	2/4 (50)	0.052	0.071 - 0.11	0.024 - 0.028	N	0.11	NA	-	Y	0.11
2-BUTANONE	2/4 (50)	0.028	0.021 - 0.029	0.024 - 0.099	L	0.12	NA	-	Y	0.029
METHYLENE CHLORIDE	1/4 (25)	0.0083	0.02	0.0061 - 0.013	L	0.16	NA	-	Y	0.02
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROARMOMATICS										
1,3-DINITROBENZENE	4/17 (24)	0.24	0.3 - 0.7	0.25	U	0.7	NA	-	Y	0.7
1,3,5-TRINITROBENZENE	3/17 (18)	0.22	0.6 - 0.8	0.25	U	0.8	NA	-	Y	0.8
2-AMINO-4,6-DINITROTOLUENE	1/13 (8)	0.14	0.3	0.25	U	0.3	NA	-	Y	0.3
2,4-DINITROTOLUENE	6/17 (35)	0.26	0.3 - 0.7	0.25	U	0.7	NA	-	Y	0.7
2,6-DINITROTOLUENE	1/17 (6)	0.14	0.4	0.25 - 0.26	U	0.4	NA	-	Y	0.4
FLUORANTHENE	1/4 (25)	0.40	0.047	0.46 - 1.6	N	0.76	NA	-	Y	0.047
MISCELLANEOUS										
TOTAL ORGANIC CARBON (pond)	2/2 (100)	66,800	40,200 - 93,400	NA	NA	NA	3,960 - 5430	-	-	-
PHOSPHORUS	1/1 (100)	3.1	3.1	NA	NA	NA	NA	-	Y	3.1

[a] Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-16

Selection of Constituents of Potential Ecological Concern at Pentolite Road Area - Sediment[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background mg/kg [d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS										
ALUMINUM	2/2 (100)	3,980	2,830 - 5,130	NA	NA	NA	3,400 - 6,020	A	N	-
ARSENIC	2/2 (100)	4.7	4.3 - 5.1	NA	NA	NA	4.4 - 4.6	A	N	-
BARIUM	1/2 (50)	30.4	48.1	25.3	NA	NA	28.5 - 53.4	A	N	-
CALCIUM	2/2 (100)	54,150	46,300 - 62,000	NA	NA	NA	8,110 - 96,000	A	N	-
CHROMIUM	2/2 (100)	8.4	6.3 - 10.4	NA	NA	NA	6.8 - 11.5	A	N	-
COPPER	2/2 (100)	11.1	7.6 - 14.5	NA	NA	NA	7.4 - 17.9	A	N	-
IRON	2/2 (100)	11,660	9,620 - 13,700	NA	NA	NA	9,330 - 16,200	A	N	-
LEAD	2/2 (100)	6.3	4.8 - 7.8	NA	NA	NA	5.6 - 12.8	A	N	-
MAGNESIUM	2/2 (100)	16,400	13,500 - 19,300	NA	NA	NA	2,710 - 10,700	-	Y	19,300
MANGANESE	2/2 (100)	413	404 - 421	NA	NA	NA	104 - 865	A	N	-
NICKEL	2/2 (100)	13.7	9.5 - 17.9	NA	NA	NA	10.4 - 18.6	A	N	-
POTASSIUM	1/2 (50)	678	1,040	631	NA	NA	<663 - <1,310	-	Y	1,040
VANADIUM	2/2 (100)	13.6	12.9 - 14.2	NA	NA	NA	7.9 - 17.4	A	N	-
ZINC	2/2 (100)	40.8	23.2 - 58.4	NA	NA	NA	36.1 - 73.3	A	N	-
VOLATILE ORGANIC COMPOUNDS										
ACETONE	1/2 (50)	0.041	0.069	0.025	NA	NA	NA	-	Y	0.069
2-BUTANONE	1/2 (50)	0.014	0.015	0.025	NA	NA	NA	-	Y	0.015
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS										
ACENAPHTHENE	1/2 (50)	0.20	0.11	0.57	NA	NA	NA	-	Y	0.11
ANTHRACENE	1/2 (50)	0.18	0.077	0.57	NA	NA	NA	-	Y	0.077
CARBAZOLE	1/2 (50)	0.23	0.18	0.57	NA	NA	NA	-	Y	0.18
DIBENZOFURAN	1/2 (50)	0.17	0.06	0.57	NA	NA	NA	-	Y	0.06
FLUORANTHENE	1/2 (50)	0.21	0.14	0.57	NA	NA	NA	-	Y	0.14
FLUORENE	1/2 (50)	0.20	0.11	0.57	NA	NA	NA	-	Y	0.11
PHENANTHRENE	1/2 (50)	0.30	0.32	0.57	NA	NA	NA	-	Y	0.32
PYRENE	1/2 (50)	0.20	0.11	0.57	NA	NA	NA	-	Y	0.11
MISCELLANEOUS										
TOTAL ORGANIC CARBON	2/2 (100)	11,225	5,450 - 17,000	NA	NA	NA	12,000 - 33,000	--	--	--

[a] Only detected constituents presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Background concentrations for inorganic constituents are based on site data.
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] Concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.

Table 6-17

Ecological Risk Assessment COPEC[a] Final Screening Assessment
Red Water Ponds
PBOW, Sandusky, Ohio

(Page 1 of 6)

Constituent/Media	Maximum Detected Concentration[b]		Screening Concentration[c]	COPEC ?	
	West Area RWPs	Pentolite Rd. RWPs		West Area RWPs	Pentolite Rd. RWPs
Surface Soil[d] - Organics (mg/kg)					
1,3-Dinitrobenzene	0.3	1.6	DNA	Y	Y
1,3,5-Trinitrobenzene	0.7	1.7	DNA	Y	Y
2,4-Dinitrotoluene	0.4	2.4	DNA	Y	Y
2,6-Dinitrotoluene	-[e]	0.8	DNA	N	Y
2,4,6-Trinitrotoluene	0.3	0.27	DNA	Y	Y
3,4-Dinitrotoluene	-	0.3	DNA	-	Y
4-Amino-2,6-Dinitrotoluene	0.3	2.7	DNA	Y	Y
Acenaphthylene	0.041	-	0.10	N	-
Acetone	0.035	-	DNA	Y	-
Anthracene	0.23	-	0.10	Y	-
Benzo(a)anthracene	0.40	-	0.10	Y	-
Benzo(b)fluoranthene	0.30	-	0.10	Y	-
Benzo(g,h,i)perylene	0.22	-	0.10	Y	-
Benzo(k)fluoranthene	0.35	-	0.10	Y	-
Chrysene	0.42	-	0.10	Y	-
Fluoranthene	0.76	-	0.10	Y	-
Indeno(1,2,3-cd)Pyrene	0.23	-	0.10	Y	-
Methylene chloride	0.0023	0.0018	0.30	N	N
Phenanthrene	0.36	-	0.10	Y	-
Pyrene	0.55	-	0.10	Y	-
Toluene	0.0032	-	0.10	N	-

Table 6-17

Ecological Risk Assessment COPEC[a] Final Screening Assessment
Red Water Ponds
PBOW, Sandusky, Ohio

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Constituent/Media	Maximum Detected Concentration[b]		Screening Concentration[c]	COPEC ?	
	West Area RWPs	Pentolite Rd. RWPs		West Area RWPs	Pentolite Rd. RWPs
Surface Soil[d] - Inorganics (mg/kg)					
Beryllium	1.2	-	0.020	Y	-
Sodium	681	1,240	DNA	Y	Y
Subsurface Soil[d] - Organics (mg/kg)					
1,3-Dinitrobenzene	2.4	9.3	DNA	Y	Y
1,3,5-Trinitrobenzene	5.5	58	DNA	Y	Y
2,4-Dinitrotoluene	5.1	25	DNA	Y	Y
2,6-Dinitrotoluene	1.5	3.6	DNA	Y	Y
2,4,6-Trinitrotoluene	0.4	12,000	DNA	Y	Y
3,4-Dinitrotoluene	0.5	4.5	DNA	Y	Y
4-Amino-2,6-Dinitrotoluene	0.7	9.5	DNA	Y	Y
Acenaphthylene	0.041	-	0.10	N	-
Acetone	0.035	0.0082	DNA	Y	Y
Anthracene	0.23	-	0.10	Y	-
Benzo(a)anthracene	0.4	-	0.10	Y	-
Benzo(b)fluroanthene	0.3	-	0.10	Y	-
Benzo(g,h,i)perylene	0.22	-	0.10	Y	-
Benzo(k)fluroanthene	0.35	-	0.10	Y	-
Chrysene	0.42	-	0.10	Y	-
Fluoranthene	0.76	-	0.10	Y	-
Indeno(1,2,3-cd)pyrene	0.23	-	0.10	Y	-
Methylene chloride	0.0023	0.0018	0.30	N	N
Nitrobenzene	-	1.1	DNA	-	Y

Table 6-17

Ecological Risk Assessment COPEC[a] Final Screening Assessment
Red Water Ponds
PBOW, Sandusky, Ohio

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Constituent/Media	Maximum Detected Concentration[b]		Screening Concentration[c]	COPEC ?	
	West Area RWPs	Pentolite Rd. RWPs		West Area RWPs	Pentolite Rd. RWPs
Subsurface Soil[d] - Organics (mg/kg) (continued)					
Phenanthrene	0.36	-	0.10	Y	-
Pyrene	0.55	-	0.10	Y	-
Toluene	0.0032	0.0017	0.10	N	N
Subsurface Soil[d] - Inorganics (mg/kg)					
Antimony	-	9.3	0.48	-	Y
Beryllium	1.2	-	0.020	Y	-
Cadmium	1.4	-	2.5	N	-
Sodium	1,270	4,130	DNA	Y	Y
Surface Water[f] - Organics (mg/L)					
1,3-Dinitrobenzene	0.0003	-	DNA	Y	-
2,4-Dinitrotoluene	0.0005	-	0.23	N	-
2,6-Dinitrotoluene	0.0008	-	DNA	Y	-
3,4-Dinitrotoluene	0.0006	-	DNA	Y	-
3-Nitrotoluene	0.054	-	DNA	Y	-
4-Amino-2-Nitrotoluene	0.0006	-	DNA	Y	-
Bromomethane	0.00021	0.00011	DNA	Y	Y
Di-n-Octylphthalate	0.0078	-	0.003	Y	-
Surface Water[f] - Inorganics (mg/L)					
Aluminum	13.8	3.04	0.2	Y	Y
Arsenic	0.0218	-	0.15	N	-
Chromium	0.0233	-	0.086	N	-
Iron	21.1	5.79	1.0	Y	Y

Table 6-17

Ecological Risk Assessment COPEC[a] Final Screening Assessment
Red Water Ponds
PBOW, Sandusky, Ohio

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Constituent/Media	Maximum Detected Concentration[b]		Screening Concentration[c]	COPEC ?	
	West Area RWPs	Pentolite Rd. RWPs		West Area RWPs	Pentolite Rd. RWPs
Surface Water[f] - Inorganics (mg/L) (continued)					
Lead	0.077	0.0087	0.0064	Y	Y
Magnesium	50.7	-	DNA	Y	-
Manganese	1.6	0.404	0.080	Y	Y
Sodium	107	-	DNA	Y	-
Vanadium	0.0522	-	0.019	Y	-
Zinc	0.0925	0.058	0.12	N	N
Sediment - Organics (mg/kg)					
1,3-Dinitrobenzene	0.7	-	DNA	Y	-
1,3,5-Trinitrobenzene	0.8	-	DNA	Y	-
2-Amino-4,6-Dinitrotoluene	0.3	-	DNA	Y	-
2-Butanone	0.029	0.015	DNA	Y	Y
2,4-Dinitrotoluene	0.7	-	DNA	Y	-
2,6-Dinitrotoluene	0.4	-	DNA	Y	-
Acenaphthene	-	0.11	See PAH_{Total}	See PAH_{Total}	
Acetone	0.11	0.069	DNA	Y	Y
Anthracene	-	0.077	See PAH_{Total}	See PAH_{Total}	
Carbazole	-	0.18	DNA	-	Y
Dibenzofuran	-	0.06	DNA	-	Y
Fluoranthene	0.047	0.14	2.9	N	N
Fluorene	-	0.11	See PAH_{Total}	See PAH_{Total}	
Methylene Chloride	0.02	-	DNA	Y	-
Phenanthrene	-	0.32	0.85	-	N

Table 6-17

Ecological Risk Assessment COPEC[a] Final Screening Assessment
Red Water Ponds
PBOW, Sandusky, Ohio

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Constituent/Media	Maximum Detected Concentration[b]		Screening Concentration[c]	COPEC ?	
	West Area RWPs	Pentolite Rd. RWPs		West Area RWPs	Pentolite Rd. RWPs
Sediment - Organics (mg/kg) (continued)					
Pyrene	-	0.11	See PAH_{Total}	See PAH_{Total}	
PAH_{Total}	0.047	0.87	2.0	N	N
Sediment - Inorganics (mg/kg)					
Aluminum	9,600	-	DNA	Y	-
Arsenic	11.3	-	6	Y	-
Barium	65	-	DNA	Y	-
Calcium	74,700	-	DNA	Y	-
Chromium	28.7	-	26	Y	-
Copper	24.5	-	16	Y	-
Iron	24,300	-	20,000	Y	-
Lead	32.1	-	31	Y	-
Magnesium	6,770	19,330	DNA	Y	Y
Manganese	726	-	460	Y	-
Phosphorus	3.1	-	DNA	Y	-
Potassium	1,500	1,040	DNA	Y	Y
Vanadium	25	-	DNA	Y	-
Zinc	94	-	120	N	-

DNA = Data not available.

[a]COPEC = Constituent of potential ecological concern
[b]Maximum detected concentration in site media, excluding background-related constituents (see text for discussion of the treatment of background), and constituents with a frequency of detection less than 5 percent.

Table 6-17

Ecological Risk Assessment COPEC[a] Final Screening Assessment
Red Water Ponds
PBOW, Sandusky, Ohio

[c]Screening concentrations as follows:

For Soil: EPA, *Region 3 BTAG Screening Levels for Soil* (1995)

For Surface Water (in order of preference):

(1) Ohio Water Quality Criteria for the Lake Erie Basin (Title 3745-1-33; assuming a hardness of 100 mg/L $CaCO_3$),

(2) EPA *Eco Update - Ecotox Threshold* (ET) values (1996), and

(3) EPA *Region 3 BTAG Screening Levels* for freshwater aquatic flora and fauna (1995).

For Sediment: Ontario Ministry of the Environment (OME) thresholds for sediment (OME, *Guidelines for the Protection and Management of Aquatic Quality in Ontario*, 1993), unless otherwise noted.

[d] Surface soil represented by results from a depth of 0 to 3 feet below ground surface; subsurface soil represented by results from a depth of 0 to 6 feet below the ground surface.

[e] "-" entry means constituent either background related, less than 5 percent frequency of detection, or not detected.

[f] Surface water results for total fraction (unfiltered).

Table 6-18

Assessment and Measurement Endpoints and Exposure Delineation
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

Assessment Goal	Assessment Endpoint	Null Hypothesis (H_o)	Selected Receptor and Exposure Routes	Measurement Endpoint
Protection of terrestrial ecosystem structure and function.	Protection of long-term survival and reproductive capabilities for soil invertebrates.	The presence of site contaminants within surficial soils will have no adverse effect on survival and reproductive capabilities of terrestrial invertebrates.	Terrestrial invertebrates Ingestion of soil and direct exposure to soil	Comparison of soil concentration to soil critical effect values (CEV).
	Protection of long-term survival and reproductive capabilities for herbivorous mammals.	The presence of site contaminants within surface and subsurface soils, surface water, and vegetation will have no adverse effect on survival and reproductive capabilities of herbivorous mammals.	Eastern cottontail (*Sylvilagus floridanus*) white-tailed deer (*Odocoileus virginianus*) ingestion of plants, water, and incidental soil	Comparison of total daily dose to species-specific toxicity endpoint values (TEV).
	Protection of long-term survival and reproductive capabilities for omnivorous mammals.	The presence of site contaminants within surface soils, surface water, terrestrial invertebrates and vegetation will have no adverse effect on survival and reproductive capabilities of omnivorous mammals.	raccoon (*Procyon lotor*) ingestion of terrestrial plants, and invertebrates, small mammals, water and incidental soil	Comparison of total daily dose to species-specific toxicity endpoint values (TEV).
	Protection of long-term survival and reproductive capabilities for omnivorous mammals.	The presence of site contaminants within surficial soils, surface water, terrestrial invertebrates, and vegetation will have no adverse effect on survival and reproductive capabilities of omnivorous mammals.	deer mouse (*Peromyscus maniculatus*) ingestion of terrestrial invertebrates, plants, water, and incidental soil	Comparison of total daily dose to species-specific TEVs.

Table 6-18

Assessment and Measurement Endpoints and Exposure Delineation
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

Assessment Goal	Assessment Endpoint	Null Hypothesis (H_o)	Selected Receptor and Exposure Routes	Measurement Endpoint
Protection of terrestrial ecosystem structure and function.	Protection of long-term survival and reproductive capabilities for carnivorous birds.	The presence of site contaminants within surficial soils, surface water, small mammals, and birds will have no adverse effect on survival and reproductive capabilities of carnivorous birds.	red-tailed hawk (*Buteo jamacencis*) ingestion of small mammals, birds, water, incidental soil	Comparison of total daily dose to species-specific TEVs.
	Protection of long-term survival and reproductive capabilities for small insectivorous mammals.	The presence of site contaminants within surficial soils, surface water, and terrestrial invertebrates will have no adverse effect on survival and reproductive capabilities of insectivorous mammals.	short-tailed shrew (*Blarnia brevicauda*) ingestion of terrestrial invertebrates, water, and incidental soil	Comparison of total daily dose to species-specific TEVs.
	Protection of long-term survival and reproductive capabilities for insectivorous birds.	The presence of site contaminants within surficial soils, surface water, and terrestrial invertebrates will have no adverse effect on survival and reproductive capabilities of insectivorous birds.	march wren (*Cistorthorus palustris*) ingestion of terrestrial invertebrates, water, and incidental soil	Comparison of total daily dose to species-specific TEVs.

Table 6-18

Assessment and Measurement Endpoints and Exposure Delineation
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 3)

Assessment Goal	Assessment Endpoint	Null Hypothesis (H_o)	Selected Receptor and Exposure Routes	Measurement Endpoint
Protection of aquatic ecosystem structure and function.	Protection of long-term survival and reproductive capabilities for benthic invertebrates.	The presence of site contaminants within sediments and surface water will have no adverse effect on survival and reproductive capabilities of benthic invertebrates.	benthic invertebrates ingestion of sediment and direct exposure to surface water	Comparison of sediment concentration to sediment CEVs.
	Protection of long-term survival and reproductive capabilities for aquatic vertebrates (fin fish).	The presence of site contaminants within surface water, benthic invertebrates, and plants will have no adverse effect on survival and reproductive capabilities of aquatic vertebrates.	aquatic vertebrates ingestion of benthic invertebrates, plants, and direct exposure to water	Comparison of surface water concentration to aquatic CEVs.
	Protection of long-term survival and reproductive capabilities for semi-aquatic omnivorous mammals (also considered in the terrestrial assessment).	The presence of site contaminants within surface water, sediments, aquatic invertebrates, and fish have no adverse effect on survival and reproductive capabilities of aquatic mammals.	raccoon (*Procyon lotor*) ingestion of aquatic invertebrates, fish, water and incidental sediment	Comparison of total daily dose to species-specific TEVs.
	Protection of long-term survival and reproductive capabilities for piscivorous birds.	The presence of site contaminants within aquatic vertebrates and benthic invertebrates will have no adverse effect on survival and reproductive capabilities of piscivorous birds.	great blue heron (*Ardea herodias*) ingestion of aquatic vertebrates, benthic invertebrates, water, and incidental sediment	Comparison of total daily dose to species-specific TEVs.

Table 6-19

Data Used to Model Exposure in the Indicator Wildlife Species
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Indicator Species	Class/ Order	Average Body Weight[a] (kg)	Average Home Range[a] (ha)	Dietary Intake[a] (kg[dw]/day)	Soil/Sed. Intake (kg[dw]/day)	Water Intake (L/day)[b]	Trophic Level	Dietary Composition[a] (percent)
Deer mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	0.0148	0.062	0.0028	0.000057 (2.0%)	0.0022	Omnivore	Terr. Inverts. : 39 Plants: 61
Eastern cottontail (*Sylvilagus floridanus*)	Mammalia/ Lagomorpha	1.132	3.1	0.096	0.006 (6.3%)	0.11	Herbivore	Plants: 100
Short-tailed shrew (*Blarina brevicauda*)	Mammalia/ Insectivora	0.015	0.39	0.008	0.00083 (10.4%)	0.0023	Insectivore	Terr. Inverts.: 100
White-tailed deer (*Odocoileus virginianus*)	Mammalia/ Artiodactyla	61[c]	518[c]	2.0[d]	0.04 (2.0%)	4.0	Herbivore	Plants: 100
Marsh wren (*Cistothorus palustris*)	Aves/ Passeriformes	0.010	0.054	0.0095	0.00019 (2.0%)	0.0027	Insectivore	Terr. Inverts.: 100
Red-tailed hawk (*Buteo jamaicensis*)	Aves/ Falconiformes	0.957	842	0.1	0.002 (2.0%)	0.057	Carnivore	Rabbits: 25.3 Shrews: 25.3 Mice: 25.3 Birds: 24
Great blue heron (*Ardea herodias*)	Aves/ Ciconiiformes	2.204	4.5	0.4	0.0079 (2.0%)	0.10	Piscivore	Fish: 96 Aq. Inverts.: 4
Raccoon (*Procyon lotor*)	Mammalia/ Carnivora	5.1	156	0.26[c]	0.024 (9.4%)	0.43	Omnivore	Fish: 2.0 Aq. Inverts.: 21 Terr. Inverts.: 30 Mice: 5.0 Plants: 42

Table 6-19

Data Used to Model Exposure in the Indicator Wildlife Species
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

[a] From EPA (*Wildlife Exposure Factors*, 1993), except as noted.
[b] Allometric equations for mammals and birds from EPA (1993), as follows:
Mammals: WI (water ingestion; L/day) = 0.099 $Wt^{0.90}$ (kg), where Wt = body weight.
Birds: WI (L/day) = 0.059 $Wt^{0.67}$ (kg)
[c] Information is from *A Guide to the Mammals of Ohio* (Gottschang, 1981).
[d] Allometric equation for mammals: FI (kg/day) = 0.0687 $Wt^{0.822}$ (EPA, 1993), where FI = food ingestion (dry weight) and Wt = body weight.

Table 6-20

Octanol-Water Partition Coefficients for Organic Chemicals of Potential Ecological Concern Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Chemical	K_{ow} (unitless) [a]
1,3-Dinitrobenzene	30.9[b]
1,3,5-Trinitrobenzene	15.1[b]
2-Amino-4,6-Dinitrotoluene	100[f]
2,6-Dinitrobenzene	30.9[c]
2,4-Dinitrotoluene	95.0
2,6-Dinitrotoluene	190
2,4,6-Trinitrotoluene	100[b]
2-Butanone	1.9[d]
3,4-Dinitrotoluene	190[e]
3-Nitrotoluene	269[d]
4-Amino-2,6-dinitrotoluene	100[f]
4-Amino-2-nitrotoluene	100[f]
Acetone	0.58[d]
Anthracene	28,000
Benzo(a) anthracene	410,000
Benzo(b) fluoranthene	1,150,000
Benzo(g,h,i) perylene	3,200,000
Benzo(k) fluoranthene	1,150,000
Bromomethane	12.3
Carbazole	1,950[d]
Chrysene	410,000
Di-n-octyl phthalate	166,000[g]
Dibenzofuran	13,200[d]
Fluoranthene	79,000
Indeno(1,2,3-cd) pyrene	3,200,000
Methylene chloride	18.2

Table 6-20

Octanol-Water Partition Coefficients for Organic Chemicals of Potential Ecological Concern Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Chemical	K_{ow} (unitless) [a]
Nitrobenzene	74.0
Phenanthrene	28,000
Pyrene	80,000

[a] Octanol-water partition coefficients (K_{ow}) values are from EPA-440/4-81-014, 1982, *Aquatic Fate Process Data for Organic Priority Pollutants*, unless otherwise noted.
[b] K_{ow} values are from Rosenblatt, D. H., et. al., 1991, *Organic Explosives and Related Compounds.*
[c] The K_{ow} for 1,3-Dinitrobenzene was used as a surrogate.
[d] K_{ow} values are from Leo, A., Hansch, C., and Elkins, D., 1971, *Partition Coefficients and Their Uses.*
[e] The K_{ow} for 2,6-Dinitrotoluene was used as a surrogate.
[f] The K_{ow} for 2,4,6-Trinitrotoluene was used as a surrogate.
[g] National Library of Medicine (NLM) Hazardous Substance Data Bank (HSDB).

Table 6-21

Fate and Transport Factors for Inorganic Chemicals of Potential Ecological Concern Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Soil-to-Plant Transfer Factor	Soil-to-Insect Transfer Factor	Food-to-Muscle Transfer Factor	Water-to-Fish/Invertebrate Bio-Concentration Factor	Distribution Coefficient K_d (mL/g)
Aluminum	-	-	-	1.0×10^{2} [a]	1.5×10^{3} [b]
Antimony	5.6×10^{-4} [c]	1.0×10^{0} [a]	4.0×10^{-5} [c]	-	-
Arsenic	2.3×10^{-2} [b]	1.0×10^{0} [a]	4.0×10^{-3} [b]	4.4×10^{1} [d]	2.0×10^{2} [b]
Barium	3.0×10^{-2} [c]	1.0×10^{0} [a]	2.0×10^{-4} [c]	4.0×10^{0} [c]	6.0×10^{1} [b]
Beryllium	5.8×10^{-3} [b]	1.0×10^{0} [a]	1.0×10^{-3} [b]	1.0×10^{2} [c]	6.5×10^{2} [b]
Calcium	1.9×10^{0} [b]	1.0×10^{0} [a]	2.0×10^{-3} [c]	1.0×10^{2} [a]	4.1×10^{0} [b]
Chromium	-	-	-	2.0×10^{2} [c]	8.5×10^{2} [b]
Copper	-	-	-	2.0×10^{2} [c]	3.5×10^{1} [b]
Iron	-	-	-	2.0×10^{2} [c]	5.0×10^{3} [c]
Lead	-	-	-	3.0×10^{2} [c]	4.0×10^{2} [b]
Magnesium	7.8×10^{-1} [b]	1.0×10^{0} [a]	2.0×10^{-2} [c]	1.0×10^{2} [a]	4.6×10^{0} [b]
Manganese	-	-	-	4.0×10^{2} [c]	1.0×10^{3} [c]
Phosphorus	-	-	-	5.0×10^{4} [c]	3.5×10^{0} [b]
Potassium	7.8×10^{-1} [b]	1.0×10^{0} [a]	2.0×10^{-2} [c]	1.0×10^{2} [a]	5.6×10^{0} [b]
Sodium	6.5×10^{-2} [b]	1.0×10^{0} [a]	8.0×10^{-2} [c]	2.0×10^{1} [c]	-
Vanadium	-	-	-	1.0×10^{2} [a]	1.0×10^{3} [b]

[a] Consevative default values: 1.0×10^{0} for soil-to-insect TF, based on data in Stafford et al. (1991, *Collation and Interpretation of Data for Times Beach Confined Disposal Facility*), Ma (1982, "The Influence of Soil Properties and Worm-Related Factors ona the Concentration of Heavy Metals in Earthworms"), and NCRP (1989, *Screening Techniques for Determining Compliance with Environmental Standards: Releases of Radionuclides to the Atmosphere*); 1.0×10^{2} for water-to-fish and water-to- invertebrate BCF, based on 95% UCL for nonparametric distribution of 54 BCF values presented in IAEA (1994, *Site Management Plan, Plum Brook Ordnance Works*).

[b] From Baes et. al., (1984, *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*); for soil-to-plant transfer factors, average of vegetative and nonvegetative values was used.

[c] From IAEA (1994).

[d] From EPA (1994).

" - " Symbol indicates factor was not required as the inorganic was not selected as a COPEC for the particular pathway of concern.

Table 6-22

Reference Toxicity Values Used to Derive Wildlife Toxicity Benchmarks for COPEC Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

Chemical	Mammals			Birds		
	Toxicity Value[a]	NOAEL (mg/kg-d)	Species	Toxicity Value[a]	NOAEL (mg/kg-d)	Species
Organics						
1,3-Dinitrobenzene	59.5 (LD_{50})	0.595	rat	NA[b]	NA	NA
1,3,5-Trinitrobenzene	275 (LD_{50})	2.75	rat	NA	NA	NA
2,6-Dinitrobenzene	0.4[c]	0.4	rat	NA	NA	NA
2,4-Dinitrotoluene	268 (LD_{50})	2.68	rat	NA	NA	NA
2,6-Dinitrotoluene	177 (LD_{50})	1.77	rat	NA	NA	NA
2,4,6-Trinitrotoluene	795 (LD_{50})	7.95	rat	NA	NA	NA
2-Butanone	1,771	1,771	rat	NA	NA	NA
3,4-Dinitrotoluene	807 (LD_{50})	8.07	rat	NA	NA	NA
3-Nitrotoluene	1,072 (LD_{50})	10.72	rat	NA	NA	NA
2-Amino-4,6-dinitrotoluene	1,394 (LD_{50})	13.94	rat	3.2 (LD_{50})	0.032	Unknown
4-Amino-2,6-dinitrotoluene	959 (LD_{50})	9.59	rat	3.2 (LD_{50})	0.032	Unknown
4-Amino-2-nitrotoluene	6,860 (LD_{50})	68.6	rat	3.2 (LD_{50})	0.032	Unknown
Acetone	10	10	rat	NA	NA	NA
Anthracene	1.0	1.0	mouse	NA	NA	NA
Benzo(a)anthracene	1.0	1.0	mouse	NA	NA	NA
Benzo(b)fluoranthene	1.0	1.0	mouse	NA	NA	NA
Benzo(g,h,i)perylene	1.0	1.0	mouse	NA	NA	NA
Benzo(k)fluoranthene	1.0	1.0	mouse	NA	NA	NA
Bromomethane	214 (LD_{50})	2.14	rat	NA	NA	NA
Carbazole	200 (LD_{50})	2.0	mouse	NA	NA	NA
Chrysene	1.0	1.0	mouse	NA	NA	NA
Di-n-octyl phthalate	47,000 (LD_{50})	470	rat	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Fluoranthene	125	125	mouse	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.0	1.0	mouse	NA	NA	NA

Table 6-22

Reference Toxicity Values Used to Derive Wildlife Toxicity Benchmarks for COPEC Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

Chemical	Mammals			Birds		
	Toxicity Value[a]	NOAEL (mg/kg-d)	Species	Toxicity Value[a]	NOAEL (mg/kg-d)	Species
Methylene chloride	5.85	5.85	rat	NA	NA	NA
Nitrobenzene	4.6[c]	0.23	mouse	NA	NA	NA
Phenanthrene	1.0	1.0	mouse	NA	NA	NA
Pyrene	75[c]	75	mouse	NA	NA	NA
Inorganics						
Aluminum	1.93	1.93	mouse	110	110	ringed dove
Antimony	0.125	0.125	mouse	NA	NA	NA
Arsenic	0.126	0.126	mouse	2.46	2.46	cowbird
Barium	5.1	5.1	rat	20.8	20.8	chicks
Beryllium	0.66	0.66	rat	NA	NA	NA
Calcium	--	1,053[d]	rabbit	--	2,833[d]	Jap. quail
Chromium	2,737	2,737	rat	1.0	1.0	black duck
Copper	11.7	11.7	mink	47	47	chicks
Iron	--	26[d]	rabbit	--	50[d]	poultry
Lead	8.0	8.0	rat	3.85	3.85	Am. kestrel
Magnesium	--	158[d]	rabbit	--	150[d]	poultry
Manganese	88	88	rat	977	977	Jap. quail
Phosphorus	--	526[d]	rabbit	--	400[d]	poultry
Potassium	--	1,579[d]	rabbit	--	1,000[d]	poultry
Sodium	--	1,579[d]	rabbit	--	1,000[d]	poultry
Vanadium	0.21	0.21	rat	11.4	11.4	mallard

[a]Toxicity values are derived from no-observed-adverse-effects levels (NOAEL) taken from Sample, et. al., 1996, *Toxicological Benchmarks for Wildlife: 1996 Revision*, unless otherwise noted. LD_{50} values were converted to chronic NOAELs by dividing by a factor of 100 and subchronic low-observed-adverse-effects-levels were converted to chronic NOAELs by dividing by a factor of 20, as recommended by Wentsel, et. al., 1996, *Tri-Service Procedural Guidelines for Ecological Risk Assessments.*
[b]NA indicates that the information was not available.
[c]The value is based on data contained in the EPA IRIS database.
[d]NOAELs for selected nutrients are estimated based on mineral dietary requirements or maximum tolerated doses (Appendix N).

Table 6-22

Reference Toxicity Values Used to Derive Wildlife Toxicity Benchmarks for COPEC Red Water Ponds, PBOW, Sandusky, Ohio

Note: LD_{50} values from RTECS (1998), as summarized in the TOMES CPC™ System Data Base (1/1/99).

The following surrogates were used:

The NOAEL for benzo(a)pyrene was used for anthracene, benzo(a)anthracene, benzo(b)fluroanthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and phenanthrene.
The NOAEL for 2,4-DNT was used for 2,6-DNT.
The LD_{50} for 4-Amino-2-Nitrotoluene was used for 2-Amino-4,6-DNT and 4-Amino-2,6-DNT.

Table 6-23

Uncertainty Factors [a] for Ecological RTV [b] Extrapolations [c]
Red Water Ponds, PBOW, Sandusky, Ohio

Laboratory Animals (toxicity database)		Selected Site Receptor Species	
Rat	G: Rattus F: Muridae O: Rodentia	Deer mouse	G: Peromyscus F: Cricetidae O: Rodentia
Mouse	G: Mus F: Muridae O: Rodentia	Eastern cottontail	G: Sylvilagus F: Leporidae O: Lagomorpha
Mink	G: Mustela F: Mustelidae O: Carnivora	Raccoon	G: Procyon F: Procyonidae O: Carnivora
Rabbit: G: Oryctolagus (N. Zealand White)	F: Leporidae O:Lagomorpha	Short-tailed shrew	G: Blarina F: Soricidae O: Insectivora
Ringed dove	G: Streptopelia F: Columbidae O: Columbiformes	White-tailed deer	G: Odocoileus F: Cervidae O: Artiodactyla
Cowbird	G: Molothrus F: Emberizidae O: Passeriformes	Great blue heron	G: Ardea F: Ardeidae O: Ciconiiformes
Chick, Poultry F: Phasianidae	G: Gallus O: Galliformes	March wren	G: Cistothorus F: Troglodytidae O: Passeriformes
Black duck, Mallard F: Anatidae	G: Anas O: Anseriformes	Red-tailed hawk	G: Buteo F: Accipitridae O: Falconiformes
Japanese quail	G: Coturnix F: Phasianidae O: Galliformes		
American kestrel	G: Falco F: Falconidae O: Falconiformes		

[a] From *Tri-Service Procedural Guidelines for Ecological Risk Assessment* (Wentsel, et al. 1996)
[b] RTV = Reference toxicity value.
[c] Interclass extrapolations not performed; only within bird class or within mammal class.

Extrapolation between two different species = uncertainty factor of 2
Extrapolation between two different genera (G) = uncertainty factor of 4
Extrapolation between two different families (F) or orders (O) = uncertainty factor of 8
Thus, for all extrapolations used in the current Eco RA (except for the New Zealand White extrapolated to the cottontail), an uncertainty factor of 8 was used. For the latter, an uncertainty factor of 4 was used.

Table 6-24

Terrestrial Plant Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Constituent	Source-Term Surface Soil Concentration[a] (mg/kg)		Benchmark Concentration for Plants [b] (mg/kg)	Benchmark Exceeded?	
	West Area RWP	Pentolite Road RWP		West Area RWP	Pentolite Rd RWP
Organics					
1,3-Dinitrobenzene	0.125	0.125	DNA[c]	cnba[e]	cnba
1,3,5-Trinitrobenzene	0.125	0.125	DNA	cnba	cnba
2,4-Dinitrotoluene	0.125	0.125	DNA	cnba	cnba
2,6-Dinitrotoluene	-- [d]	0.13	DNA	--	cnba
2,4,6-Trinitrotoluene	0.125	0.125	DNA	cnba	cnba
3,4-Dinitrotoluene	--	0.125	DNA	--	cnba
4-Amino-2,6-Dinitrotoluene	0.125	0.125	DNA	cnba	cnba
Acetone	0.012	--	DNA	cnba	--
Anthracene	0.2	--	DNA	cnba	--
Benzo(a)anthracene	0.2	--	DNA	cnba	--
Benzo(b)fluoranthene	0.2	--	DNA	cnba	--
Benzo(g,h,i)perylene	0.2	--	DNA	cnba	--
Benzo(k)fluoranthene	0.2	--	DNA	cnba	--

Table 6-24

Terrestrial Plant Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Constituent	Source-Term Surface Soil Concentration[a] (mg/kg)		Benchmark Concentration for Plants [b] (mg/kg)	Benchmark Exceeded?	
	West Area RWP	Pentolite Road RWP		West Area RWP	Pentolite Rd RWP
Organics (continued)					
Chrysene	0.2	--	DNA	cnba	--
Fluoranthene	0.2	--	DNA	cnba	--
Indeno(1,2,3-cd)pyrene	0.2	--	DNA	cnba	--
Phenanthrene	0.2	--	DNA	cnba	--
Pyrene	0.2	--	DNA	cnba	--
Inorganics					
Beryllium	0.6	--	10	No	--
Sodium	298.5	--	DNA	cnba	--

[a] 95 percent upper confidence limit concentrations presented for COPEC (Tables 6-17 for COPEC and Tables 6-9 and 6-10 for 95% UCL concentration.
[b] Will and Suter (1995, *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants*).
[c] DNA = data not available.
[d] indicates this constituent not selected as COPEC for the indicated area.
[e]cnba = could not be assessed.

Table 6-25

Aquatic Biota Surface Water Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Constituent	Source -Term Concentration (µg/L) [a]		AWQC [b] (µg/L)	Tier II [c] (µg/L)	State of Ohio [d] (µg/L)	Other [e] (µg/L)	Benchmark Exceeded?	
	West Area RWPs	Pentolite Road RWPs					West Area	Pentolite Road
Organics								
1,3-Dinitrobenzene	0.3	--	NA	71	NA	NA	No	--
2,6-Dinitrotoluene	0.8	--	230 #	NA	NA	200	No	--
3,4-Dinitrotoluene	0.6	--	230 #	NA	NA	200	No	--
3-Nitrotoluene	54	--	NA	NA	NA	NA	cnba	--
4-Amino-2-Nitrotoluene	0.6	--	NA	NA	NA	NA	cnba	--
Bromomethane	0.21	0.11	NA	NA	NA	NA	cnba	cnba
Di-n-octyl phthalate	7.8	--	NA	NA	NA	3,822 *	No	--
Inorganics								
Aluminum	13,800	3,040	87	NA	NA	3,288 *	Yes (2/2)	Yes (1/2)
Iron	21,100	5,790	1,000	NA	1,000	1,300 *	Yes (3/3)	Yes (3/3)
Lead	77	8.7	18.6	NA	37	18.9 *	Yes (3/3)	No
Magnesium	50,700	--	NA	NA	NA	82,000 *	No	--
Manganese	1,600	404	1,500 #	80	NA	1,770 *	Yes (2/3)	Yes (1/3)
Sodium	107,000	--	15,000,000 #	NA	NA	680,000 *	No	--
Vanadium	52.2	--	NA	19	NA	80 *	Yes (1/2)	--

[a]COPEC from Table 6-17 and 95% UCL concentrations from Tables 6-13 and 6-14.
[b]Ambient water quality criteria for chronic exposure (federal) from 40 CFR 131.36, Quality Criteria for Water (Red Book) (EPA, 1976), and EPA Health and Ecological Criteria Division recommendations (1997). Lowest effect concentration (LEC) values (that are not criteria) are indicated with "#".

Table 6-25

Aquatic Biota Surface Water Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

[c]Values calculated using Great Lakes Water Quality Initiative Tier II methodology, as summarized in *Eco Update - Ecotex Thresholds* (EPA, 1996).
[d]Ohio Water Quality Criteria for the protection of aquatic life (Lake Erie Basin; Title 3745-1-33, assuming a hardness of 400 mg/L $CaCO_3$).
[e]Other references include the following:

- Water Quality Criteria for 2,4-DNT and 2,6-DNT (Etnier, *Water Quality Criteria for 2,4- and 2,6-Dinitrotolune*, ORNL, 1987)
- Lowest effect concentration (LEC) for fish from the AQUIRE database. Value is chronic LEC, or estimated lowest chronic value for fish (or daphnids for Mg and Na) using LC50 and equation from Suter and Mabrey (1994) -- indicated with "*".

Notes:

1) Water hardness measurements ranged from 372 to 592 mg/L at West Area and from 284 to 488 mg/L at Pentolite Road, Tables 6-13 and 6-14.
2) NA = Not available.
3) Hardness dependent criteria calculated for total water body concentration, not dissolved fraction, using average hardness of approximately 400 mg/L $CaCO_3$.
4) 2,4-Dinitrotoluene used as a surrogate for 2,6-DNT and 4,3-DNT.
5) cnba = Could not be assessed.

Table 6-26

Aquatic Biota Sediment Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 3)

COPEC	Source-Term Concentration[a] (mg/kg)		NOAA ER-L[b] (mg/kg)	NOAA ER-M[c] (mg/kg)	FDEP TEL[d] (mg/kg)	FDEP PEL[e] (mg/kg)	Ontario MOE Low[f] (mg/kg)	Ontario MOE Severe[g] (mg/kg)	Benchmark Exceeded?	
	West Area RWPs	Pentolite Rd. RWPs							West Area	Pentolite Rd.
Organics										
1,3-Dinitrobenzene	0.7	--	NA[h]	NA	NA	NA	NA	NA	cnba[i]	--
1,3,5-Trinitrobenzene	0.8	--	NA	NA	NA	NA	NA	NA	cnba	--
2-Amino-4,6-Dinitrotoluene	0.3	--	NA	NA	NA	NA	NA	NA	cnba	--
2-Butanone	0.029	--	NA	NA	NA	NA	NA	NA	cnba	--
2,4-Dinitrotoluene	0.7	--	NA	NA	NA	NA	NA	NA	cnba	--
2,6-Dinitrotoluene	0.4	--	NA	NA	NA	NA	NA	NA	cnba	--
Acetone	0.11	--	NA	NA	NA	NA	NA	NA	cnba	--
Carbazole	--	0.18	NA	NA	NA	NA	NA	NA	--	cnba
Dibenzofuran	--	0.06	NA	NA	NA	NA	NA	NA	--	cnba

Table 6-26

Aquatic Biota Sediment Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 3)

COPEC	Source-Term Concentration[a] (mg/kg)		NOAA ER-L[b] (mg/kg)	NOAA ER-M[c] (mg/kg)	FDEP TEL[d] (mg/kg)	FDEP PEL[e] (mg/kg)	Ontario MOE Low[f] (mg/kg)	Ontario MOE Severe[g] (mg/kg)	Benchmark Exceeded?	
	West Area RWPs	Pentolite Rd. RWPs							West Area	Pentolite Rd.
Inorganics										
Aluminum	9,600	--	NA	NA	NA	NA	NA	NA	cnba	--
Arsenic	6.5	--	8.2	70	7.24	41.6	6	33	Yes (1/4)	--
Barium	65	--	NA	NA	NA	NA	NA	NA	cnba	--
Calcium	74,700	--	NA	NA	NA	NA	NA	NA	cnba	--
Chromium	18.1	--	81	370	52.3	160	26	110	No	--
Copper	24.5	--	34	270	18.7	108	16	110	Yes (2/4)	--
Iron	24,300	--	NA	NA	NA	NA	20,000	40,000	Yes (1/2)	--
Lead	18.8	--	46.7	218	30.2	112	31	250	No	--
Magnesium	6,770	19,330	NA	NA	NA	NA	NA	NA	cnba	cnba
Manganese	299	--	NA	NA	NA	NA	460	1,110	No	--
Phosphorus	3.1	--	NA	NA	NA	NA	NA	NA	cnba	--

Table 6-26

Aquatic Biota Sediment Impact Assessment
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 3 of 3)

COPEC	Source-Term Concentration[a] (mg/kg)		NOAA ER-L[b] (mg/kg)	NOAA ER-M[c] (mg/kg)	FDEP TEL[d] (mg/kg)	FDEP PEL[e] (mg/kg)	Ontario MOE Low[f] (mg/kg)	Ontario MOE Severe[g] (mg/kg)	Benchmark Exceeded?	
	West Area RWPs	Pentolite Rd. RWPs							West Area	Pentolite Rd.
Organics (continued)										
Potassium	1,353	1,040	NA	NA	NA	NA	NA	NA	cnba	cnba
Vanadium	25	--	NA	NA	NA	NA	NA	NA	cnba	--

[a] COPEC from Table 6-17 and 95% UCL concentrations from Tables 6-15 and 6-16.
[b] Effects Range - Low, developed by NOAA published by Long and Morgan (1990, *The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program*), updated by Long (1995, *Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments*), and summarized in Jones, et al. (1996, *Toxicologicala Benchmarks or Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota*). Used only if no freshwater benchmarks available (e.g., FDEP and MOE).
[c] Effects Range - Medium, developed by NOAA published by Long and Morgan (1990), updated by Long (1995), and summarized in Jones, et al. (1996). Used only if no freshwater benchmarks available (e.g., FDEP and MOE).
[d] Florida Dept. of Environmental Protection, threshold effects level, summarized in Jones, et al. (1996).
[e] Florida Dept. of Environmental Protection, probable effects level, summarized in Jones, et al. (1996).
[f] Ontario Ministry of the Environment (MOE), Low = lowest effect level and is the 5th percentile of the screening level concentration.
[g] Ontario Ministry of the Environment (MOE), Severe = severe effect level and is the 95th percentile of the screening level concentration.
[h] Not available.
[i] Could not be assessed.

Table 6-27

Terrestrial Receptors Hazard Index (HI) Summary for West Area[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Media	Terrestrial Receptor						
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer	Hawk
Soil [b] HI	21	1.1	91	450	19	0.010	0.0013
Risk Drivers:	92% PAHs (invertebrate intake)	60% 1,3-Dinitrobenzene (plant intake)	92% PAHs (invertebrate intake)	99% 4-Amino-2,6-DNT (invertebrate intake)	92% PAHs (invertebrate intake)	55% 1,3-DNB (plant intake)	93% 4-Amino-2,6-DNT (soil intake)
Surface Water HI	7.7	8.0	5.0	2.2	19	8.3	0.0049
Risk Drivers:	93% Aluminum (water intake)	95% Aluminum (water intake)	93% Aluminum (water intake)	41% Iron (water intake)	93% Aluminum (water intake)	93% Aluminum (water intake)	41% Iron (water intake)
Total Receptor HI	28	9.1	96	452	38	8.3	0.0062

[a] Details presented in eco risk assessment spreadsheets in Appendix M.
[b] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated COPEC via deep feeder roots.

Table 6-28

Aquatic Receptor Hazard Index (HI) Summary for West Area [a]
Red Water Ponds, PBOW, Sandusky, Ohio

Media	Aquatic Receptor	
	Great Blue Heron	Raccoon
Sediment HI	106	582
Risk Drivers:	33% 2-Amino-4,6-DNT (invertebrate intake)	58% Aluminum (sediment intake)
	24% Phosphorus (invertebrate intake)	11% Aluminum (invertebrate intake)
	13% Iron (sediment intake)	7.9% Calcium (invertebrate intake)
	10% Calcium (invertebrate intake)	5.3% Phosphorus (invertebrate intake)
Surface Water HI	618	83
Risk Drivers:	60% Iron (fish intake)	79% Aluminum (fish intake)
	24% Magnesium (fish intake)	10% Aluminum (water intake)
	8.8% Aluminum (fish intake)	5.4% Iron (water intake)
	4.2% Lead (fish intake)	
Total Receptor HI	724	665

[a]Details presented in eco risk assessment spreadsheets (Appendix M).

Table 6-29

Terrestrial Receptors Hazard Index (HI) Summary for Pentolite Road Area[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Media	Terrestrial Receptor						
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer	Hawk
Soil [b] HI	2.5	0.96	14	451	2.1	0.026	0.0011
Risk Drivers:	32% 1,3-DNB (invertebrate intake)	59% 1,3-DNB (plant intake)	45% Antimony (soil intake)	99% 4-Amino-2,6-DNT (invertebrate intake)	33% 1,3-DNB (invertebrate intake)	63% Nitrobenzene (plant intake)	60% 4-Amino-2,6-DNT (soil intake)
	19% 1,3-DNB (plant intake)	19% 1,3,5-TNB (plant intake)	26% 1,3-DNB (invertebrate intake)		18% 1,3-DNB (plant intake)		
Surface Water HI	1.6	1.7	1.1	0.32	4.0	1.8	0.0007
Risk Drivers:	96% Aluminum (water intake)	98% Aluminum (water intake)	96% Aluminum (water intake)	79% Iron (water intake)	96% Aluminum (water intake)	96% Aluminum (water intake)	79% Iron (water intake)
Total Receptor HI	4.1	2.7	15	451	6.1	1.8	0.0018

[a] Details presented in eco risk assessment spreadsheets in Appendix M.
[b] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated COPEC via deep feeder roots.

Table 6-30

Aquatic Receptor Hazard Index (HI) Summary for Pentolite Road Area[a] Red Water Ponds, PBOW, Sandusky, Ohio

Media	Aquatic Receptor	
	Great Blue Heron	Raccoon
Sediment HI	9.0	20
Risk Drivers:	48% Potassium (invertebrate intake)	57% Carbazole (invertebrate intake)
	41% Magnesium (sediment intake)	21% Potassium (invertebrate intake)
Surface Water HI	117	18
Risk Drivers:	86% Iron (fish intake)	92% Aluminum (fish intake)
	10% Aluminum (fish intake)	11% Aluminum (water intake)
Total Receptor HI	126	38

[a]Details presented in eco risk assessment spreadsheet (Appendix M).

Table 6-31

Uncertainty Analysis
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 1 of 2)

Component	Bias	Magnitude	Ways to Minimize Uncertainty
Use of 95% UCL as source-term concentration	Overestimates Risk	Medium	Use central tendency
Assumption that soil depth interval of 0-3 ft is representative of surface soil	Overestimates Risk	Low to Medium	Resample to obtain additional samples 0-0.5 ft. for surface soil characterization
Assumption that MDC for COPEC in surface water or sediment is representative	Overestimates Risk	Medium	Collect additional surface water or sediment samples for those COPEC with < 5 data points
Use of representative receptor species for site ecological community	Underestimates Risk	Low	Select additional receptor species
Use of average intake values and average body weights	Underestimates Risk	Low	Measure site-specific intake values and species' body weights
Use of conservative foraging factors (i.e., 100%) for all species, except deer and hawk	Overestimates Risk	Medium	Use site-specific foraging factors, i.e., less than 100%
Assumption that all COPEC are 100% bioavailable	Overestimates Risk	Medium to High	Obtain medium- and COPEC-specific bioavailability factors
Discounting of dermal and inhalation exposure routes	Underestimates Risk	Low	Include dermal and inhalation routes of exposure
Use of partitioning and transfer factors to estimate COPEC concentrations in plants, invertebrates, fish, other prey items, and sediment pore water	Overestimates Risk	Medium to High	Measure COPEC concentrations in site plants, invertebrates, fish, other prey species, and sediment pore water
Assumption that estimated pore water inorganic COPEC concentrations do not exceed representative nutrient solubilities	Overestimates or Underestimates Risk	Low	Select alternative nutrient compound solubilities (e.g., different than MgO, CaO, Al_2O_3, and $FeCO_3$)
Assumption that soil F_{oc} = 1%	Overestimates or Underestimates Risk	Un-known	Measure site-specific soil F_{oc}
Use of K_{ow} to estimate fish BCFs for organic COPEC	Overestimates Risk	Medium to High	Use alternative BCF estimation method (e.g., Bintein and Devillers, 1993)

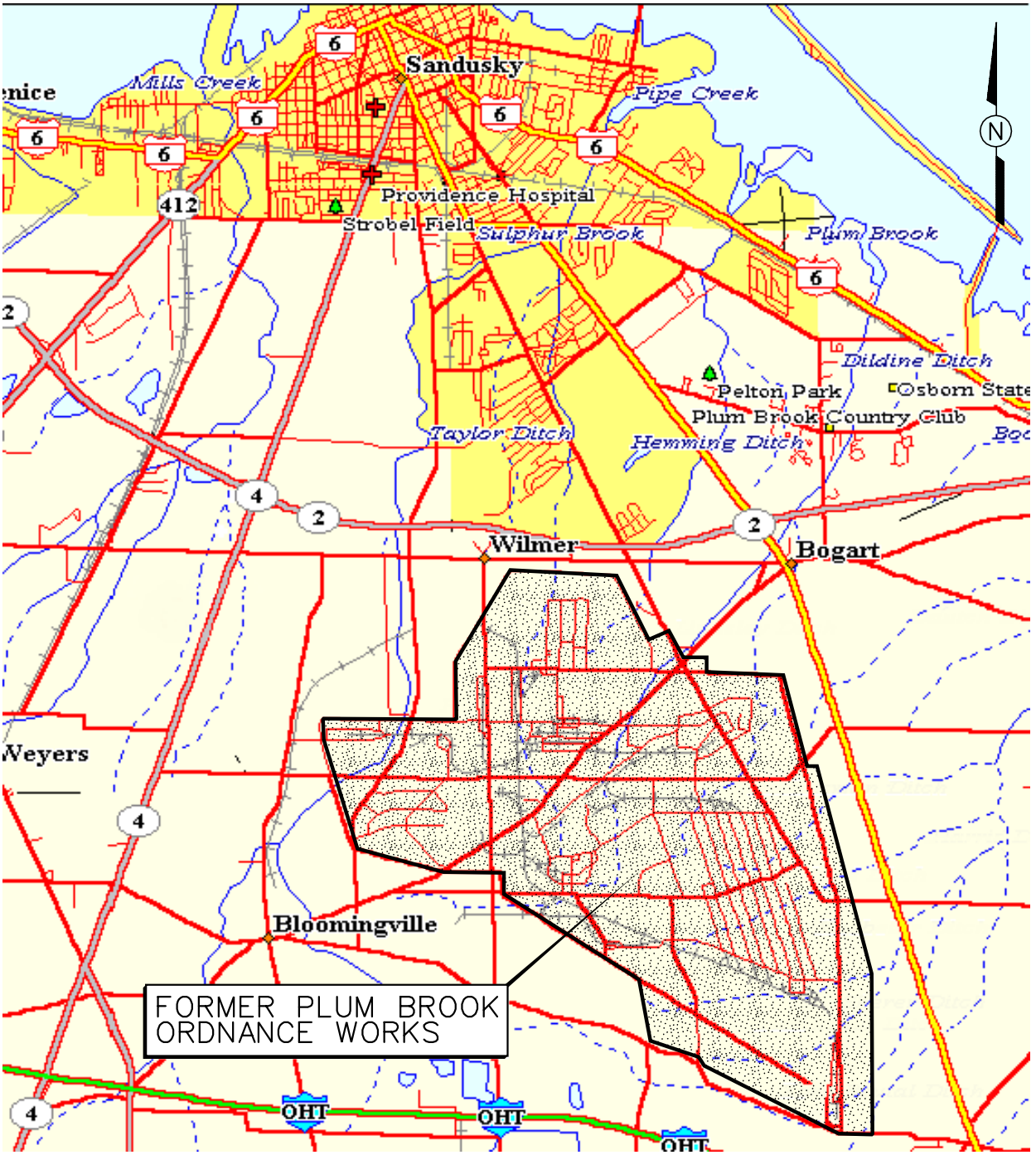
Table 6-31

Uncertainty Analysis
Red Water Ponds, PBOW, Sandusky, Ohio

(Page 2 of 2)

Component	Bias	Magnitude	Ways to Minimize Uncertainty
Assumption that surface-water-to-fish-tissue BCFs, and sediment-pore-water-to-benthic-macroinvertebrate BCFs, are linear	Overestimates Risk	Medium to High; for nutrients	Measure nutrient concentrations (i.e., iron, magnesium) in site fish and benthic macroinvertebrates, or perform literature search for alternative BCF values
Use of fish BCFs to represent sediment-pore-water-to-benthic-macroinvertebrate BCFs	Unknown	Un-known	Measure site-specific-pore-water-to-benthic-macroinvertebrate BCFs
Use of unfiltered surface water data and BCFs to estimate fish tissue concentrations	Overestimates Risk	Medium	Collect additional surface water samples that are representative of filtered surface water data
Use of safety factors to convert LOAEL and LD_{50} toxicity data to NOAELs	Overestimates Risk	Medium	Obtain COPEC-specific NOAEL data
Use of uncertainty factor of 8 to extrapolate RTVs between most species within the same class	Overestimates Risk	Medium	1) Assume RTVs similar for all species in the same genus, family, or order; or 2) obtain species-specific NOAEL data
Assumption that body weight scaling factor = 0 for all bird species' NOAEL toxicity data	Overestimates or Underestimates Risk	Low	Obtain species-specific NOAEL toxicity data
Use of surrogate constituents to estimate toxicity for those COPEC without available toxicity data	Overestimates Risk	Low to Medium	Obtain COPEC-specific toxicity data

FIGURES



NOT TO SCALE

FIGURE 1-1
VICINITY MAP

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 12/16/97	DATE LAST REV.: 10/30/01	DRAFT. CHCK. BY:	INITIATOR: D. KESSLER	DWG. NO.: \773701ES.001	
DRAWN BY: D. BILLINGSLEY	DRAWN BY: bvanderg	ENGR. CHCK. BY: D. KESSLER	PROJ. MGR.: M.SPANGBERG	PROJ. NO.: 773701	

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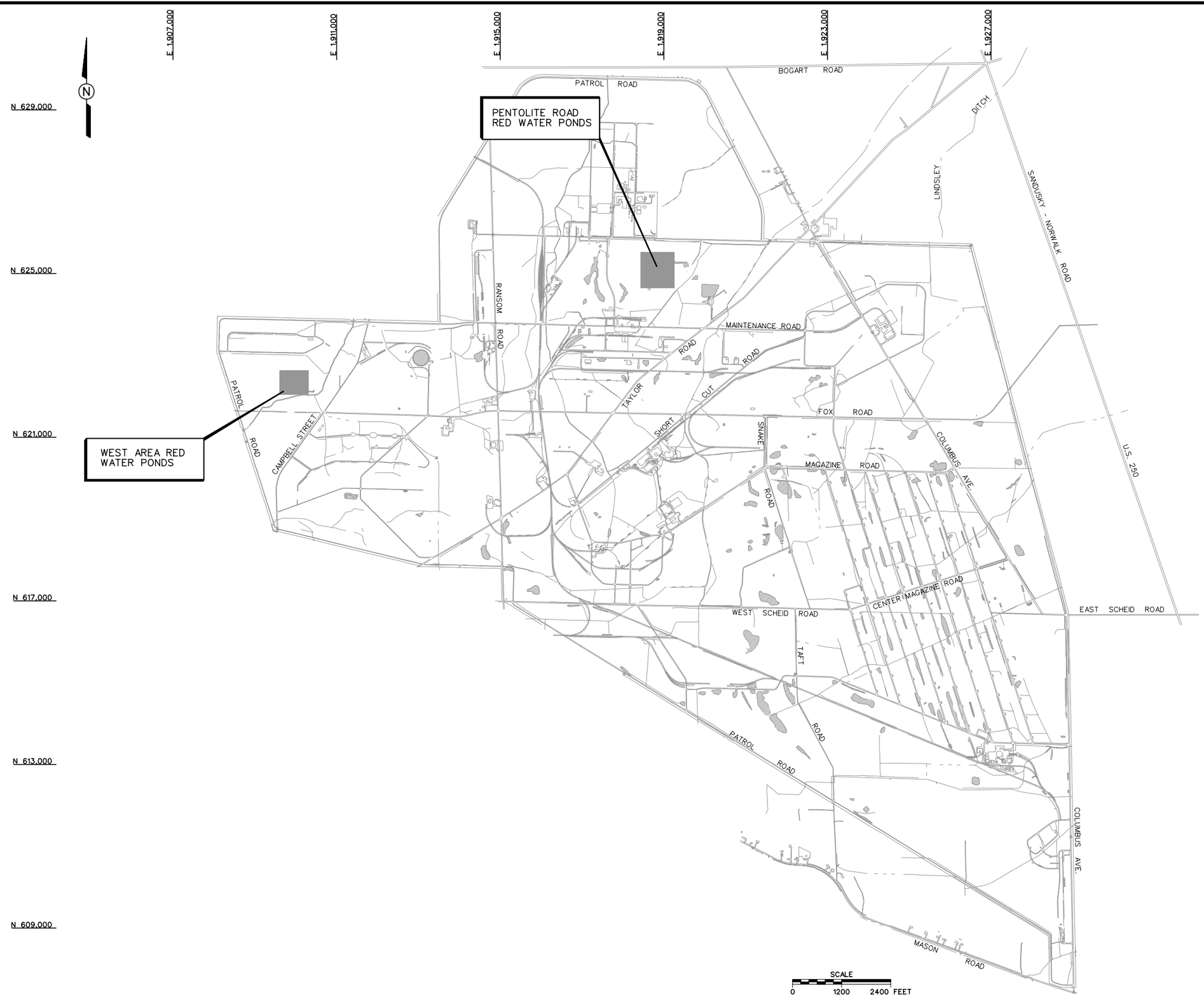

LEGEND:

- AREAS OF CONCERN
- BUILDINGS
- RAILROAD
- SURFACE WATER
- DITCH
- FENCE (PBOW BOUNDARY)

FIGURE 1-2
LOCATIONS OF AREAS OF CONCERN

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

DWG. NO.:..\773701es.010	INITIATOR: G.YU	DRAFT. CHCK. BY: D.HALL	DATE LAST REV.:
PROJ. NO.: 771481	PROJ. MGR.: SPANGBERG	ENGR. CHCK. BY: G.YU	DRAWN BY:
STARTING DATE: 9/3/98	DRAWN BY: D.HALL		
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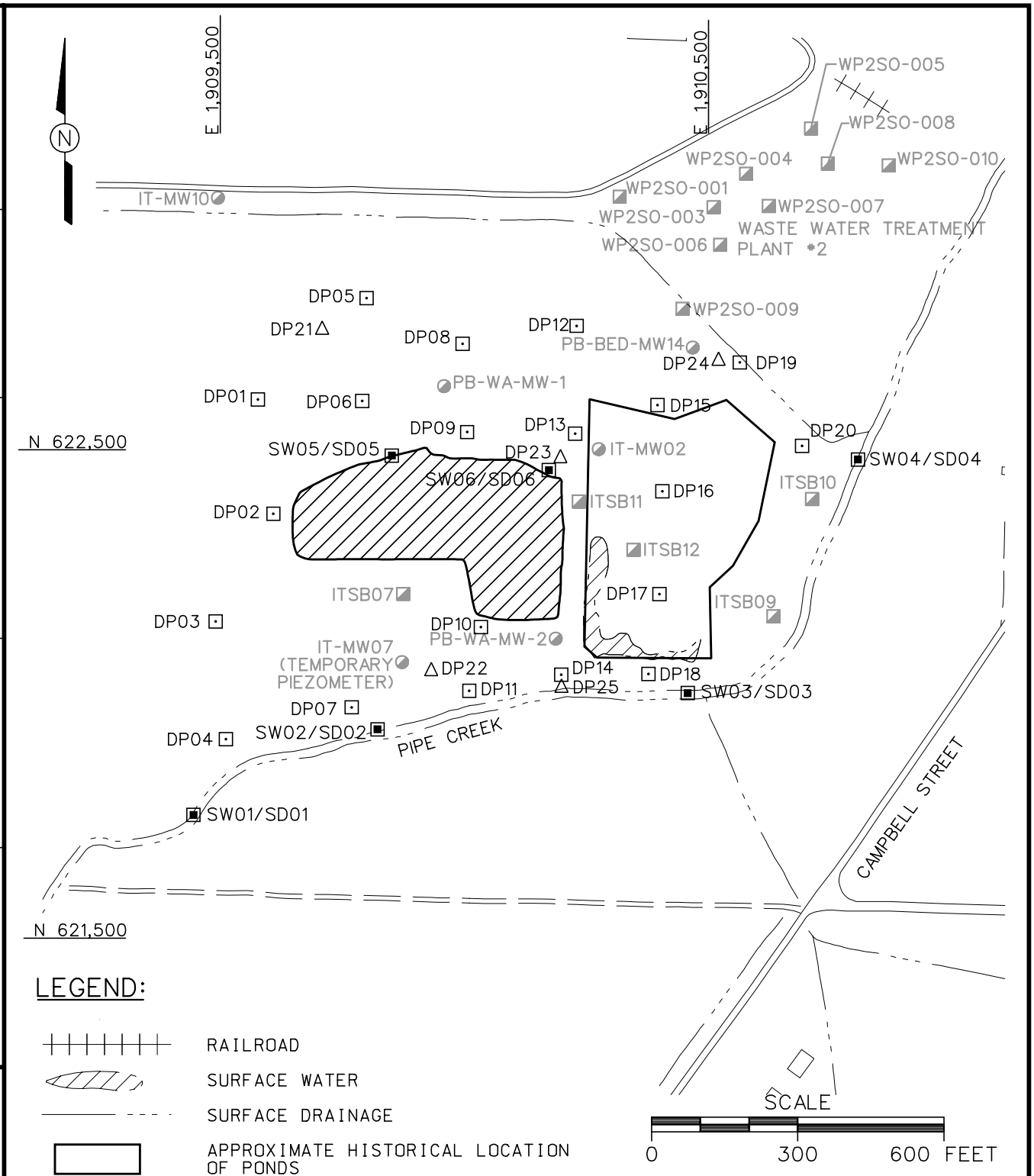

LEGEND:

	RAILROAD
	SURFACE WATER
	SURFACE DRAINAGE
	APPROXIMATE HISTORICAL LOCATION OF PONDS
IT-MW02	EXISTING MONITORING WELL LOCATION
WP2SO-010	EXISTING SOIL BORING LOCATION
DP01	DIRECT PUSH SAMPLE LOCATIONS
DP21	DIRECT PUSH GEOTECHNICAL LOCATIONS
SW01/SD01	SURFACE WATER/SEDIMENT SAMPLES
	UNPAVED ROADS/DRIVES
	PAVED ROADS

FIGURE 2-1
WEST AREA RED WATER PONDS SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 12/16/97	DATE LAST REV.:	DRAFT. CHCK. BY: C. TUMLIN	INITIATOR: D. KESSLER	DWG. NO.: \773701ES.011
DRAWN BY: D. BILLINGSLEY	DRAWN BY:	ENGR. CHCK. BY: R. ELLIS	PROJ. MGR.: SPANGBERG	PROJ. NO.: 773701

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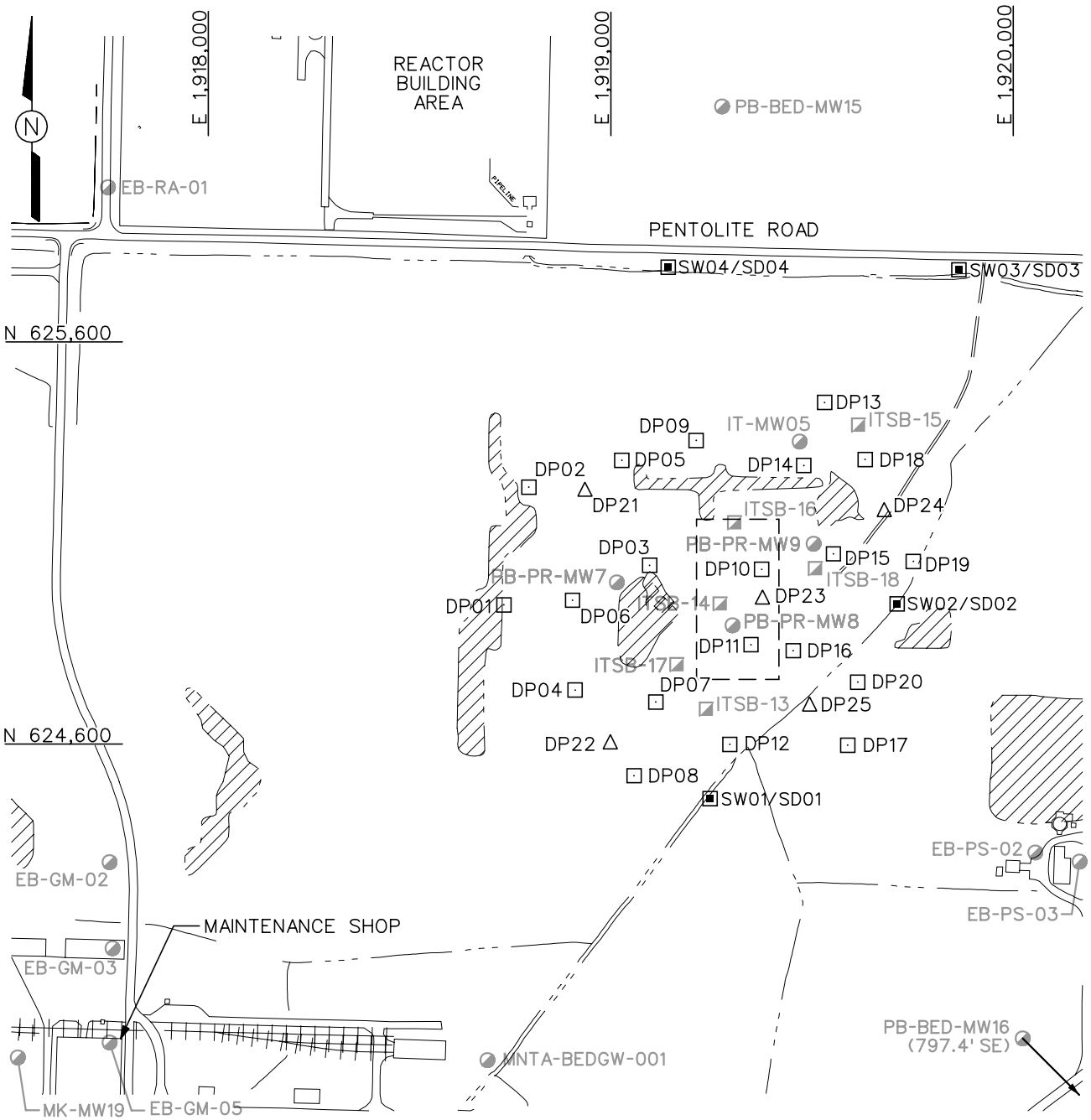

LEGEND:

	BUILDINGS
	RAILROAD
	SURFACE WATER
	SURFACE WATER DRAINAGE
	APPROXIMATE HISTORICAL LOCATION OF PONDS
	FENCE (PBOW BOUNDARY)
IT-MW02	EXISTING MONITORING WELL LOCATION
ITSB-13	EXISTING SOIL BORING LOCAITON
DP01	DIRECT PUSH SAMPLE LOCATIONS
DP21	DIRECT PUSH GEOTECHNICAL LOCATIONS
SW01/SD01	SURFACE WATER/SEDIMENT SAMPLES

SCALE

0 400 800 FEET

FIGURE 2-2
PENTOLITE ROAD RED WATER PONDS SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

DWG. NO.:\773701ES.012
PROJ. NO.: 773701
INITIATOR: D. KESSLER
PROJ. MGR.: SPANGBERG
DRAFT. CHCK. BY: C. TUMLIN
ENGR. CHCK. BY: R. ELLIS
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 12/16/97
DRAWN BY: D. BILLINGSLEY
01:19:32
04/22/02
BVANDERG
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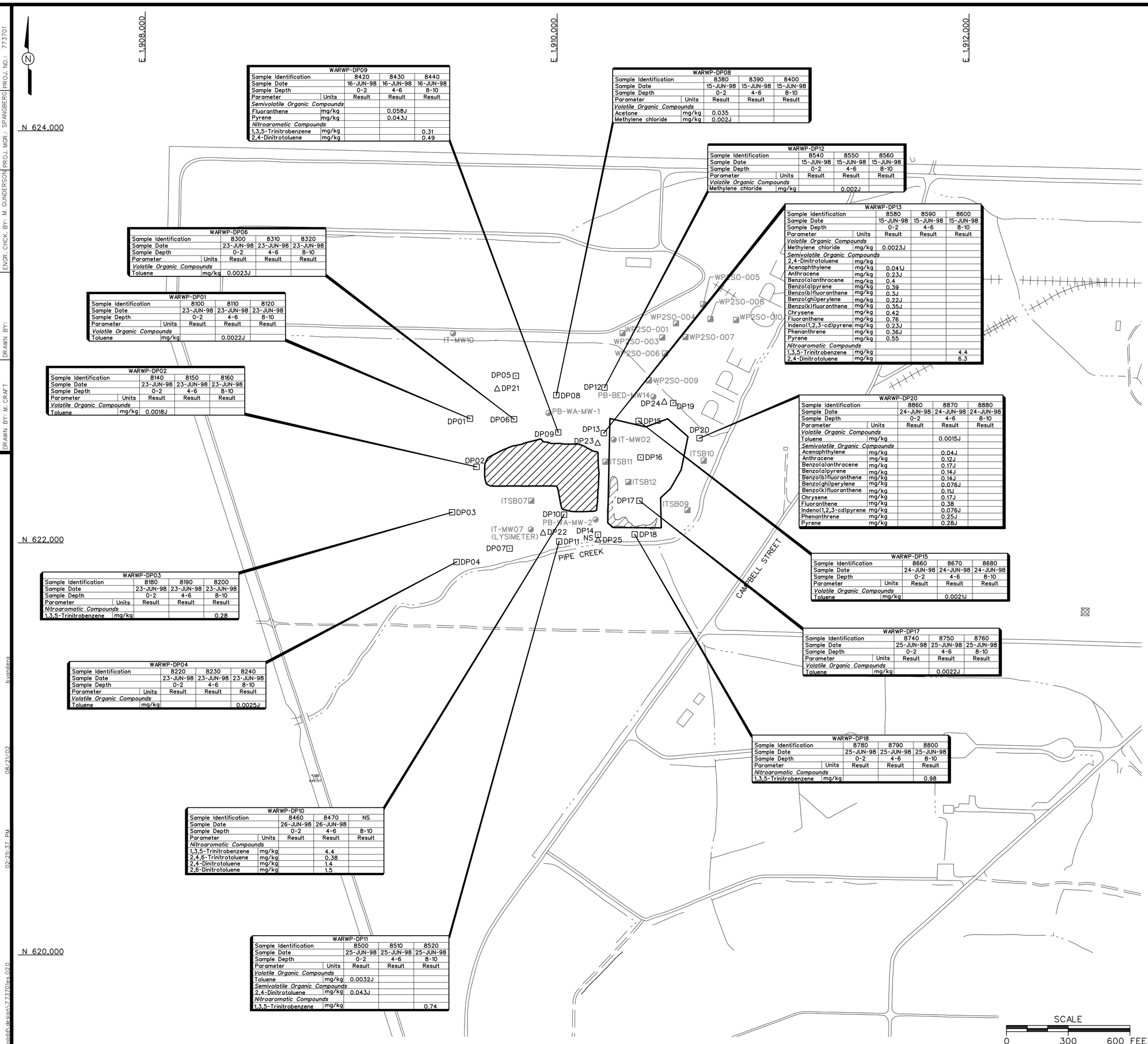

WARWP-DP09				
Sample Identification		8420	8430	8440
Sample Date		16-JUN-98	16-JUN-98	16-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Semivolatile Organic Compounds				
Fluoranthene	mg/kg		0.058J	
Pyrene	mg/kg		0.043J	
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			0.31
2,4-Dinitrotoluene	mg/kg			0.49

WARWP-DP08				
Sample Identification		8380	8390	8400
Sample Date		15-JUN-98	15-JUN-98	15-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Acetone	mg/kg	0.035		
Methylene chloride	mg/kg	0.002J		

WARWP-DP12				
Sample Identification		8540	8550	8560
Sample Date		15-JUN-98	15-JUN-98	15-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Methylene chloride	mg/kg		0.002J	

WARWP-DP06				
Sample Identification		8300	8310	8320
Sample Date		23-JUN-98	23-JUN-98	23-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg	0.0023J		

WARWP-DP01				
Sample Identification		8100	8110	8120
Sample Date		23-JUN-98	23-JUN-98	23-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg		0.0022J	

WARWP-DP02				
Sample Identification		8140	8150	8160
Sample Date		23-JUN-98	23-JUN-98	23-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg	0.0018J		

WARWP-DP13				
Sample Identification		8580	8590	8600
Sample Date		15-JUN-98	15-JUN-98	15-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Methylene chloride	mg/kg	0.0023J		
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg			
Acenaphthylene	mg/kg	0.041J		
Anthracene	mg/kg	0.23J		
Benzo(a)anthracene	mg/kg	0.4		
Benzo(a)pyrene	mg/kg	0.39		
Benzo(b)fluoranthene	mg/kg	0.3J		
Benzo(ghi)perylene	mg/kg	0.22J		
Benzo(k)fluoranthene	mg/kg	0.35J		
Chrysene	mg/kg	0.42		
Fluoranthene	mg/kg	0.76		
Indeno(1,2,3-cd)pyrene	mg/kg	0.23J		
Phenanthrene	mg/kg	0.36J		
Pyrene	mg/kg	0.55		
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			4.4
2,4-Dinitrotoluene	mg/kg			6.3

WARWP-DP20				
Sample Identification		8860	8870	8880
Sample Date		24-JUN-98	24-JUN-98	24-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg		0.0015J	
Semivolatile Organic Compounds				
Acenaphthylene	mg/kg		0.04J	
Anthracene	mg/kg		0.12J	
Benzo(a)anthracene	mg/kg		0.17J	
Benzo(a)pyrene	mg/kg		0.14J	
Benzo(b)fluoranthene	mg/kg		0.14J	
Benzo(ghi)perylene	mg/kg		0.076J	
Benzo(k)fluoranthene	mg/kg		0.11J	
Chrysene	mg/kg		0.17J	
Fluoranthene	mg/kg		0.38	
Indeno(1,2,3-cd)pyrene	mg/kg		0.076J	
Phenanthrene	mg/kg		0.25J	
Pyrene	mg/kg		0.28J	

WARWP-DP15				
Sample Identification		8660	8670	8680
Sample Date		24-JUN-98	24-JUN-98	24-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg		0.0021J	

WARWP-DP03				
Sample Identification		8180	8190	8200
Sample Date		23-JUN-98	23-JUN-98	23-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			0.28

WARWP-DP17				
Sample Identification		8740	8750	8760
Sample Date		25-JUN-98	25-JUN-98	25-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg		0.0022J	

WARWP-DP04				
Sample Identification		8220	8230	8240
Sample Date		23-JUN-98	23-JUN-98	23-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg			0.0025J

WARWP-DP18				
Sample Identification		8780	8790	8800
Sample Date		25-JUN-98	25-JUN-98	25-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			0.98

WARWP-DP10				
Sample Identification		8460	8470	NS
Sample Date		26-JUN-98	26-JUN-98	
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg		4.4	
2,4,6-Trinitrotoluene	mg/kg		0.38	
2,4-Dinitrotoluene	mg/kg		1.4	
2,6-Dinitrotoluene	mg/kg		1.5	

WARWP-DP11				
Sample Identification		8500	8510	8520
Sample Date		25-JUN-98	25-JUN-98	25-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg	0.0032J		
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg	0.043J		
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			0.74

LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- IT-MW02 — EXISTING MONITORING WELL LOCATION
- WP2SO-010 — EXISTING SOIL BORING LOCATION
- DP01 — DIRECT PUSH SAMPLE LOCATIONS
- NS — NOT SAMPLED
- DP21 — DIRECT PUSH GEOTECHNICAL LOCATIONS
- UNPAVED ROADS/DRIVES
- PAVED ROADS

SCALE
0 300 600 FEET

FIGURE 4-1
DETECTED ORGANIC CONSTITUENTS IN SOIL, WEST AREA RED WATER PONDS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 3/2/99 | DATE LAST REV.: | DRAFT. CHCK. BY: | INITIATOR: M. GUNDERSON | DWG. NO.: 773701es.020
DRAWN BY: M. CRAFT | DRAWN BY: | ENGR. CHCK. BY: M. GUNDERSON | PROJ. MGR.: SPANGBERG | PROJ. NO.: 773701

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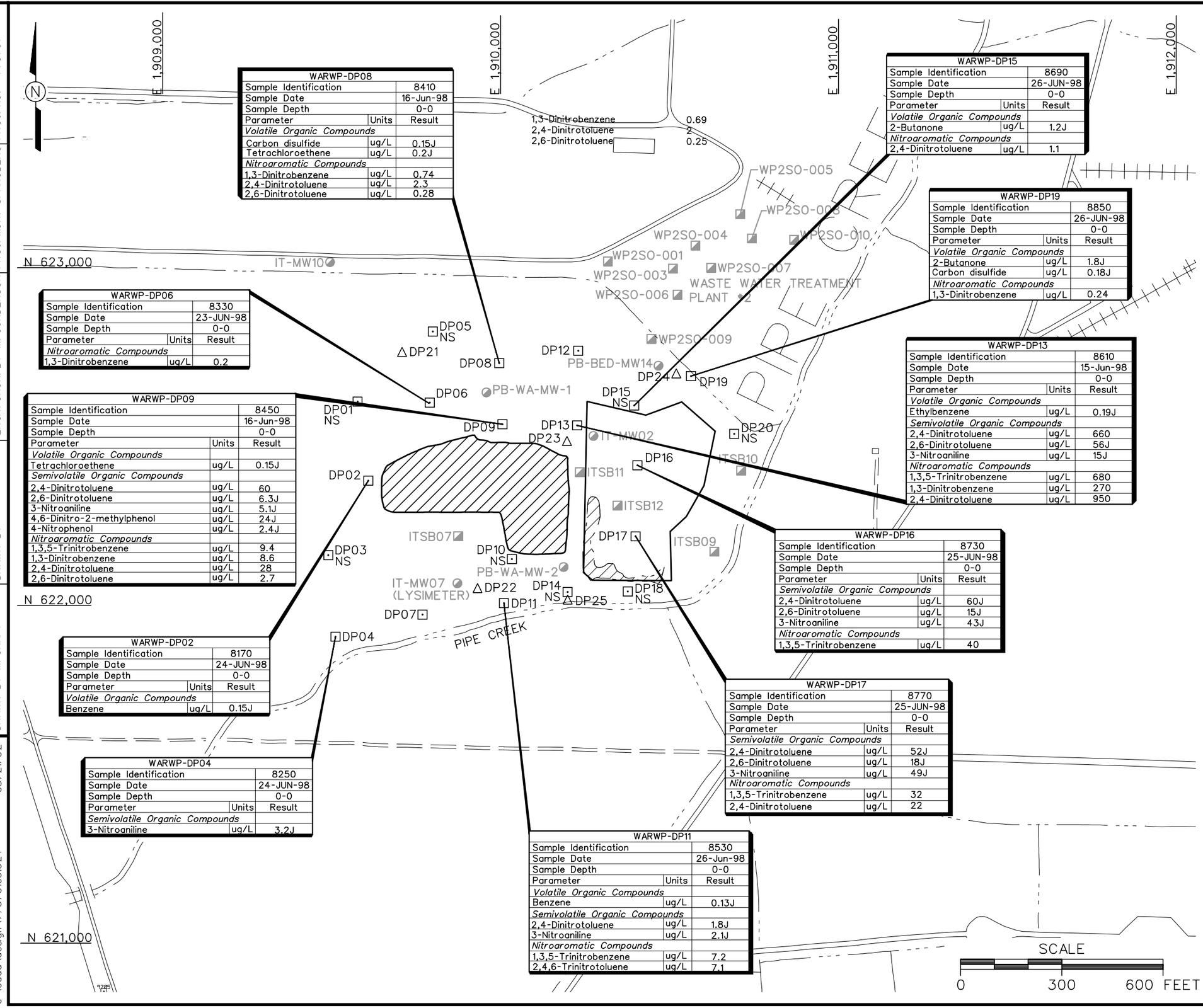

WARWP-DP08		
Sample Identification		8410
Sample Date		16-Jun-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Carbon disulfide	ug/L	0.15J
Tetrachloroethene	ug/L	0.2J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	0.74
2,4-Dinitrotoluene	ug/L	2.3
2,6-Dinitrotoluene	ug/L	0.28

WARWP-DP15		
Sample Identification		8690
Sample Date		26-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
2-Butanone	ug/L	1.2J
Nitroaromatic Compounds		
2,4-Dinitrotoluene	ug/L	1.1

WARWP-DP19		
Sample Identification		8850
Sample Date		26-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
2-Butanone	ug/L	1.8J
Carbon disulfide	ug/L	0.18J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	0.24

WARWP-DP06		
Sample Identification		8330
Sample Date		23-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	0.2

WARWP-DP13		
Sample Identification		8610
Sample Date		15-Jun-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Ethylbenzene	ug/L	0.19J
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	660
2,6-Dinitrotoluene	ug/L	56J
3-Nitroaniline	ug/L	15J
Nitroaromatic Compounds		
1,3,5-Trinitrobenzene	ug/L	680
1,3-Dinitrobenzene	ug/L	270
2,4-Dinitrotoluene	ug/L	950

WARWP-DP09		
Sample Identification		8450
Sample Date		16-Jun-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Tetrachloroethene	ug/L	0.15J
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	60
2,6-Dinitrotoluene	ug/L	6.3J
3-Nitroaniline	ug/L	5.1J
4,6-Dinitro-2-methylphenol	ug/L	24J
4-Nitrophenol	ug/L	2.4J
Nitroaromatic Compounds		
1,3,5-Trinitrobenzene	ug/L	9.4
1,3-Dinitrobenzene	ug/L	8.6
2,4-Dinitrotoluene	ug/L	28
2,6-Dinitrotoluene	ug/L	2.7

WARWP-DP16		
Sample Identification		8730
Sample Date		25-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	60J
2,6-Dinitrotoluene	ug/L	15J
3-Nitroaniline	ug/L	43J
Nitroaromatic Compounds		
1,3,5-Trinitrobenzene	ug/L	40

WARWP-DP02		
Sample Identification		8170
Sample Date		24-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Benzene	ug/L	0.15J

WARWP-DP17		
Sample Identification		8770
Sample Date		25-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	52J
2,6-Dinitrotoluene	ug/L	18J
3-Nitroaniline	ug/L	49J
Nitroaromatic Compounds		
1,3,5-Trinitrobenzene	ug/L	32
2,4-Dinitrotoluene	ug/L	22

WARWP-DP04		
Sample Identification		8250
Sample Date		24-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
3-Nitroaniline	ug/L	3.2J

WARWP-DP11		
Sample Identification		8530
Sample Date		26-Jun-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Benzene	ug/L	0.13J
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	1.8J
3-Nitroaniline	ug/L	2.1J
Nitroaromatic Compounds		
1,3,5-Trinitrobenzene	ug/L	7.2
2,4,6-Trinitrotoluene	ug/L	7.1

LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- IT-MW02 — EXISTING MONITORING WELL LOCATION
- WP2SO-010 — EXISTING SOIL BORING LOCATION
- DP01 — DIRECT PUSH SAMPLE LOCATIONS
- NS — NOT SAMPLED
- DP21 — DIRECT PUSH GEOTECHNICAL LOCATIONS
- UNPAVED ROADS/DRIVES
- PAVED ROADS

SCALE
0 300 600 FEET

FIGURE 4-2
DETECTED ORGANIC CONSTITUENTS IN GROUNDWATER, WEST AREA RED WATER PONDS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

DWG. NO.: \773701es.024 | PROJ. NO.: 773701
INITIATOR: M. GUNDERSON | PROJ. MGR.: SPANGBERG
DRAFT. CHCK. BY: | ENGR. CHCK. BY: M. GUNDERSON
DATE LAST REV.: | DRAWN BY:
STARTING DATE: 3/3/99 | DRAWN BY: M. CRAFT
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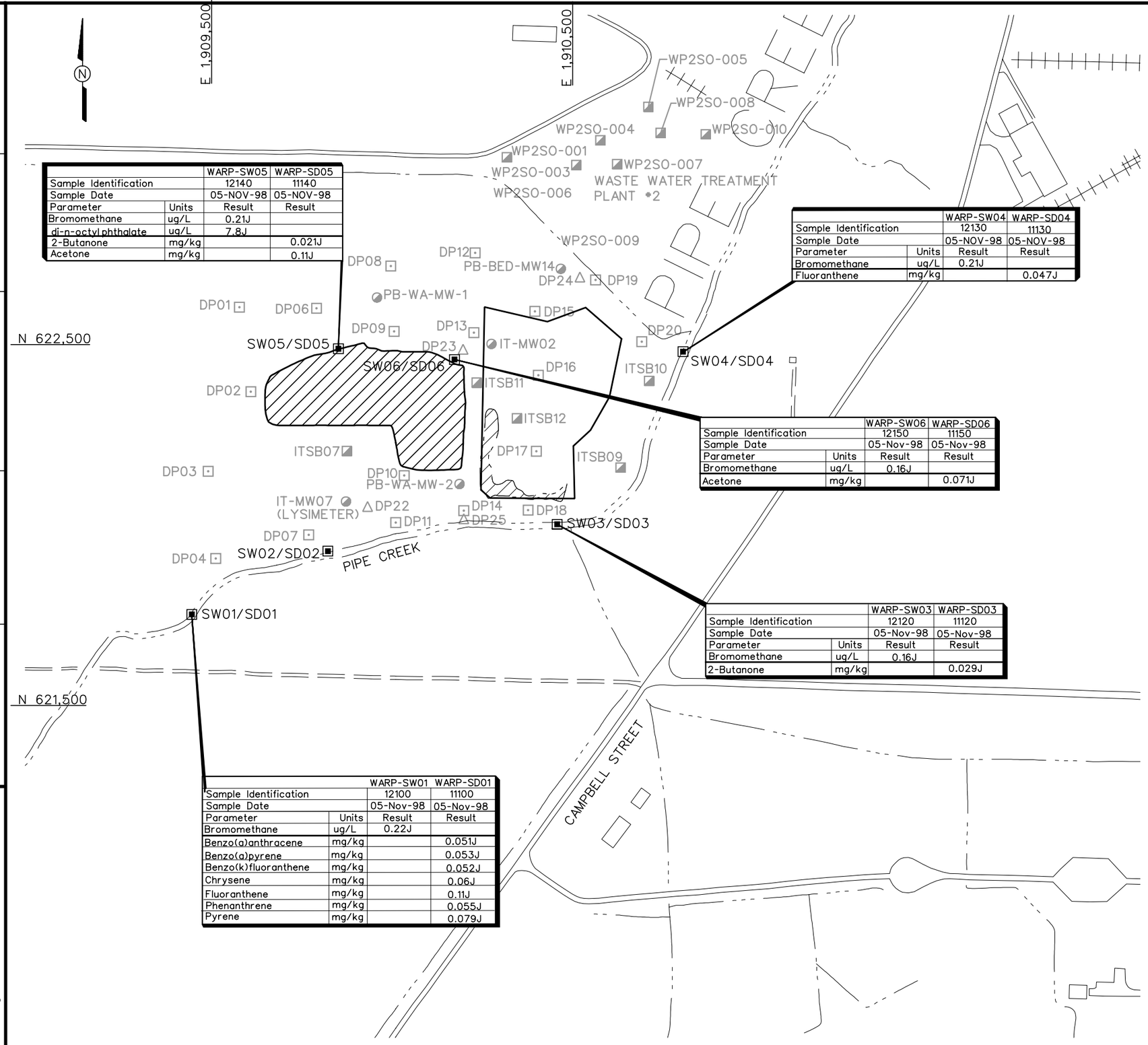

		WARP-SW05	WARP-SD05
Sample Identification		12140	11140
Sample Date		05-NOV-98	05-NOV-98
Parameter	Units	Result	Result
Bromomethane	ug/L	0.21J	
di-n-octylphthalate	ug/L	7.8J	
2-Butanone	mg/kg		0.021J
Acetone	mg/kg		0.11J

		WARP-SW04	WARP-SD04
Sample Identification		12130	11130
Sample Date		05-NOV-98	05-NOV-98
Parameter	Units	Result	Result
Bromomethane	ug/L	0.21J	
Fluoranthene	mg/kg		0.047J

		WARP-SW06	WARP-SD06
Sample Identification		12150	11150
Sample Date		05-Nov-98	05-Nov-98
Parameter	Units	Result	Result
Bromomethane	ug/L	0.16J	
Acetone	mg/kg		0.071J

		WARP-SW03	WARP-SD03
Sample Identification		12120	11120
Sample Date		05-Nov-98	05-Nov-98
Parameter	Units	Result	Result
Bromomethane	ug/L	0.16J	
2-Butanone	mg/kg		0.029J

		WARP-SW01	WARP-SD01
Sample Identification		12100	11100
Sample Date		05-Nov-98	05-Nov-98
Parameter	Units	Result	Result
Bromomethane	ug/L	0.22J	
Benzo(a)anthracene	mg/kg		0.051J
Benzo(a)pyrene	mg/kg		0.053J
Benzo(k)fluoranthene	mg/kg		0.052J
Chrysene	mg/kg		0.06J
Fluoranthene	mg/kg		0.11J
Phenanthrene	mg/kg		0.055J
Pyrene	mg/kg		0.079J

LEGEND:

- RAILROAD
- SURFACE WATER
- SURFACE DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- IT-MW02 — EXISTING MONITORING WELL LOCATION
- WP2SO-010 — EXISTING SOIL BORING LOCATION
- DP01 — DIRECT PUSH SAMPLE LOCATIONS
- DP21 — DIRECT PUSH GEOTECHNICAL LOCATIONS
- SW01/SD01 — SURFACE WATER/SEDIMENT SAMPLES
- UNPAVED ROADS/DRIVES
- PAVED ROADS

SCALE

0 300 600 FEET

FIGURE 4-3
DETECTED ORGANIC CONSTITUENTS IN SW/SD SAMPLES WEST AREA RED WATER PONDS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 3/5/99	DRAWN BY: P. COLEMAN	DRAFT. CHCK. BY: C. TUMLIN	INITIATOR: D. KESSLER
DATE LAST REV.:	DRAWN BY:	ENGR. CHCK. BY: R. ELLIS	PROJ. MGR.: SPANGBERG
			PROJ. NO.: 773701
			DWG. NO.:\773701es.025

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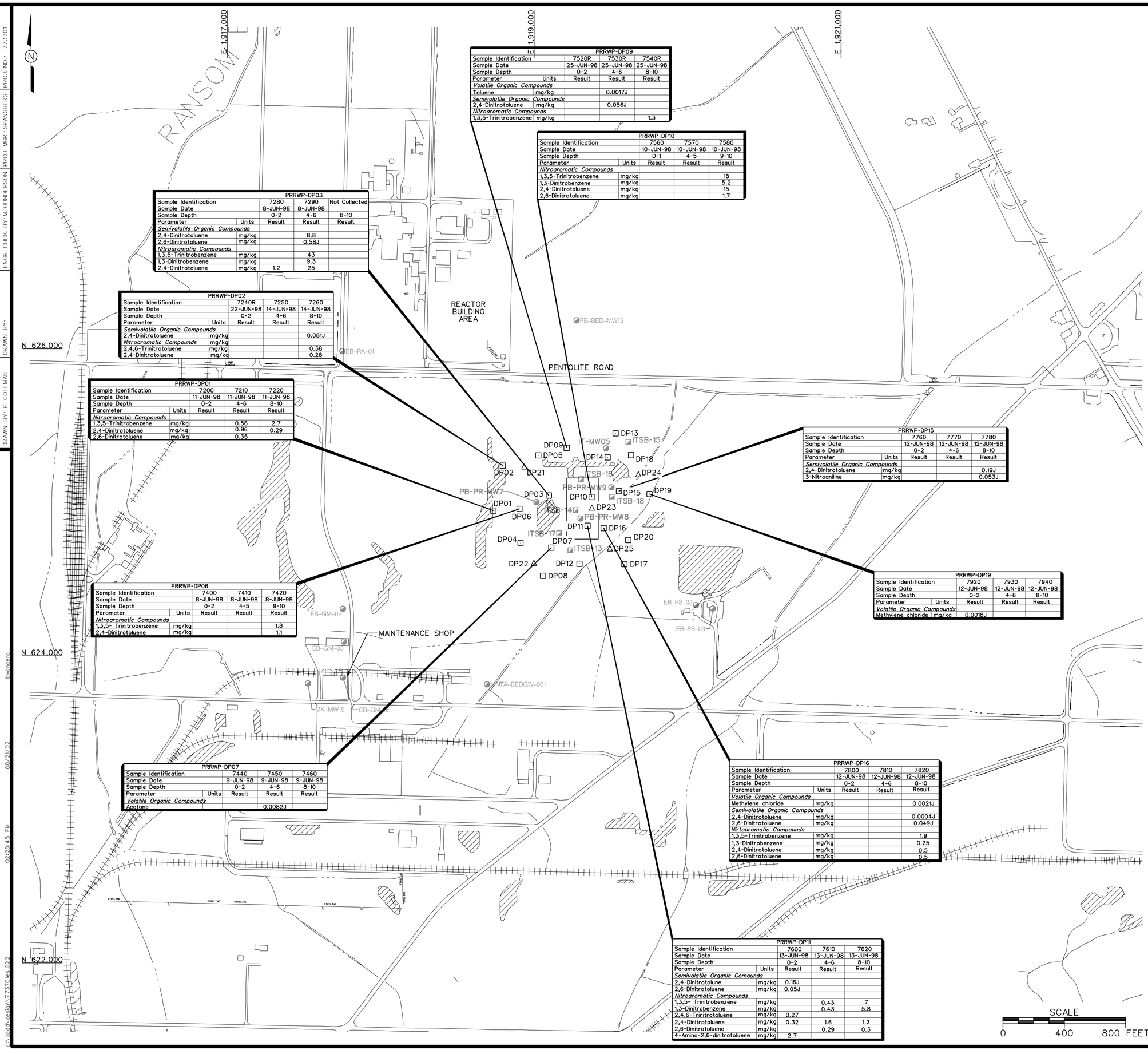

PRRWP-DP09				
Sample Identification		7520R	7530R	7540R
Sample Date		25-JUN-98	25-JUN-98	25-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Toluene	mg/kg		0.0017J	
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg		0.056J	
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			1.3

PRRWP-DP10				
Sample Identification		7560	7570	7580
Sample Date		10-JUN-98	10-JUN-98	10-JUN-98
Sample Depth		0-1	4-5	9-10
Parameter	Units	Result	Result	Result
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			18
1,3-Dinitrobenzene	mg/kg			5.2
2,4-Dinitrotoluene	mg/kg			15
2,6-Dinitrotoluene	mg/kg			1.7

PRRWP-DP03				
Sample Identification		7280	7290	Not Collected
Sample Date		8-JUN-98	8-JUN-98	
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg		8.8	
2,6-Dinitrotoluene	mg/kg		0.58J	
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg		43	
1,3-Dinitrobenzene	mg/kg		9.3	
2,4-Dinitrotoluene	mg/kg	1.2	25	

PRRWP-DP02				
Sample Identification		7240R	7250	7260
Sample Date		22-JUN-98	14-JUN-98	14-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg			0.081J
Nitroaromatic Compounds	mg/kg			
2,4,6-Trinitrotoluene	mg/kg			0.38
2,4-Dinitrotoluene	mg/kg			0.28

PRRWP-DP01				
Sample Identification		7200	7210	7220
Sample Date		11-JUN-98	11-JUN-98	11-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Nitroaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg		0.56	2.7
2,4-Dinitrotoluene	mg/kg		0.96	0.29
2,6-Dinitrotoluene	mg/kg		0.35	

PRRWP-DP15				
Sample Identification		7760	7770	7780
Sample Date		12-JUN-98	12-JUN-98	12-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg			0.19J
3-Nitroaniline	mg/kg			0.053J

PRRWP-DP19				
Sample Identification		7920	7930	7940
Sample Date		12-JUN-98	12-JUN-98	12-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Methylene chloride	mg/kg	0.0018J		

PRRWP-DP06				
Sample Identification		7400	7410	7420
Sample Date		8-JUN-98	8-JUN-98	8-JUN-98
Sample Depth		0-2	4-5	9-10
Parameter	Units	Result	Result	Result
Nitroaromatic Compounds				
1,3,5- Trinitrobenzene	mg/kg			1.8
2,4-Dinitrotoluene	mg/kg			1.1

PRRWP-DP07				
Sample Identification		7440	7450	7460
Sample Date		9-JUN-98	9-JUN-98	9-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Acetone			0.0082J	

PRRWP-DP16				
Sample Identification		7800	7810	7820
Sample Date		12-JUN-98	12-JUN-98	12-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Volatile Organic Compounds				
Methylene chloride	mg/kg			0.0021J
Semivolatile Organic Compounds				
2,4-Dinitrotoluene	mg/kg			0.0004J
2,6-Dinitrotoluene	mg/kg			0.049J
Nirtoaromatic Compounds				
1,3,5-Trinitrobenzene	mg/kg			1.9
1,3-Dinitrobenzene	mg/kg			0.25
2,4-Dinitrotoluene	mg/kg			0.5
2,6-Dinitrotoluene	mg/kg			0.5

PRRWP-DP11				
Sample Identification		7600	7610	7620
Sample Date		13-JUN-98	13-JUN-98	13-JUN-98
Sample Depth		0-2	4-6	8-10
Parameter	Units	Result	Result	Result
Semivolatile Organic Comounds				
2,4-Dinitrotolune	mg/kg	0.16J		
2,6-Dinitrotoluene	mg/kg	0.05J		
Nitroaromatic Compounds				
1,3,5- Trinitrobenzene	mg/kg		0.43	7
1,3-Dinitrobenzene	mg/kg		0.43	5.8
2,4,6-Trinitrotoluene	mg/kg	0.27		
2,4-Dinitrotoluene	mg/kg	0.32	1.6	1.2
2,6-Dinitrotoluene	mg/kg		0.29	0.3
4-Amino-2,6-dinitrotoluene	mg/kg	2.7		

LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE WATER DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- FENCE (PBOW BOUNDARY)
- IT-MW02 — EXISTING MONITORING WELL LOCATION
- ITSB-13 — EXISTING SOIL BORING LOCAITON
- DP01 — DIRECT PUSH SAMPLE LOCATIONS
- DP21 — DIRECT PUSH GEOTECHNICAL LOCATIONS
- NS — NOT SAMPLED

SCALE
0 400 800 FEET

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 4-4
DETECTED ORGANIC CONSTITUENTS IN SOIL, PENTOLITE ROAD RED WATER PONDS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

STARTING DATE: 3/3/99 | DATE LAST REV.: | DRAFT. CHCK. BY: | INITIATOR:M. GUNDERSON | DWG. NO.: 773701es.022
DRAWN BY: P. COLEMAN | DRAWN BY: | ENGR. CHCK. BY:M. GUNDERSON | PROJ. MGR.:SPANGBERG | PROJ. NO.: 773701

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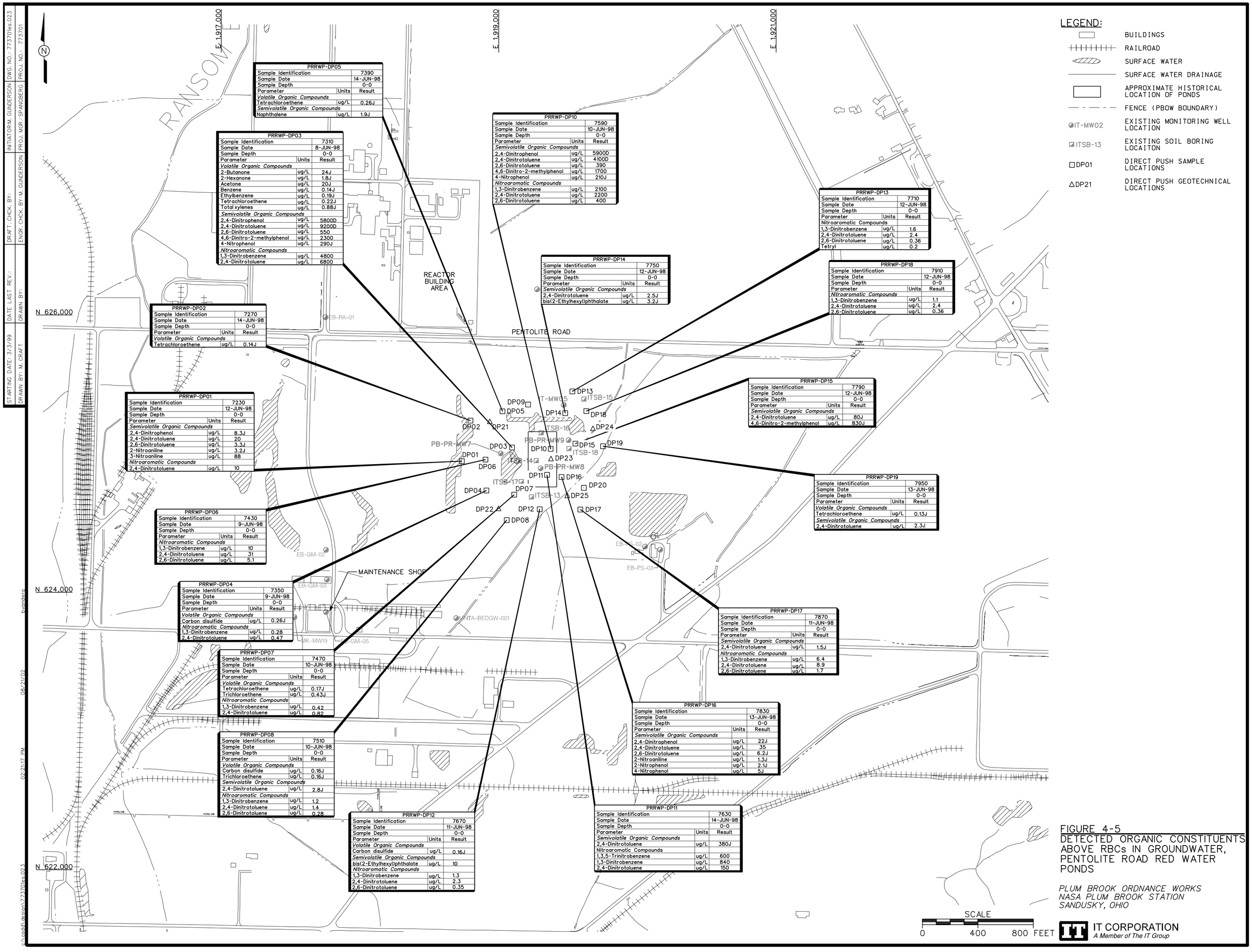

PRRWP-DP05		
Sample Identification		7390
Sample Date		14-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Tetrachloroethene	ug/L	0.26J
Semivolatile Organic Compounds		
Naphthalene	ug/L	1.9J

PRRWP-DP03		
Sample Identification		7310
Sample Date		8-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
2-Butanone	ug/L	24J
2-Hexanone	ug/L	1.8J
Acetone	ug/L	20J
Benzene	ug/L	0.14J
Ethylbenzene	ug/L	0.19J
Tetrachloroethene	ug/L	0.22J
Total xylenes	ug/L	0.88J
Semivolatile Organic Compounds		
2,4-Dinitrophenol	ug/L	5800D
2,4-Dinitrotoluene	ug/L	9200D
2,6-Dinitrotoluene	ug/L	550
4,6-Dinitro-2-methylphenol	ug/L	230D
4-Nitrophenol	ug/L	290J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	4800
2,4-Dinitrotoluene	ug/L	6800

PRRWP-DP02		
Sample Identification		7270
Sample Date		14-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Tetrachloroethene	ug/L	0.14J

PRRWP-DP01		
Sample Identification		7230
Sample Date		12-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrophenol	ug/L	8.3J
2,4-Dinitrotoluene	ug/L	20
2,6-Dinitrotoluene	ug/L	3.3J
2-Nitroaniline	ug/L	3.2J
3-Nitroaniline	ug/L	88
Nitroaromatic Compounds		
2,4-Dinitrotoluene	ug/L	10

PRRWP-DP06		
Sample Identification		7430
Sample Date		9-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	10
2,4-Dinitrotoluene	ug/L	31
2,6-Dinitrotoluene	ug/L	5.1

PRRWP-DP04		
Sample Identification		7350
Sample Date		9-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Carbon disulfide	ug/L	0.26J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	0.28
2,4-Dinitrotoluene	ug/L	0.47

PRRWP-DP07		
Sample Identification		7470
Sample Date		10-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Tetrachloroethene	ug/L	0.17J
Trichloroethene	ug/L	0.43J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	0.42
2,4-Dinitrotoluene	ug/L	0.82

PRRWP-DP08		
Sample Identification		7510
Sample Date		10-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Carbon disulfide	ug/L	0.16J
Trichloroethene	ug/L	0.16J
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	2.8J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	1.2
2,4-Dinitrotoluene	ug/L	1.4
2,6-Dinitrotoluene	ug/L	0.28

PRRWP-DP12		
Sample Identification		7670
Sample Date		11-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Carbon disulfide	ug/L	0.16J
Semivolatile Organic Compounds		
bis(2-Ethylhexyl)phthalate	ug/L	10
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	1.3
2,4-Dinitrotoluene	ug/L	2.3
2,6-Dinitrotoluene	ug/L	0.35

PRRWP-DP10		
Sample Identification		7590
Sample Date		10-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrophenol	ug/L	5900D
2,4-Dinitrotoluene	ug/L	4100D
2,6-Dinitrotoluene	ug/L	390
4,6-Dinitro-2-methylphenol	ug/L	1700
4-Nitrophenol	ug/L	210J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	2100
2,4-Dinitrotoluene	ug/L	2200
2,6-Dinitrotoluene	ug/L	400

PRRWP-DP14		
Sample Identification		7750
Sample Date		12-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	2.5J
bis(2-Ethylhexyl)phthalate	ug/L	3.2J

PRRWP-DP13		
Sample Identification		7710
Sample Date		12-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	1.6
2,4-Dinitrotoluene	ug/L	2.4
2,6-Dinitrotoluene	ug/L	0.36
Tetryl	ug/L	0.2

PRRWP-DP18		
Sample Identification		7910
Sample Date		12-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	1.1
2,4-Dinitrotoluene	ug/L	2.4
2,6-Dinitrotoluene	ug/L	0.36

PRRWP-DP15		
Sample Identification		7790
Sample Date		12-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	80J
4,6-Dinitro-2-methylphenol	ug/L	830J

PRRWP-DP19		
Sample Identification		7950
Sample Date		13-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Volatile Organic Compounds		
Tetrachloroethene	ug/L	0.13J
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	2.3J

PRRWP-DP17		
Sample Identification		7870
Sample Date		11-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	1.5J
Nitroaromatic Compounds		
1,3-Dinitrobenzene	ug/L	6.4
2,4-Dinitrotoluene	ug/L	8.9
2,6-Dinitrotoluene	ug/L	1.7

PRRWP-DP16		
Sample Identification		7830
Sample Date		13-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrophenol	ug/L	22J
2,4-Dinitrotoluene	ug/L	35
2,6-Dinitrotoluene	ug/L	6.2J
2-Nitroaniline	ug/L	1.3J
2-Nitrophenol	ug/L	2.1J
4-Nitrophenol	ug/L	5J

PRRWP-DP11		
Sample Identification		7630
Sample Date		14-JUN-98
Sample Depth		0-0
Parameter	Units	Result
Semivolatile Organic Compounds		
2,4-Dinitrotoluene	ug/L	380J
Nitroaromatic Compounds		
1,3,5-Trinitrobenzene	ug/L	600
1,3-Dinitrobenzene	ug/L	840
2,4-Dinitrotoluene	ug/L	150

FIGURE 4-5
DETECTED ORGANIC CONSTITUENTS ABOVE RBCs IN GROUNDWATER, PENTOLITE ROAD RED WATER PONDS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 3/3/99 | DATE LAST REV.: | DRAFT. CHCK. BY: | INITIATOR:M. GUNDERSON | DWG. NO.: 773701es.023
DRAWN BY: M. CRAFT | DRAWN BY: | ENGR. CHCK. BY:M. GUNDERSON | PROJ. MGR.:SPANGBERG | PROJ. NO.: 773701

08/21/02 02:21:17 PM bvandsen
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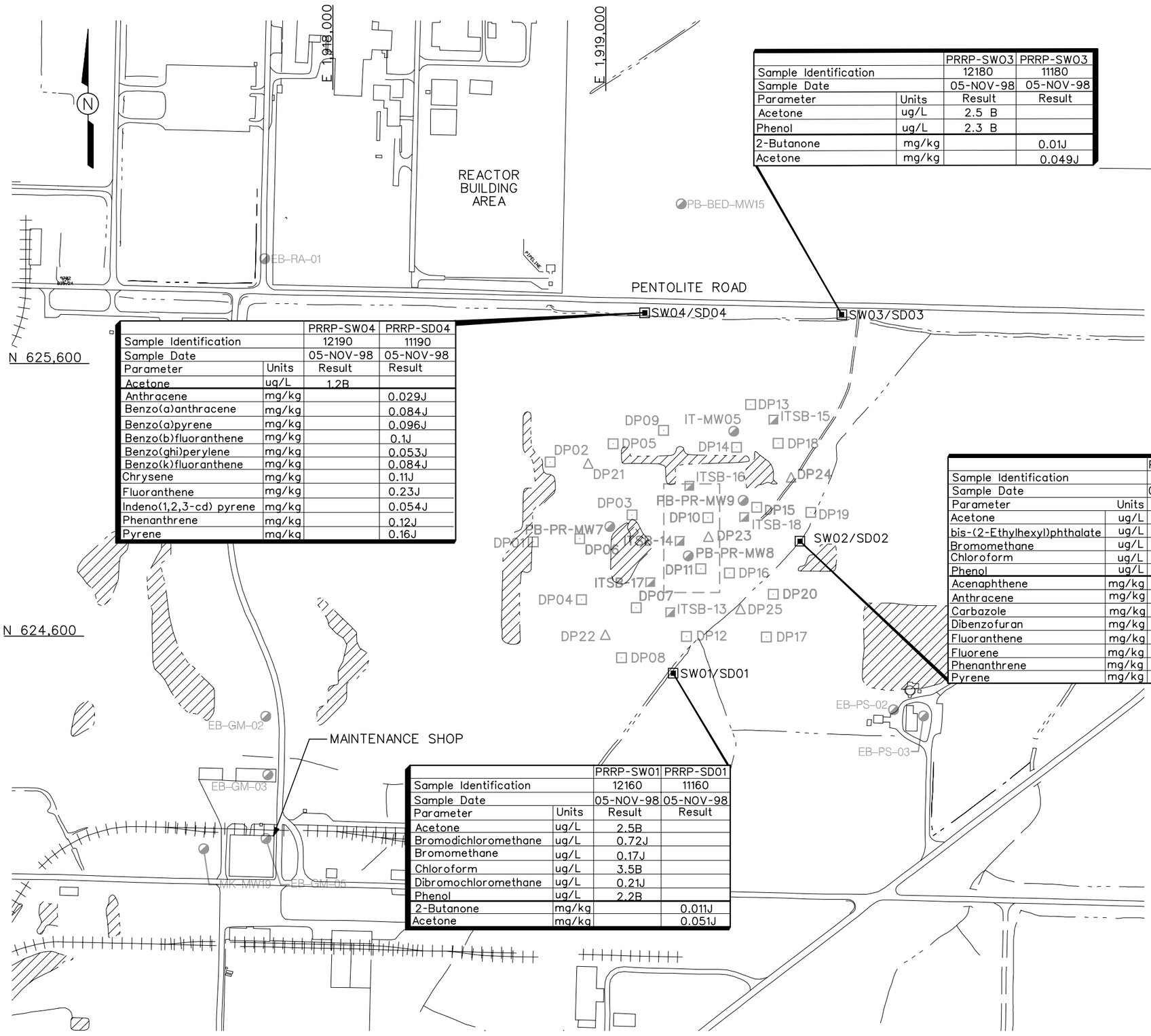

		PRRP-SW03	PRRP-SW03
Sample Identification		12180	11180
Sample Date		05-NOV-98	05-NOV-98
Parameter	Units	Result	Result
Acetone	ug/L	2.5 B	
Phenol	ug/L	2.3 B	
2-Butanone	mg/kg		0.01J
Acetone	mg/kg		0.049J

		PRRP-SW04	PRRP-SD04
Sample Identification		12190	11190
Sample Date		05-NOV-98	05-NOV-98
Parameter	Units	Result	Result
Acetone	ug/L	1.2B	
Anthracene	mg/kg		0.029J
Benzo(a)anthracene	mg/kg		0.084J
Benzo(a)pyrene	mg/kg		0.096J
Benzo(b)fluoranthene	mg/kg		0.1J
Benzo(ghi)perylene	mg/kg		0.053J
Benzo(k)fluoranthene	mg/kg		0.084J
Chrysene	mg/kg		0.11J
Fluoranthene	mg/kg		0.23J
Indeno(1,2,3-cd) pyrene	mg/kg		0.054J
Phenanthrene	mg/kg		0.12J
Pyrene	mg/kg		0.16J

		PRRP-SW02	PRRP-SW02
Sample Identification		12170	11170
Sample Date		05-NOV-98	05-NOV-98
Parameter	Units	Result	Result
Acetone	ug/L	1.7B	
bis-(2-Ethylhexyl)phthalate	ug/L	2.1B	
Bromomethane	ug/L	0.11J	
Chloroform	ug/L	0.55B	
Phenol	ug/L	1.9B	
Acenaphthene	mg/kg		0.11J
Anthracene	mg/kg		0.077J
Carbazole	mg/kg		0.18J
Dibenzofuran	mg/kg		0.06J
Fluoranthene	mg/kg		0.14J
Fluorene	mg/kg		0.11J
Phenanthrene	mg/kg		0.32J
Pyrene	mg/kg		0.11J

		PRRP-SW01	PRRP-SD01
Sample Identification		12160	11160
Sample Date		05-NOV-98	05-NOV-98
Parameter	Units	Result	Result
Acetone	ug/L	2.5B	
Bromodichloromethane	ug/L	0.72J	
Bromomethane	ug/L	0.17J	
Chloroform	ug/L	3.5B	
Dibromochloromethane	ug/L	0.21J	
Phenol	ug/L	2.2B	
2-Butanone	mg/kg		0.011J
Acetone	mg/kg		0.051J

LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE WATER DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- FENCE (PBOW BOUNDARY)
- IT-MW02 — EXISTING MONITORING WELL LOCATION
- ITSB-13 — EXISTING SOIL BORING LOCAITON
- DP01 — DIRECT PUSH SAMPLE LOCATIONS
- DP21 — DIRECT PUSH GEOTECHNICAL LOCATIONS
- SW01/SD01 — SURFACE WATER/SEDIMENT SAMPLES

SCALE

0 400 800 FEET

FIGURE 4-6
DETECTED ORGANIC CONSTITUENTS IN SW/SD SAMPLES PENTOLITE ROAD RED WATER PONDS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

DWG. NO.:\773701es.026 PROJ. NO.:773701
INITIATOR: D. KESSLER PROJ. MGR.:SPANGBERG
DRAFT. CHCK. BY: C. TUMLIN ENGR. CHCK. BY: R. ELLIS
DATE LAST REV.: DRAWN BY:
STARTING DATE: 12/16/97 DRAWN BY: D. BILLINGSLEY
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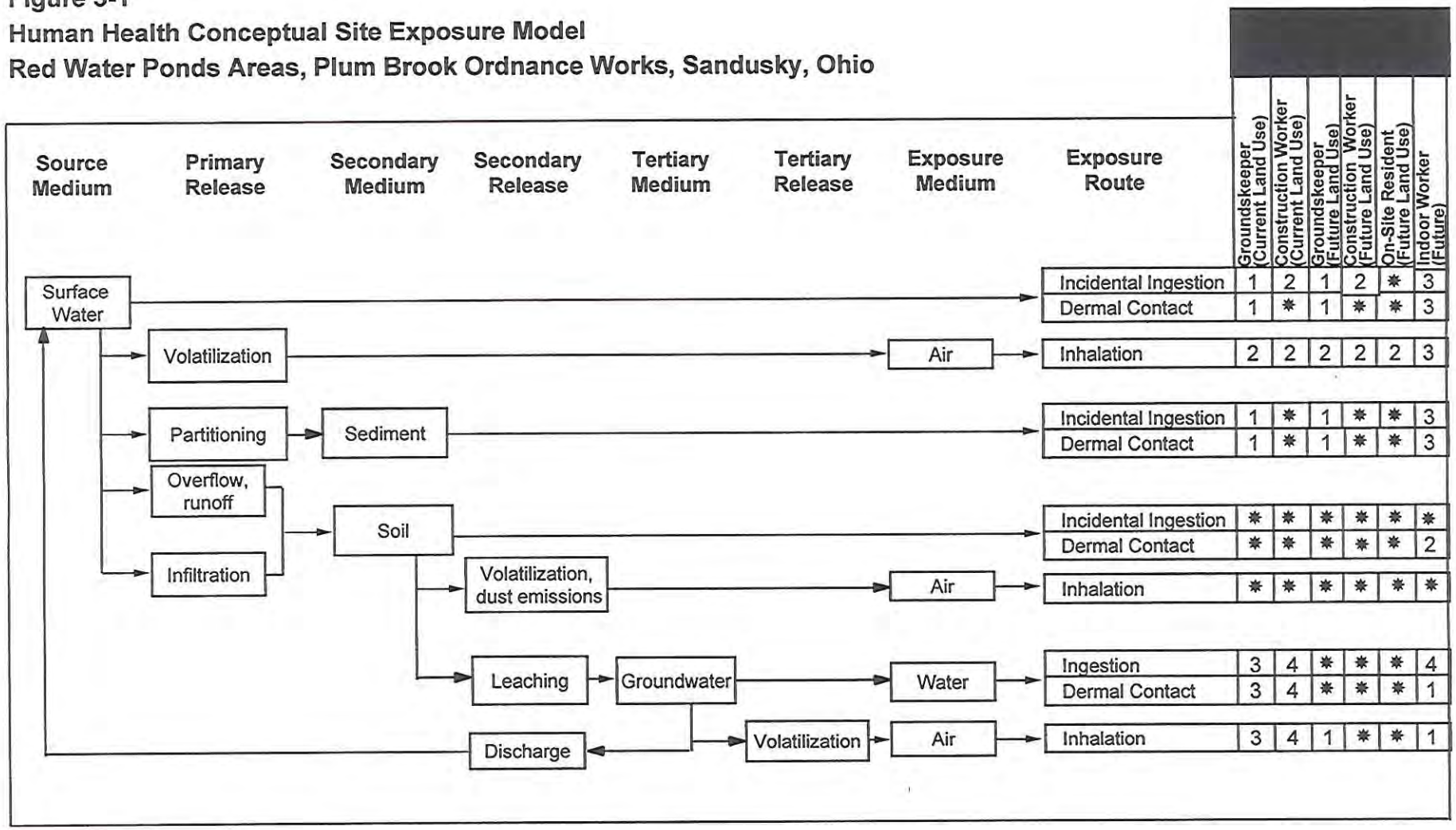
Figure 5-1
Human Health Conceptual Site Exposure Model
Red Water Ponds Areas, Plum Brook Ordnance Works, Sandusky, Ohio



* = Complete exposure pathway evaluated in the risk assessment.
1 = Contact with this medium, although possible, is not part of this receptor's normal or expected activities; therefore, contact would be sporadic and is not quantified.
2 = Although theoretically complete, this pathway is not quantified as explained in text.
3 = There is no plausible pathway for exposure to this medium.
4 = Although a complete pathway, groundwater data are not available. Future groundwater exposures will be assessed when data become available.

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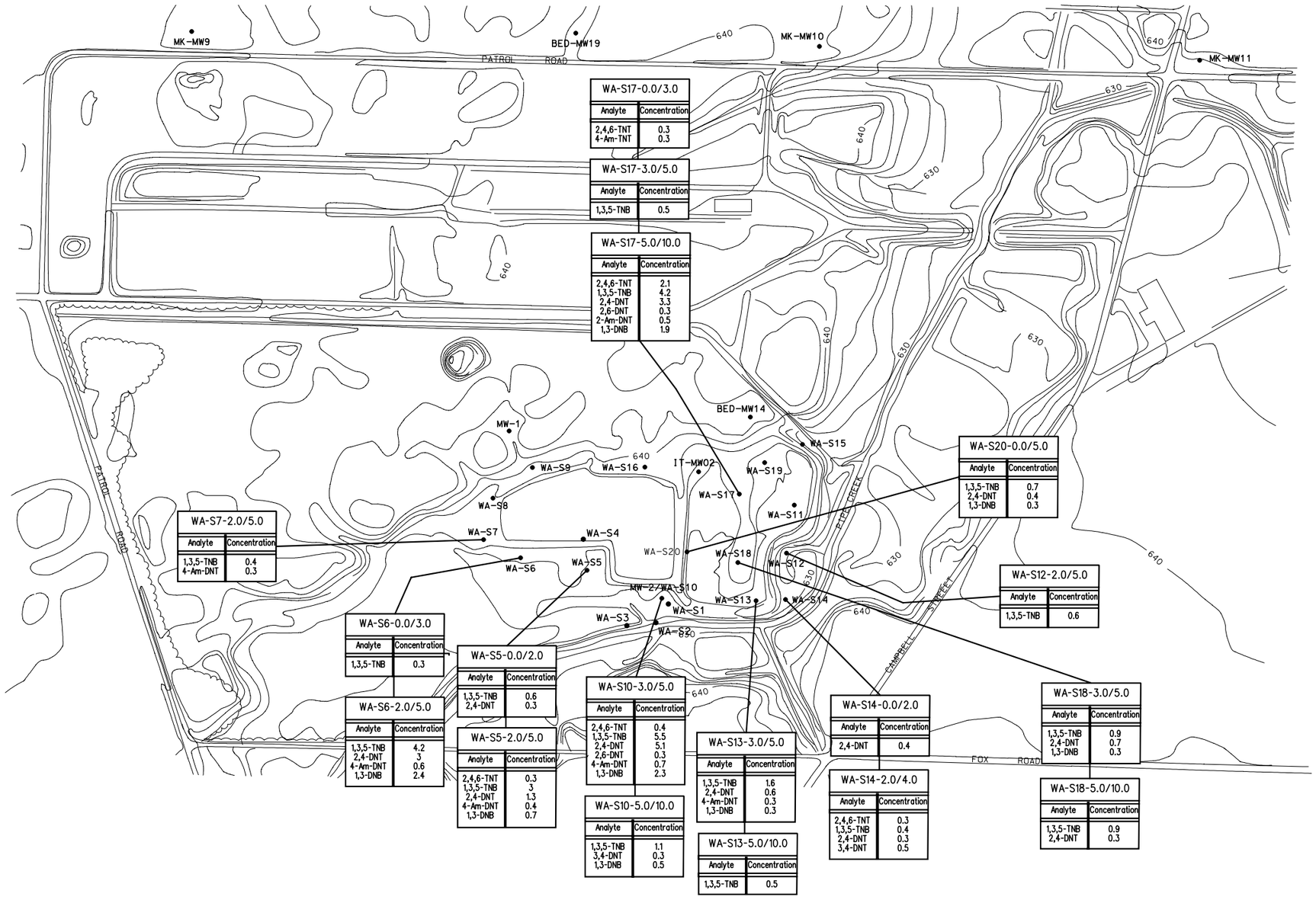
Figure 5-2

Detected Concentrations of Selected COPC in Subsurface Soil Ranked from Highest to Lowest[a]
West Area, Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Result	Units	Sample Location	Sample Number
4-Amino-2,6-dinitrotoluene	**0.7**	mg/kg	PB-RWP-DS-S10	PB-WA-S10-3.0/5.0
4-Amino-2,6-dinitrotoluene	0.6	mg/kg	PB-RWP-DS-S6	PB-WA-S6-2.0/5.0
4-Amino-2,6-dinitrotoluene	0.4	mg/kg	PB-RWP-DS-S5	PB-WA-S5-2.0/5.0
4-Amino-2,6-dinitrotoluene	0.3	mg/kg	PB-RWP-DS-S13	PB-WA-S13-3.0/5.0
4-Amino-2,6-dinitrotoluene	0.3	mg/kg	PB-RWP-DS-S7	PB-WA-S7-2.0/5.0
1,3-Dinitrobenzene	**2.4**	mg/kg	PB-RWP-DS-S6	PB-WA-S6-2.0/5.0
1,3-Dinitrobenzene	**2.3**	mg/kg	PB-RWP-DS-S10	PB-WA-S10-3.0/5.0
1,3-Dinitrobenzene	1.9	mg/kg	PB-RWP-DS-S17	PB-WA-S17-5.0/10.0
1,3-Dinitrobenzene	0.7	mg/kg	PB-RWP-DS-S5	PB-WA-S5-2.0/5.0
1,3-Dinitrobenzene	0.5	mg/kg	PB-RWP-DS-S10	PB-WA-S10-5.0/10.0
1,3-Dinitrobenzene	0.3	mg/kg	PB-RWP-DS-S18	PB-WA-S18-3.0/5.0
2,4-Dinitrotoluene	**6.3**	mg/kg	WARP-DP13	8600
2,4-Dinitrotoluene	**5.1**	mg/kg	PB-RWP-DS-S10	PB-WA-S10-3.0/5.0
2,4-Dinitrotoluene	**3.3**	mg/kg	PB-RWP-DS-S17	PB-WA-S17-5.0/10.0
2,4-Dinitrotoluene	3	mg/kg	PB-RWP-DS-S6	PB-WA-S6-2.0/5.0
2,4-Dinitrotoluene	1.4	mg/kg	WARP-DP10	8470
2,4-Dinitrotoluene	1.3	mg/kg	PB-RWP-DS-S5	PB-WA-S5-2.0/5.0
2,4-Dinitrotoluene	0.7	mg/kg	PB-RWP-DS-S18	PB-WA-S18-3.0/5.0
2,4-Dinitrotoluene	0.6	mg/kg	PB-RWP-DS-S13	PB-WA-S13-3.0/5.0
2,4-Dinitrotoluene	0.49	mg/kg	WARP-DP09	8440
2,4-Dinitrotoluene	0.3	mg/kg	PB-RWP-DS-S14	PB-WA-S14-2.0/5.0
2,4-Dinitrotoluene	0.3	mg/kg	PB-RWP-DS-S18	PB-WA-S18-5.0/10.0
2,6-Dinitrotoluene	1.5	mg/kg	WARP-DP10	8470
2,6-Dinitrotoluene	0.3	mg/kg	PB-RWP-DS-S10	PB-WA-S10-3.0/5.0
2,6-Dinitrotoluene	0.3	mg/kg	PB-RWP-DS-S17	PB-WA-S17-5.0/10.0

mg/kg - Milligrams per kilogram.
[a] Bolded values exceed the source-term concentration.



NOTES:

CONCENTRATIONS ARE IN mg/Kg

FIGURE 5-3

WEST AREA RED WATER PONDS SOIL BORING LOCATIONS AND EXPLOSIVE RESIDUES CONCENTRATIONS

PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

SOURCE: DAMES & MOORE 1996

DRAFT. CHCK. BY: C. TUMLIN | INITIATOR: M. GUNDERSON | DWG. NO.: \807053es.001
ENGR. CHCK. BY: M. GUNDERSON | PROJ. MGR.: SPANGBERG | PROJ. NO.: 807053
STARTING DATE: 09/22/00 | DATE LAST REV.:
DRAWN BY: B. VANDERGRIFF | DRAWN BY:
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Figure 5-4

Detected Concentrations of Selected COPC in Subsurface Soil Ranked from Highest to Lowest[a]
Pentolite Road Red Water Area, Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Result	Units	Sample Location	Sample Number
4-Amino-2,6-dinitrotoluene	**9.5**	mg/kg	PB-RWP-PR-S14	PB-PR-S14-3.0/5.0
4-Amino-2,6-dinitrotoluene	**2**	mg/kg	PB-RWP-PR-S14	PB-PR-S14-5.0/10.0
4-Amino-2,6-dinitrotoluene	1	mg/kg	PB-RWP-PR-S6	PB-PR-S6-5.0/10.0
4-Amino-2,6-dinitrotoluene	0.7	mg/kg	PB-RWP-PR-S13	PB-PR-S13-5.0/10.0
4-Amino-2,6-dinitrotoluene	0.3	mg/kg	PB-RWP-PR-S6	PB-PR-S6-3.0/5.0
4-Amino-2,6-dinitrotoluene	0.3	mg/kg	PB-RWP-PR-S7	PB-PR-S7-3.0/5.0
1,3-Dinitrobenzene	**9.3**	mg/kg	PRRP-DP03	7290
1,3-Dinitrobenzene	**6.7**	mg/kg	PB-RWP-PR-S14	PB-PR-S14-5.0/10.0
1,3-Dinitrobenzene	**6.6**	mg/kg	PB-RWP-PR-S15	PB-PR-S15-5.0/10.0
1,3-Dinitrobenzene	**6.4**	mg/kg	PB-RWP-PR-S14	PB-PR-S14-3.0/5.0
1,3-Dinitrobenzene	**5.8**	mg/kg	PRRP-DP11	7620
1,3-Dinitrobenzene	**5.2**	mg/kg	PRRP-DP10	7580
1,3-Dinitrobenzene	**4.3**	mg/kg	PB-RWP-PR-S16	PB-PR-S16-5.0/10.0
1,3-Dinitrobenzene	**3.8**	mg/kg	PB-RWP-PR-S6	PB-PR-S6-5.0/10.0
1,3-Dinitrobenzene	**3.4**	mg/kg	PB-RWP-PR-S6	PB-PR-S6-3.0/5.0
1,3-Dinitrobenzene	**3.2**	mg/kg	PB-RWP-PR-S13	PB-PR-S13-5.0/10.0
1,3-Dinitrobenzene	**3.2**	mg/kg	PB-RWP-PR-S4	PB-PR-S4-3.0/5.0
1,3-Dinitrobenzene	**2.5**	mg/kg	PB-RWP-PR-S10	PB-PR-S10-5.0/10.0
1,3-Dinitrobenzene	2.2	mg/kg	PB-RWP-PR-S9	PB-PR-S9-5.0/10.0
1,3-Dinitrobenzene	2.1	mg/kg	PB-RWP-PR-S4	PB-PR-S4-5.0/10.0
1,3-Dinitrobenzene	2.1	mg/kg	PB-RWP-PR-S7	PB-PR-S7-3.0/5.0
1,3-Dinitrobenzene	1.6	mg/kg	PB-RWP-PR-S10	PB-PR-S10-3.0/5.0
1,3-Dinitrobenzene	1.5	mg/kg	PB-RWP-PR-S12	PB-PR-S12-5.0/10.0
1,3-Dinitrobenzene	1.5	mg/kg	PB-RWP-PR-S9	PB-PR-S9-3.0/5.0
1,3-Dinitrobenzene	1.4	mg/kg	PB-RWP-PR-S19	PB-PR-S19-5.0/10.0
1,3-Dinitrobenzene	1.1	mg/kg	PB-RWP-PR-S12	PB-PR-S12-3.0/5.0
1,3-Dinitrobenzene	0.5	mg/kg	PB-RWP-PR-S7	PB-PR-S7-5.0/10.0
1,3-Dinitrobenzene	0.43	mg/kg	PRRP-DP11	7610
1,3-Dinitrobenzene	0.3	mg/kg	PB-RWP-PR-S2	PB-PR-S2-5.0/10.0
1,3-Dinitrobenzene	0.25	mg/kg	PRRP-DP16	7820
2,4-Dinitrotoluene	**25**	mg/kg	PRRP-DP03	7290
2,4-Dinitrotoluene	**19**	mg/kg	PB-RWP-PR-S14	PB-PR-S14-5.0/10.0
2,4-Dinitrotoluene	**15**	mg/kg	PRRP-DP10	7580
2,4-Dinitrotoluene	**14**	mg/kg	PB-RWP-PR-S15	PB-PR-S15-5.0/10.0
2,4-Dinitrotoluene	**8.9**	mg/kg	PB-RWP-PR-S16	PB-PR-S16-5.0/10.0
2,4-Dinitrotoluene	**8.7**	mg/kg	PB-RWP-PR-S6	PB-PR-S6-3.0/5.0
2,4-Dinitrotoluene	**7.6**	mg/kg	PB-RWP-PR-S6	PB-PR-S6-5.0/10.0
2,4-Dinitrotoluene	**5.7**	mg/kg	PB-RWP-PR-S4	PB-PR-S4-3.0/5.0
2,4-Dinitrotoluene	5.2	mg/kg	PB-RWP-PR-S13	PB-PR-S13-5.0/10.0
2,4-Dinitrotoluene	3.8	mg/kg	PB-RWP-PR-S9	PB-PR-S9-3.0/5.0
2,4-Dinitrotoluene	3.4	mg/kg	PB-RWP-PR-S7	PB-PR-S7-3.0/5.0
2,4-Dinitrotoluene	2.8	mg/kg	PB-RWP-PR-S4	PB-PR-S4-5.0/10.0
2,4-Dinitrotoluene	2.6	mg/kg	PB-RWP-PR-S10	PB-PR-S10-3.0/5.0
2,4-Dinitrotoluene	2.2	mg/kg	PB-RWP-PR-S10	PB-PR-S10-5.0/10.0

Figure 5-4

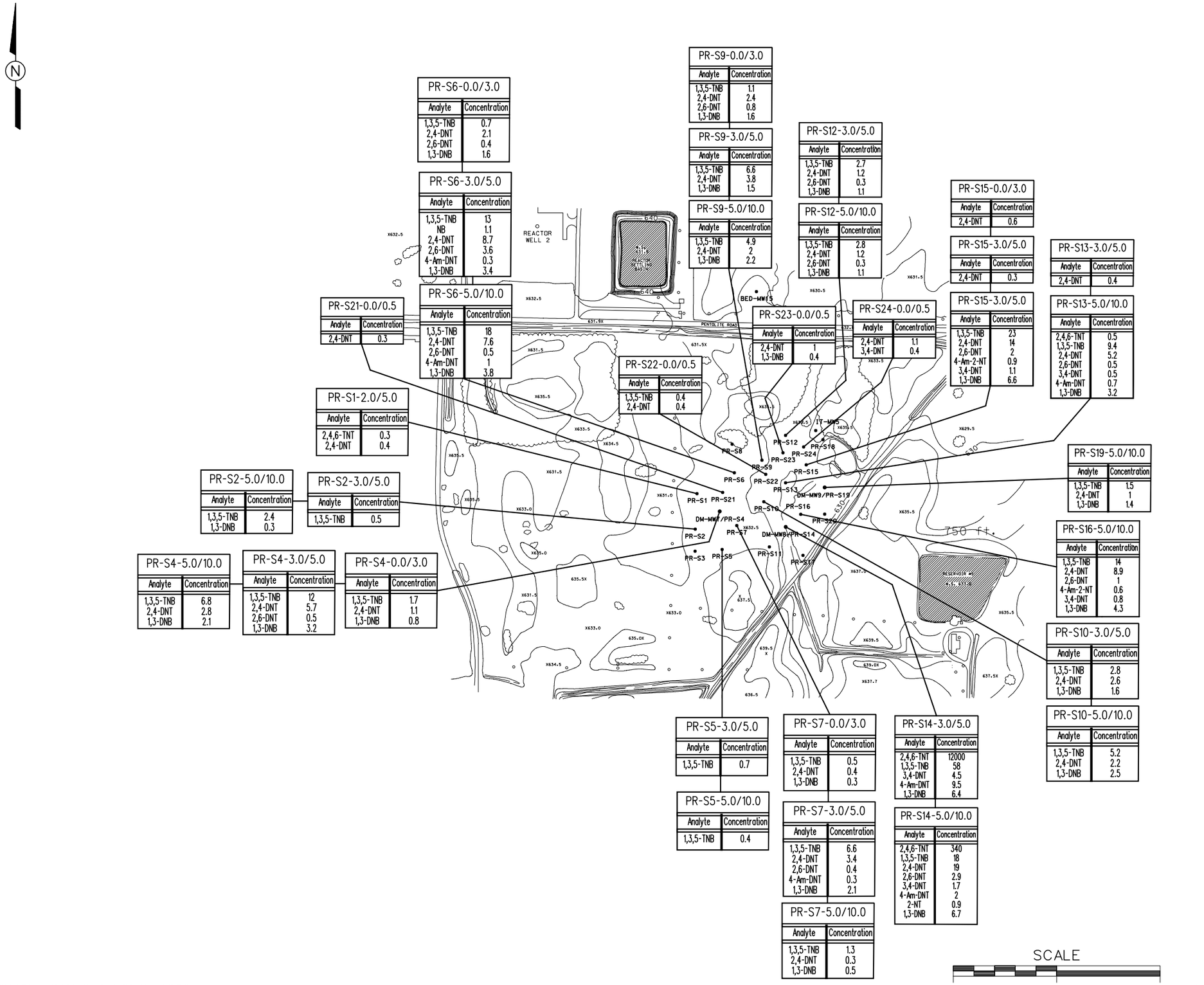
Detected Concentrations of Selected COPC in Subsurface Soil Ranked from Highest to Lowest[a]
Pentolite Road Red Water Area, Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Result		Units	Sample Location	Sample Number
2,4-Dinitrotoluene	2		mg/kg	PB-RWP-PR-S9	PB-PR-S9-5.0/10.0
2,4-Dinitrotoluene	1.6		mg/kg	PRRP-DP11	7610
2,4-Dinitrotoluene	1.6		mg/kg	PB-RWP-PR-S12	PB-PR-S12-5.0/10.0
2,4-Dinitrotoluene	1.2		mg/kg	PRRP-DP11	7620
2,4-Dinitrotoluene	1.2		mg/kg	PB-RWP-PR-S12	PB-PR-S12-3.0/5.0
2,4-Dinitrotoluene	1.1		mg/kg	PRRP-DP06	7420
2,4-Dinitrotoluene	1		mg/kg	PB-RWP-PR-S19	PB-PR-S19-5.0/10.0
2,4-Dinitrotoluene	0.96		mg/kg	PRRP-DP01	7210
2,4-Dinitrotoluene	0.5		mg/kg	PRRP-DP16	7820
2,4-Dinitrotoluene	0.4		mg/kg	PB-RWP-PR-S1	PB-PR-S1-2.0/5.0
2,4-Dinitrotoluene	0.4		mg/kg	PB-RWP-PR-S13	PB-PR-S13-3.0/5.0
2,4-Dinitrotoluene	0.3		mg/kg	PB-RWP-PR-S15	PB-PR-S15-3.0/5.0
2,4-Dinitrotoluene	0.3		mg/kg	PB-RWP-PR-S7	PB-PR-S7-5.0/10.0
2,4-Dinitrotoluene	0.29		mg/kg	PRRP-DP01	7220
2,4-Dinitrotoluene	0.28		mg/kg	PRRP-DP02	7260
2,6-Dinitrotoluene	**3.6**		mg/kg	PB-RWP-PR-S6	PB-PR-S6-3.0/5.0
2,6-Dinitrotoluene	**2.9**		mg/kg	PB-RWP-PR-S14	PB-PR-S14-5.0/10.0
2,6-Dinitrotoluene	**2**		mg/kg	PB-RWP-PR-S15	PB-PR-S15-5.0/10.0
2,6-Dinitrotoluene	**1.7**		mg/kg	PRRP-DP10	7580
2,6-Dinitrotoluene	**1**		mg/kg	PB-RWP-PR-S16	PB-PR-S16-5.0/10.0
2,6-Dinitrotoluene	0.5		mg/kg	PRRP-DP16	7820
2,6-Dinitrotoluene	0.5		mg/kg	PB-RWP-PR-S13	PB-PR-S13-5.0/10.0
2,6-Dinitrotoluene	0.5		mg/kg	PB-RWP-PR-S4	PB-PR-S4-3.0/5.0
2,6-Dinitrotoluene	0.5		mg/kg	PB-RWP-PR-S6	PB-PR-S6-5.0/10.0
2,6-Dinitrotoluene	0.4		mg/kg	PB-RWP-PR-S7	PB-PR-S7-3.0/5.0
2,6-Dinitrotoluene	0.35		mg/kg	PRRP-DP01	7210
2,6-Dinitrotoluene	0.3		mg/kg	PRRP-DP11	7620
2,6-Dinitrotoluene	0.3		mg/kg	PB-RWP-PR-S12	PB-PR-S12-3.0/5.0
2,6-Dinitrotoluene	0.3		mg/kg	PB-RWP-PR-S12	PB-PR-S12-5.0/10.0
2,6-Dinitrotoluene	0.29		mg/kg	PRRP-DP11	7610
2,4,6-Trinitrotoluene	**12000**	b	mg/kg	PB-RWP-PR-S14	PB-PR-S14-3.0/5.0
2,4,6-Trinitrotoluene	**340**	b	mg/kg	PB-RWP-PR-S14	PB-PR-S14-5.0/10.0
2,4,6-Trinitrotoluene	0.5		mg/kg	PB-RWP-PR-S13	PB-PR-S13-5.0/10.0
2,4,6-Trinitrotoluene	0.38		mg/kg	PRRP-DP02	7260
2,4,6-Trinitrotoluene	0.3		mg/kg	PB-RWP-PR-S1	PB-PR-S1-2.0/5.0

mg/kg - Milligrams per kilogram.

[a] Bolded values exceed the source-term concentration, unless otherwise noted.

[b] Although these values do not exceed the source-term concentration, they do exceed the RBSC.



PR-S6-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	0.7
2,4-DNT	2.1
2,6-DNT	0.4
1,3-DNB	1.6

PR-S6-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	13
NB	1.1
2,4-DNT	8.7
2,6-DNT	3.6
4-Am-DNT	0.3
1,3-DNB	3.4

PR-S6-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	18
2,4-DNT	7.6
2,6-DNT	0.5
4-Am-DNT	1
1,3-DNB	3.8

PR-S21-0.0/0.5	
Analyte	Concentration
2,4-DNT	0.3

PR-S1-2.0/5.0	
Analyte	Concentration
2,4,6-TNT	0.3
2,4-DNT	0.4

PR-S2-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	2.4
1,3-DNB	0.3

PR-S2-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.5

PR-S4-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	6.8
2,4-DNT	2.8
1,3-DNB	2.1

PR-S4-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	12
2,4-DNT	5.7
2,6-DNT	0.5
1,3-DNB	3.2

PR-S4-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	1.7
2,4-DNT	1.1
1,3-DNB	0.8

PR-S9-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	1.1
2,4-DNT	2.4
2,6-DNT	0.8
1,3-DNB	1.6

PR-S9-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	6.6
2,4-DNT	3.8
1,3-DNB	1.5

PR-S9-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	4.9
2,4-DNT	2
1,3-DNB	2.2

PR-S12-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	2.7
2,4-DNT	1.2
2,6-DNT	0.3
1,3-DNB	1.1

PR-S12-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	2.8
2,4-DNT	1.2
2,6-DNT	0.3
1,3-DNB	1.1

PR-S15-0.0/3.0	
Analyte	Concentration
2,4-DNT	0.6

PR-S15-3.0/5.0	
Analyte	Concentration
2,4-DNT	0.3

PR-S15-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	23
2,4-DNT	14
2,6-DNT	2
4-Am-2-NT	0.9
3,4-DNT	1.1
1,3-DNB	6.6

PR-S13-3.0/5.0	
Analyte	Concentration
2,4-DNT	0.4

PR-S13-5.0/10.0	
Analyte	Concentration
2,4,6-TNT	0.5
1,3,5-TNB	9.4
2,4-DNT	5.2
2,6-DNT	0.5
3,4-DNT	0.5
4-Am-DNT	0.7
1,3-DNB	3.2

PR-S23-0.0/0.5	
Analyte	Concentration
2,4-DNT	1
1,3-DNB	0.4

PR-S24-0.0/0.5	
Analyte	Concentration
2,4-DNT	1.1
3,4-DNT	0.4

PR-S22-0.0/0.5	
Analyte	Concentration
1,3,5-TNB	0.4
2,4-DNT	0.4

PR-S19-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	1.5
2,4-DNT	1
1,3-DNB	1.4

PR-S16-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	14
2,4-DNT	8.9
2,6-DNT	1
4-Am-2-NT	0.6
3,4-DNT	0.8
1,3-DNB	4.3

PR-S10-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	2.8
2,4-DNT	2.6
1,3-DNB	1.6

PR-S10-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	5.2
2,4-DNT	2.2
1,3-DNB	2.5

PR-S5-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	0.7

PR-S5-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	0.4

PR-S7-0.0/3.0	
Analyte	Concentration
1,3,5-TNB	0.5
2,4-DNT	0.4
1,3-DNB	0.3

PR-S7-3.0/5.0	
Analyte	Concentration
1,3,5-TNB	6.6
2,4-DNT	3.4
2,6-DNT	0.4
4-Am-DNT	0.3
1,3-DNB	2.1

PR-S7-5.0/10.0	
Analyte	Concentration
1,3,5-TNB	1.3
2,4-DNT	0.3
1,3-DNB	0.5

PR-S14-3.0/5.0	
Analyte	Concentration
2,4,6-TNT	12000
1,3,5-TNB	58
3,4-DNT	4.5
4-Am-DNT	9.5
1,3-DNB	6.4

PR-S14-5.0/10.0	
Analyte	Concentration
2,4,6-TNT	340
1,3,5-TNB	18
2,4-DNT	19
2,6-DNT	2.9
3,4-DNT	1.7
4-Am-DNT	2
2-NT	0.9
1,3-DNB	6.7

NOTES:
CONCENTRATIONS ARE IN mg/Kg

SOURCE: DAMES & MOORE 1996

FIGURE 5-5
PENTOLITE ROAD RED WATER PONDS SOIL BORING LOCATIONS AND EXPLOSIVE RESIDUES CONCENTRATIONS

PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

DWG. NO.:\807053es.002 | INITIATOR:M. GUNDERSON | STARTING DATE: 09/25/00 | DATE LAST REV.:
PROJ. NO.: 807053 | PROJ. MGR.: SPANGBERG | DRAWN BY: B. VANDERGRIFF | DRAFT. CHCK. BY: C. TUMLIN | DRAWN BY:
ENGR. CHCK. BY: M. GUNDERSON | 02:24:20 PM 08/21/02 | bvanderg c:\cadd\design\807053es.002

Figure 6-1

Photo No. 1 - Pentolite Road Red Water Pond (looking northwest, potential stressed area.)

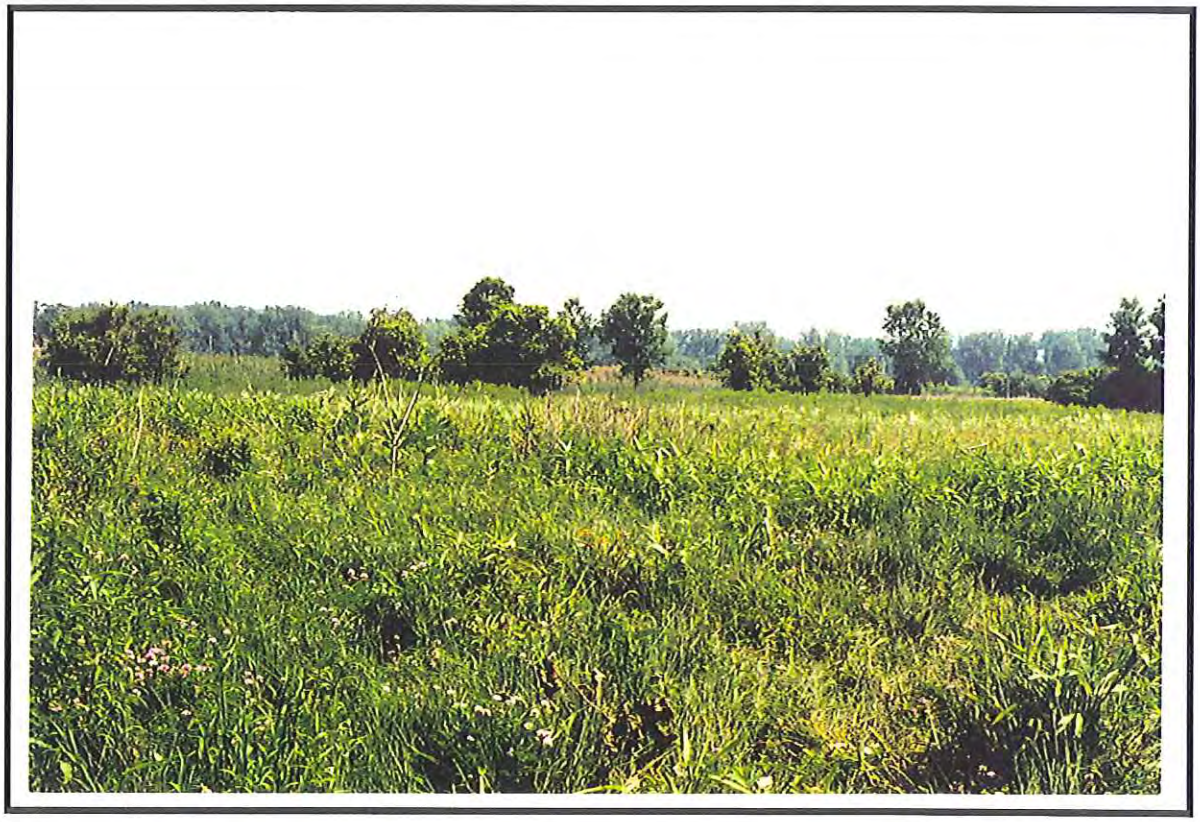


Photo No. 2 - Pentolite Road Red Water Pond (looking south southwest from DP-21 location)

Figure 6-2

Photo No. 3 - Pentolite Road Red Water Pond (old tree with woodpecker hole near DP-21 location)

Photo No. 4 - Pentolite Road Red Water Pond (looking south, wet barren area, potentially stressed)

Figure 6-3

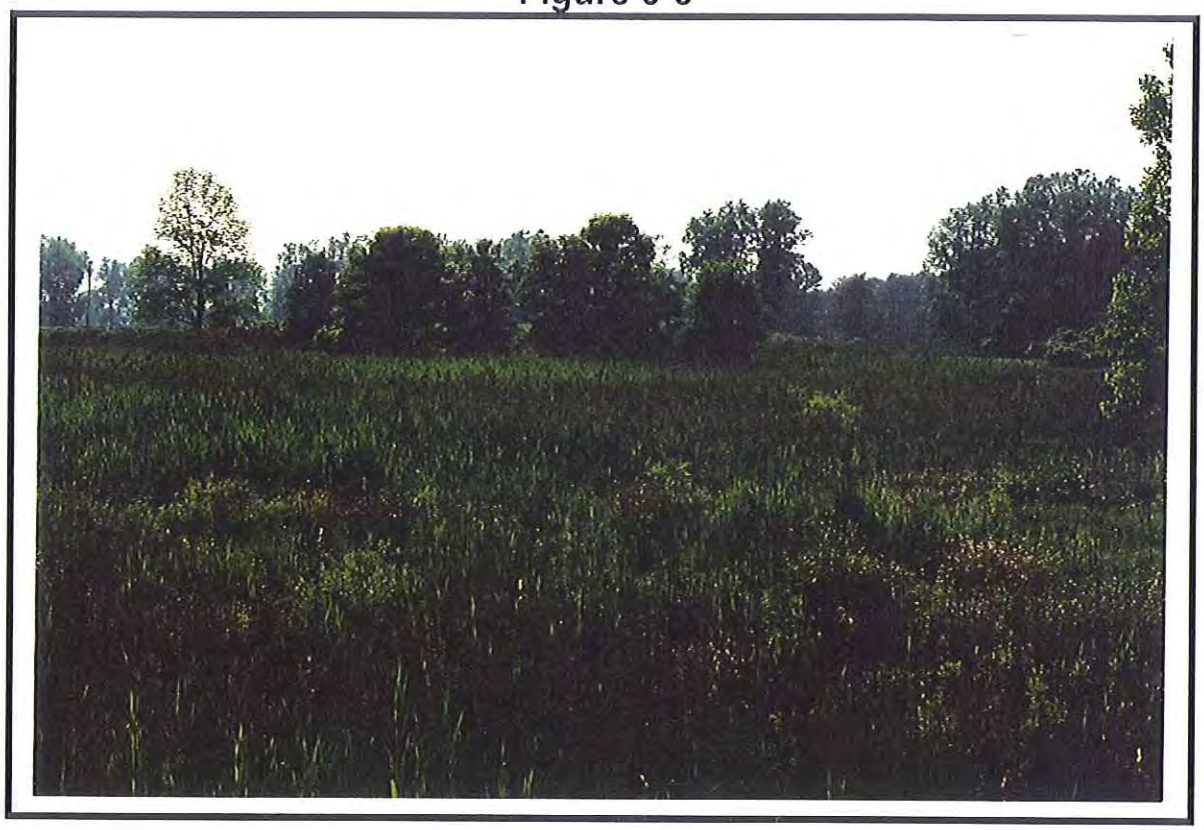


Photo No. 5 - Pentolite Road Red Water Pond (general area looking west from DP-20 location)

Photo No. 6 - Pentolite Road Red Water Pond (general area, looking north from DP-24 location)

Figure 6-4

Photo No. 7 - Pentolite Road Red Water Pond (possible sedge wren nest near DP-14 location)

Photo No. 8 - Pentolite Road Red Water Pond (looking northeast along 10-foot deep ditch)

Figure 6-5

Photo No. 9 - West Area Red Water Pond (bare spot looking south near GP-23 location)

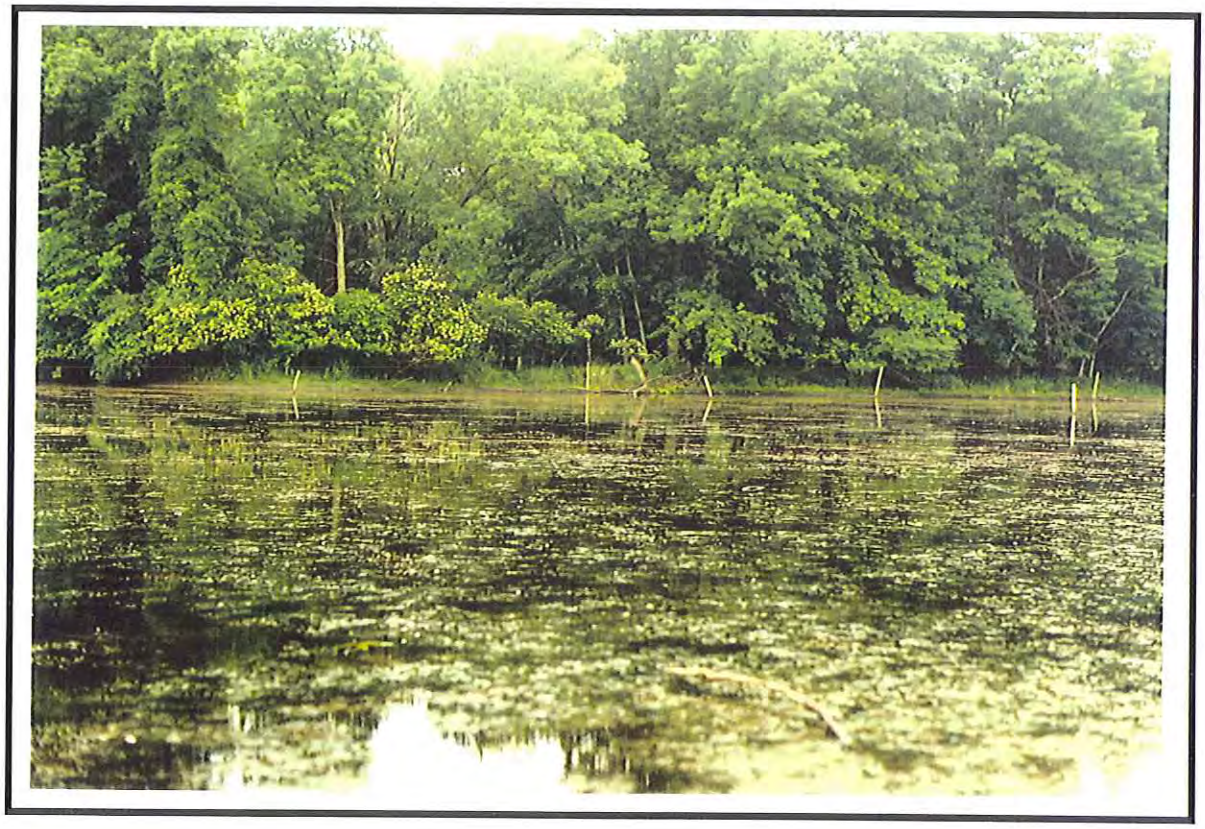


Photo No. 10 - West Area Red Water Pond (west pond area)

Figure 6-6

Photo No. 11 - West Area Red Water Pond (looking southwest, west pond surface, with deer)

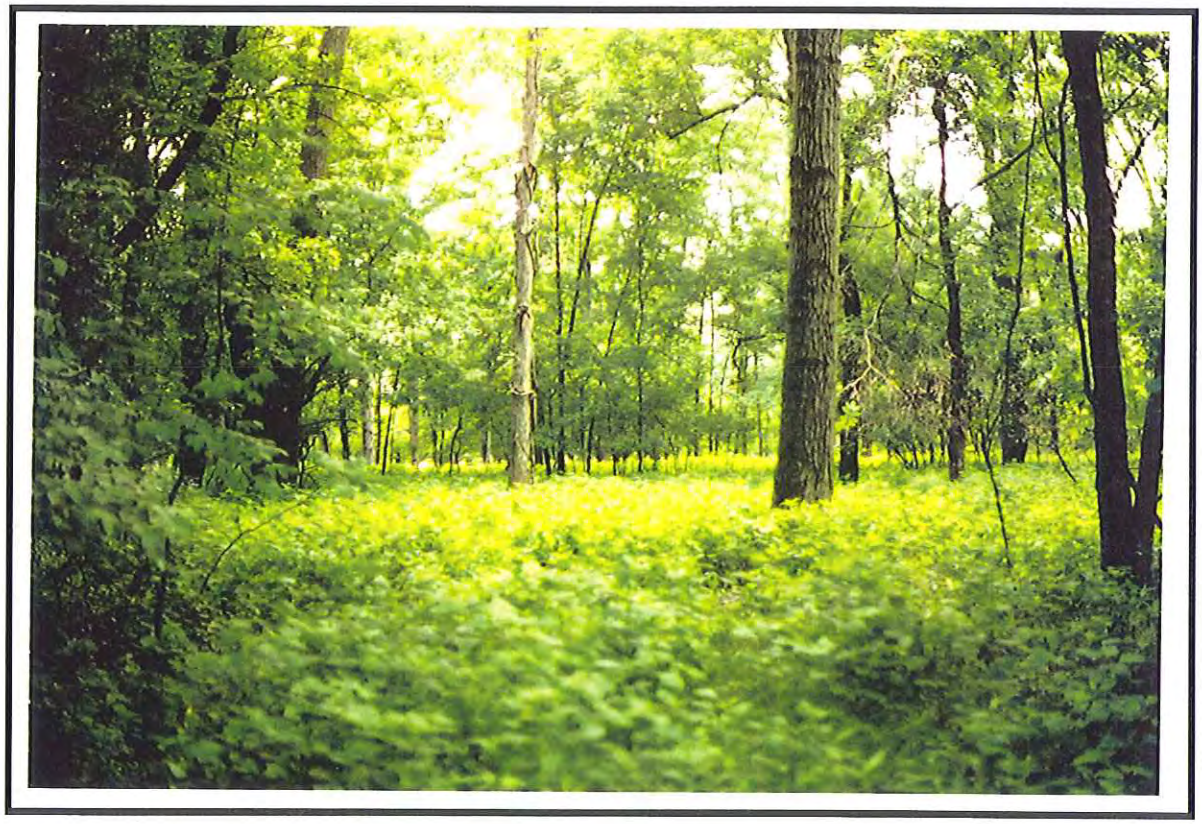


Photo No. 12 - West Area Red Water Pond (looking north, near DP-5 location)

Figure 6-7

Photo No. 13 - West Area Red Water Pond (looking southeast from SB-11 location, east pond area)

Photo No. 14 - West Area Red Water Pond (looking southwest at low-lying area, former east pond)

Figure 6-8

Photo No. 15 - West Area Red Water Pond (looking west from DP-12, only open area at site)

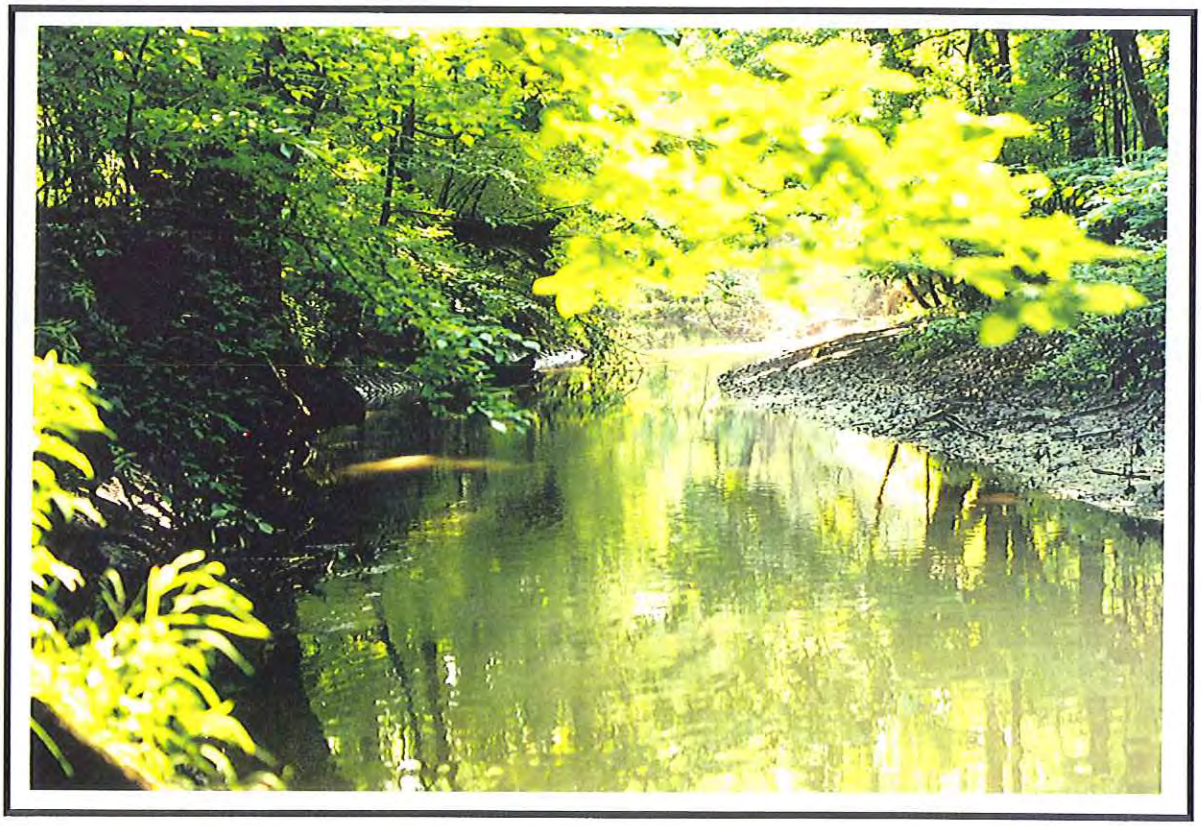
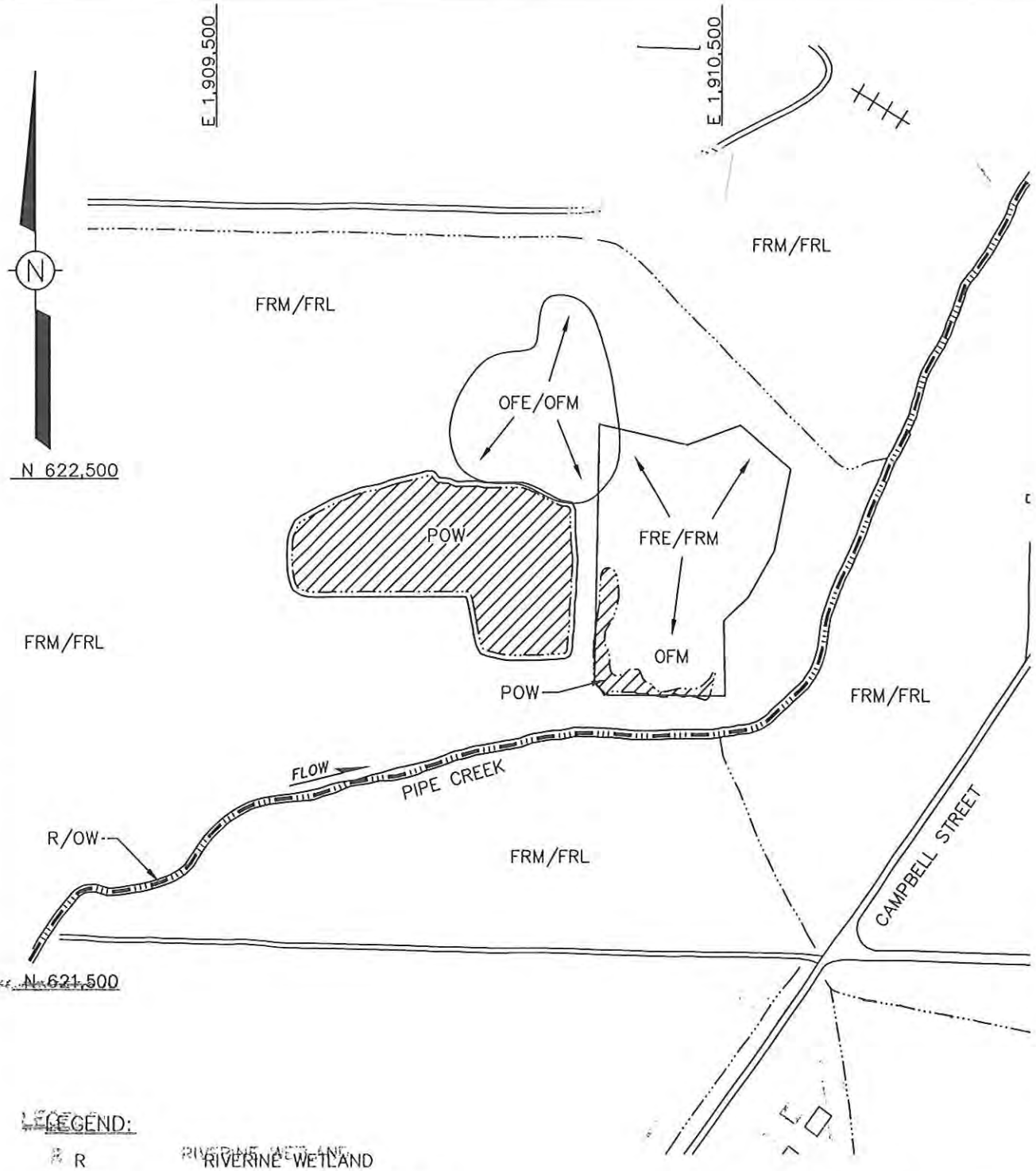


Photo No. 16 - West Area Red Water Pond (looking northeast [downstream] along Pipe Creek)



LEGEND:

R	RIVERINE WETLAND
POW	PALUSTRINE OPEN WATER
OFE	EARLY OLD FIELD
OFM	MODERATE OLD FIELD
FRE	EARLY FOREST
FRM	MODERATE FOREST
FRL	LATE FOREST
	SURFACE WATER
	SURFACE DRAINAGE
	APPROXIMATE HISTORICAL LOCATION OF PONDS
	UNPAVED AND PAVED ROADS

IT CORPORATION

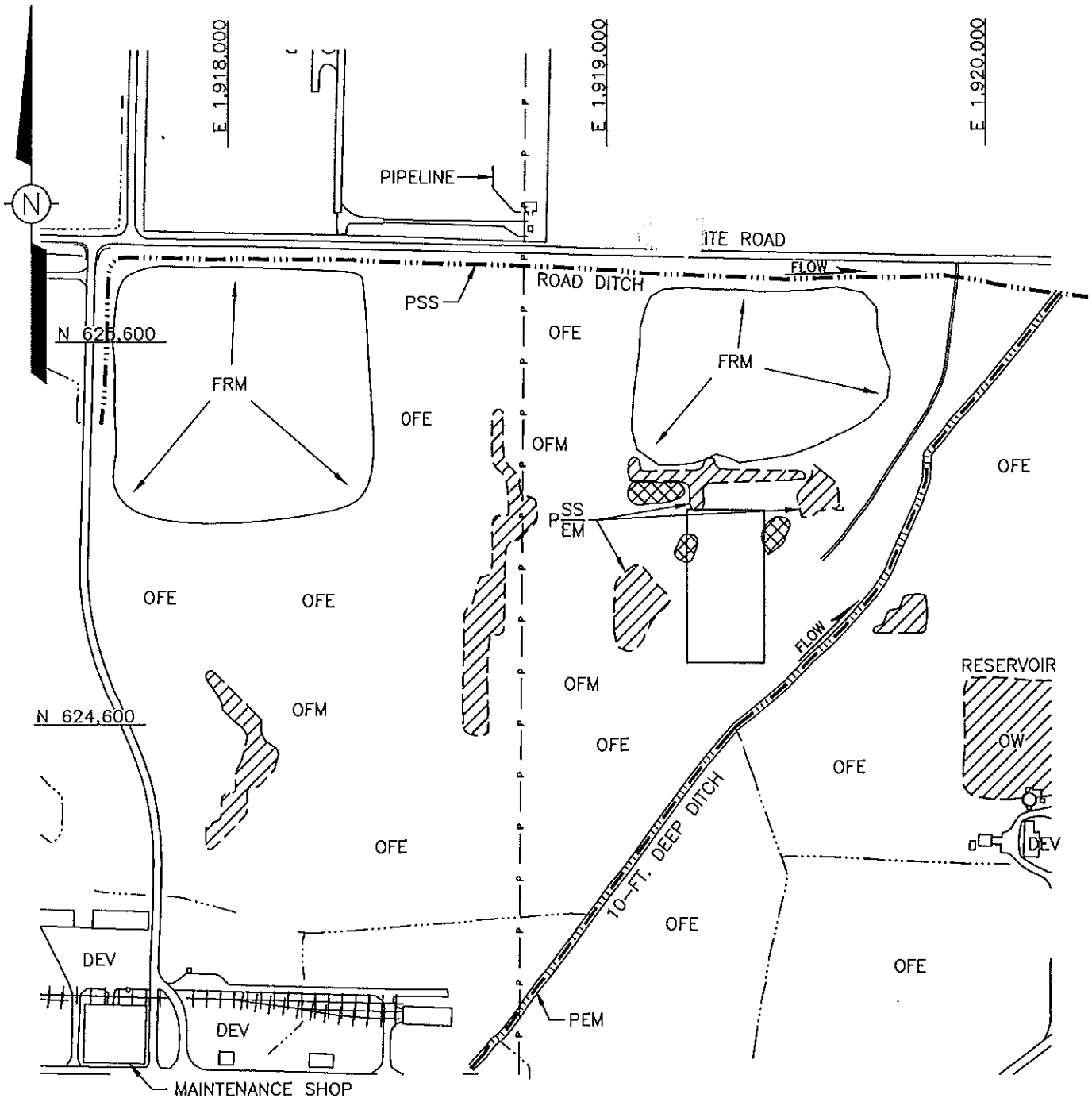
PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

FIGURE 6-9

VEGETATIVE COMMUNITIES
WEST AREA RED WATER PONDS

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE	X-REF	IMAGE
773701-A1			R. WEIBLE 21 DEC 98	PGH	---	---

DATE: 2-19-99
TIME: 1:51 PM
PLOT SCALE: 1 = 300



LEGEND:

FRM	MODERATE FOREST
OW	OPEN WATER
OFE	EARLY OLD FIELD
OFM	MODERATE OLD FIELD
PSS	PALUSTRINE SCRUB/SHRUB WETLAND
PEM	PALUSTRINE EMERGENT WETLAND
DEV	DEVELOPED AND DISTURBED AREAS
	BUILDINGS
	APPROXIMATE HISTORICAL LOCATION OF POND
	SURFACE WATER (AERIAL PHOTO, FALL 1997)
	SURFACE DRAINAGE
	UNPAVED/PAVED ROAD
	BARE SOIL
—P —P—	POWER LINE

SCALE

0 400 800 FEET

IT CORPORATION

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

FIGURE 6-10

VEGETATIVE COMMUNITIES
PENTOLITE ROAD RED WATER PONDS

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE	X-REF	IMAGE
773701-A2			R. WEIBLE 12-21-98	PGH	---	---

DATE: 2-19-99
TIME: 1:52 PM
PLOT SCALE: 1 = 400

Figure 6-11

Simplified Terrestrial Food Web Conceptual Site Model (CSM)
Plum Brook Ordnance Works, Ohio

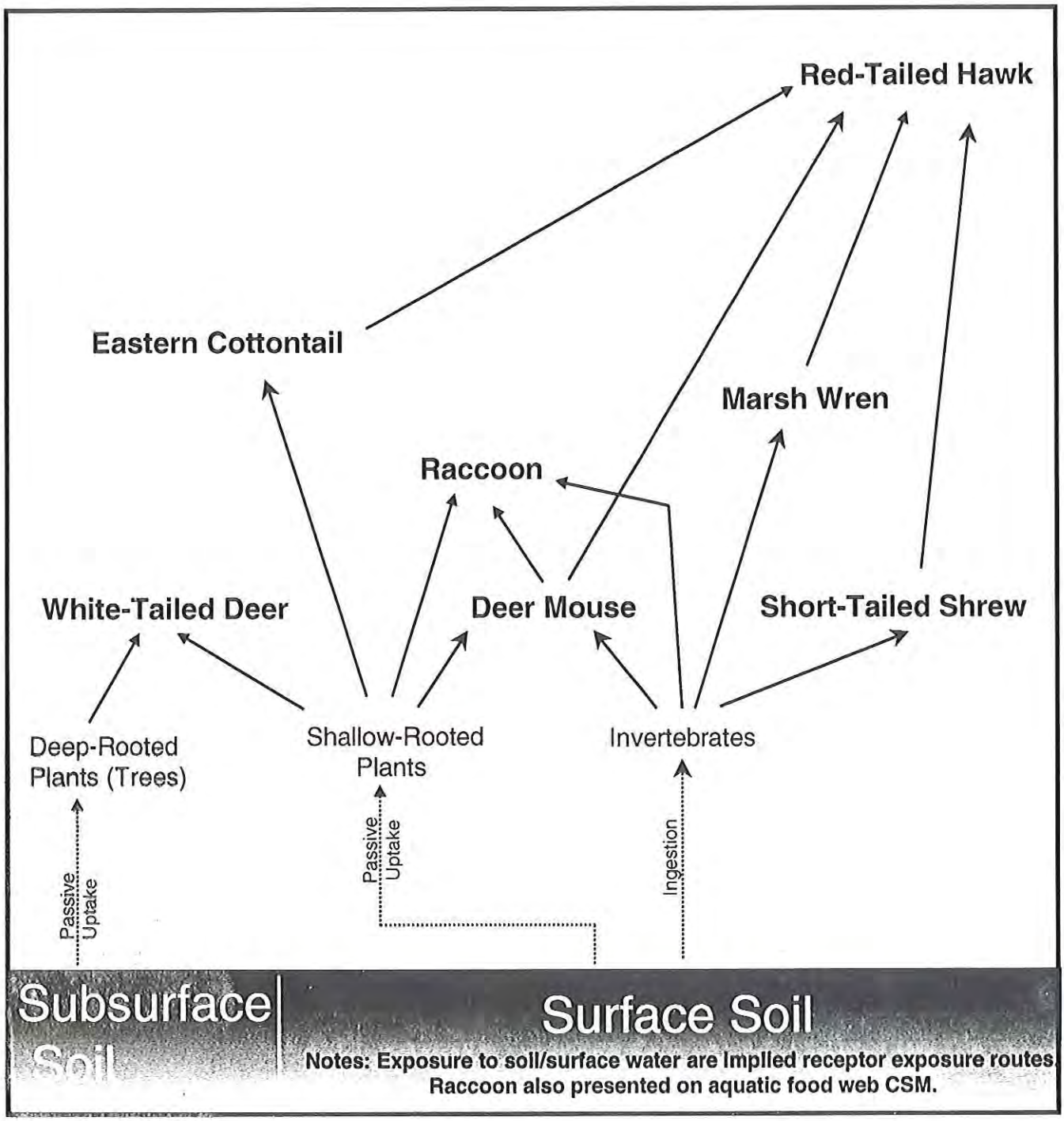
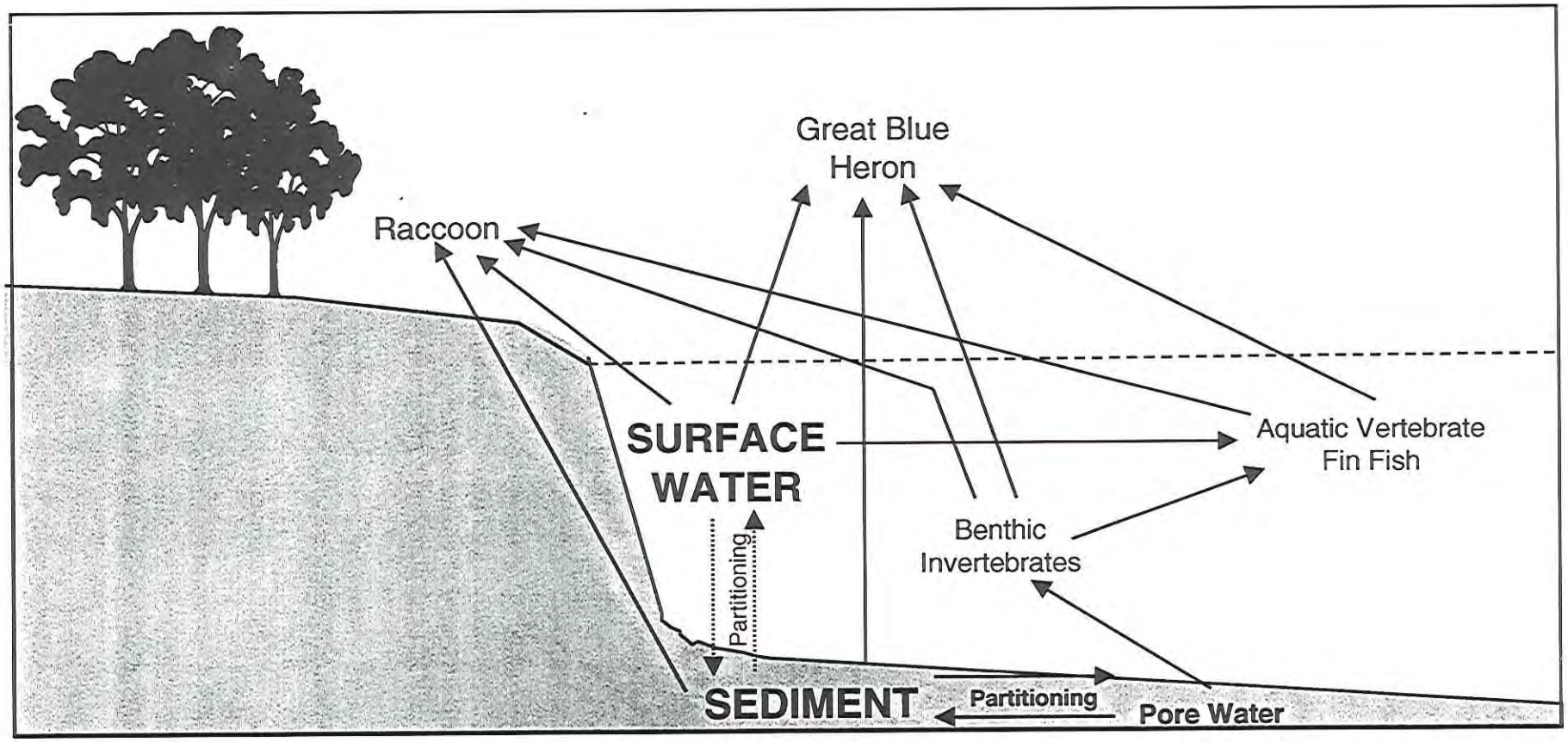


Figure 6-12

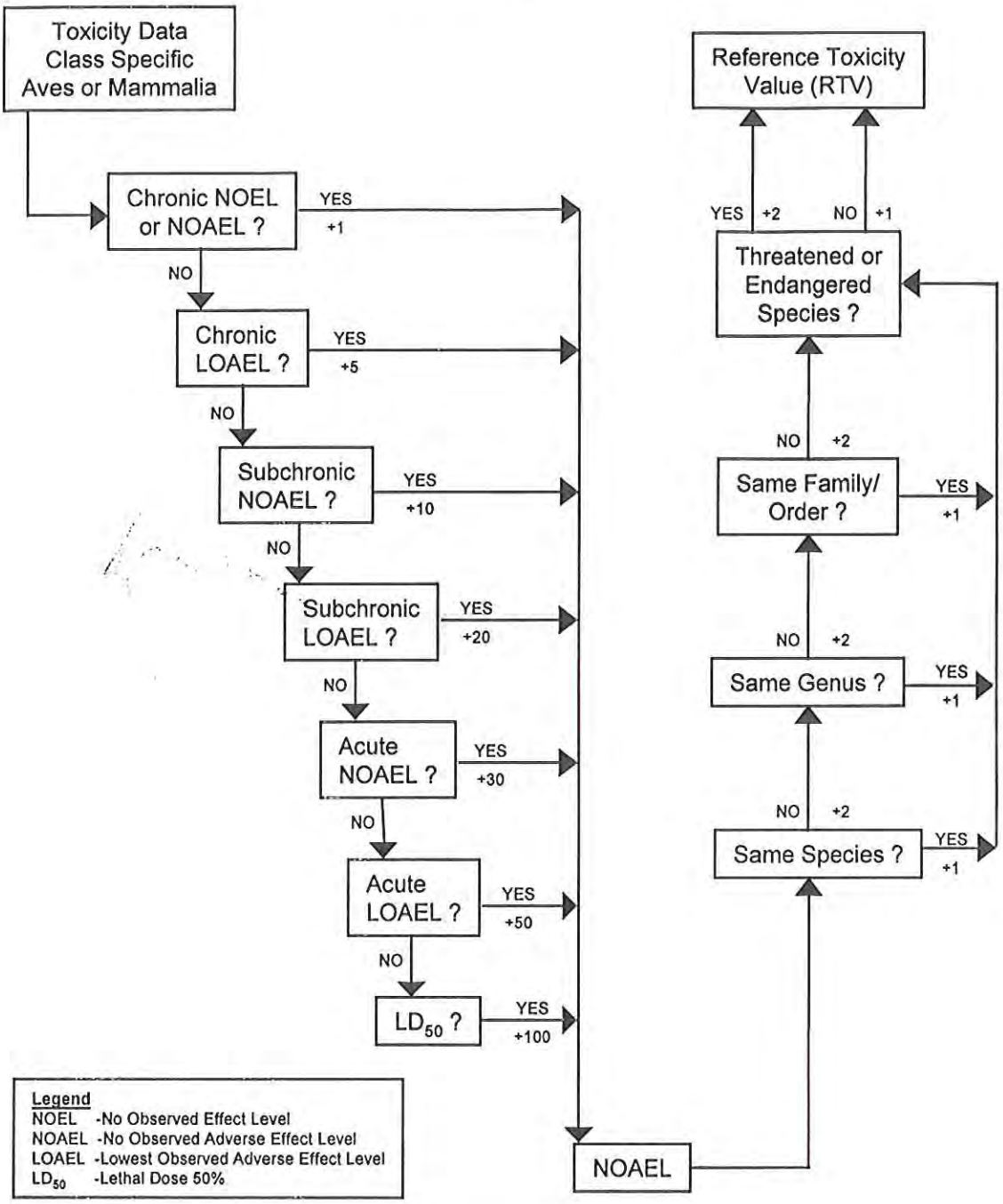
Simplified Aquatic Food Web Conceptual Site Model (CSM)
Plum Brook Ordnance Works, Ohio



Note: Raccoon also presented on terrestrial food web CSM.

Figure 6-13

Procedural Flow Chart for Deriving Reference Toxicity Values (RTVs) from Class-Specific Toxicity Data
Plum Brook Ordnance Works
Sandusky, Ohio



Credit: Adapted from *Tri-Service Procedural Guidelines for Ecological Risk Assessments*, 1996

c:\mweisberg\plumbrk\fig6-13.ppt

Final Report
Risk Assessment and Direct-Push Investigation of Red Water Pond Areas Former Plum Brook Ordnance Works Sandusky, Ohio

Volume II - Appendices

Submitted to:

Commander
U.S. Army Corps of Engineers
Nashville District
Post Office Box 1070
Nashville, Tennessee 37202-1070

IT Project No. 773701

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923

Revision 2

August 2000

APPENDIX A

HTRW DRILL LOGS AND GROUNDWATER SAMPLING LOGS

PRRP

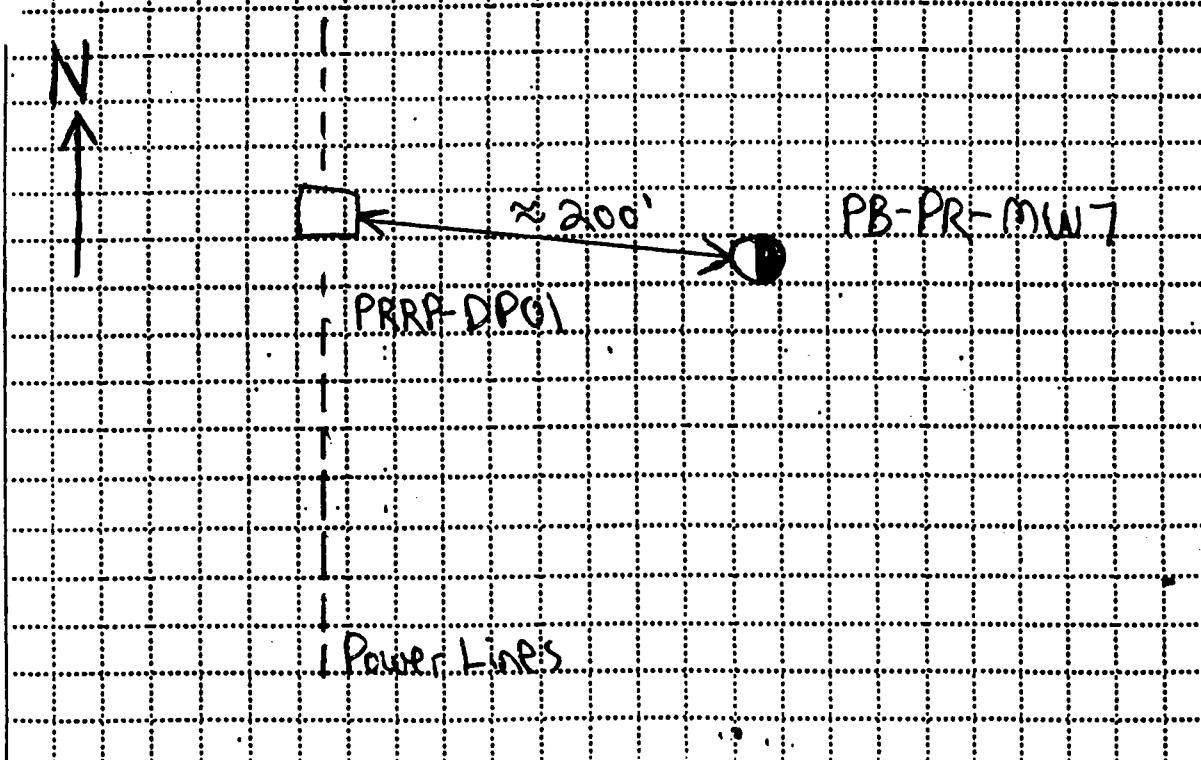
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP01
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo Environmental
SHEET / SHEETS	1 OF 3
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners (4' Long)
8. HOLE LOCATION	PRRP-DP01
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-11-98
11. DATE COMPLETED	6-11-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	≈5-6', 9-10', 10-12' Ft. BGS.
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC ✓ / TAL METALS ✓ / OTHER (SPECIFY) Nitroaromatics / OTHER (SPECIFY) SVOC's / OTHER (SPECIFY) PCB's
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	Grouted / BACKFILLED / MONITORING WELL / OTHER (SPECIFY) —
23. SIGNATURE OF INSPECTOR	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP01	624,939.62	1,918,740.53	630.39



PROJECT	PBOW - PRRP
HOLE NO	PRRP-DP01

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

PRRP-DP01

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP01

PROJECT: PBOW - PRRP

INSPECTOR: John Voegding

SHEET 2 OF 3 SHEETS

USCS Symbol (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Intervals (g)	REMARKS (h)
Pt/ml		0-0.5' Grass and Topsoil	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP01-7200-(0002)		Start Time 1230 End 1325
ml	1	0.5'-4' Soft, dark brown grading to light brown, low-med. Plasticity, Fine Sandy Silt and Sandy Clay, moist	NA			Push 1 3' Recovery	Hnu Meter Not Functioning Properly due to Atmospheric Moisture.
	2						
	3						
4'	4		4'		4	4'	
Cl	5	4'-8' Soft, brownish grey, med Plasticity, Clayey Silt and Clay, slightly wet (trace amount of free water)	NA	NA	PBOW-98-SO-PRRP-DP01-7210-(0406)	Push 2 4' Recovery	
	6						
	7						
	8		8'		8	8'	
	9	8'-12' Same as Above, med-high plasticity, wet from 9'-10'	NA		PBOW-98-SO-PRRP-DP01-7220-(080)	Push 3 (8'-12') 4' Recovery	
	10	Slightly wet from 10'-12'			10		

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP01

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP01

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Interval (g)	REMARKS (h)
Cl	11	10-12' See pg 1.	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12') 4' Recovery	
12'	12	12' Bottom of Boring at 12.0'					

PROJECT: PBOW - PRRP

HOLE NO. PRRP - DP01

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP02
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo - Environmental Drilling	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig.	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: PRRP - DP02	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-14-98	11. DATE COMPLETED: 6-14-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 8 Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

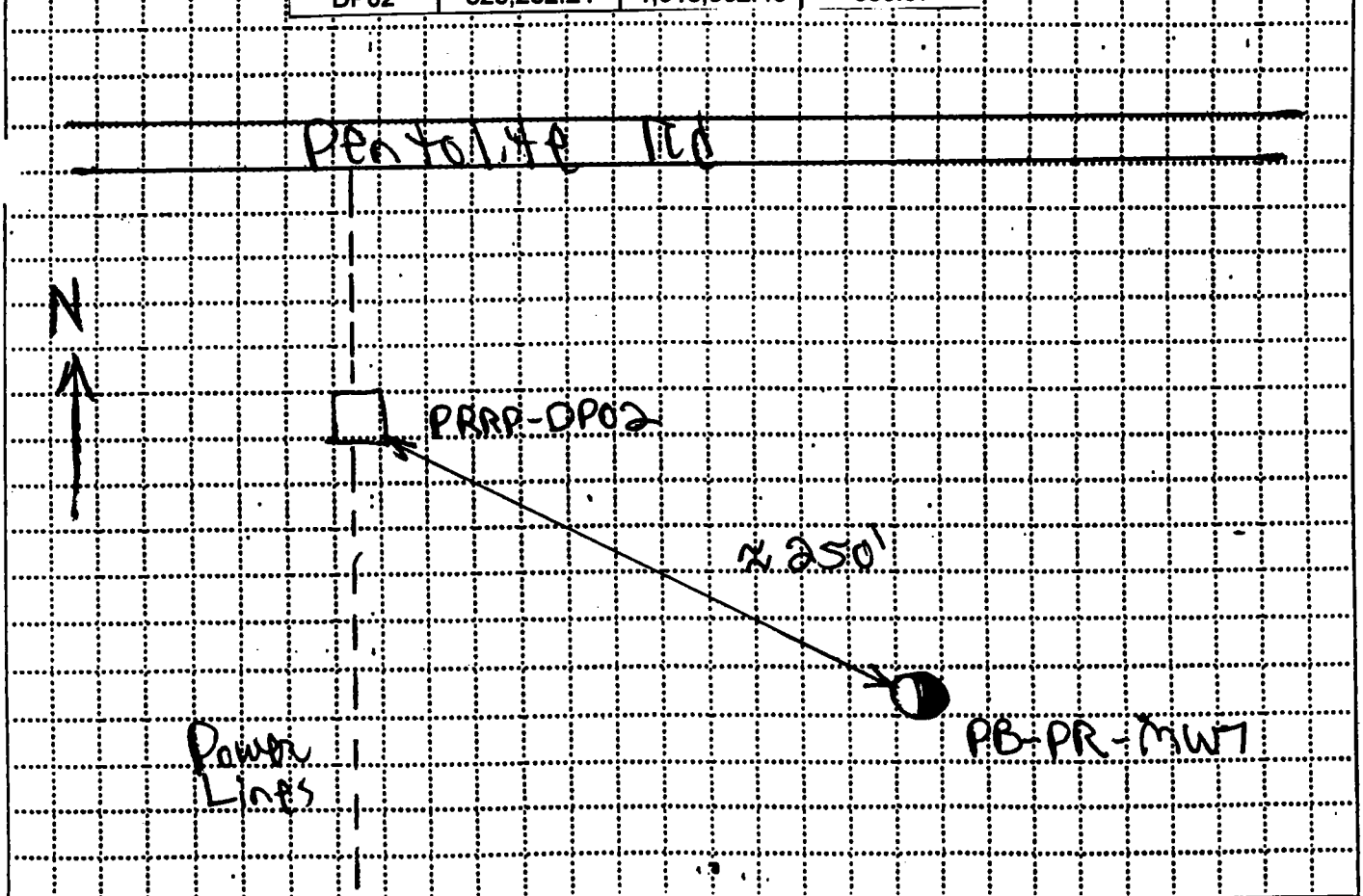
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogelin

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP02	625,232.21	1,918,802.48	630.37

SCALE: Not to Scale



PROJECT: PBOW - PRRP | HOLE NO.: PRRP-DP02

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP02

SHEET 2 OF 3 SHEETS

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 0745 End 0815
	1	0.5'-4' Soft-m. Firm, brown and grey, V. Firm, Sandy Silt and Clayey Silt, moist			PBOW-98-SO-PRRP-DP02-7240-(0002) 2'	Push 1 3.5' Recovery	
	2		NA				
	3						Hnu meter Readings are erratic due to Headspace moisture.
			4'		4'	4'	
Ml/Cl	4	4'-8' Same as Above, Clayey Silt and Clay med-high Plasticity, wet at 8'		NA	PBOW-98-SO-PRRP-DP02-7250-(0406) 6'	Push 2 4' Recovery	
	5						
	6		NA				
	7						
			8'		8'	8'	wet at 8'
	8	8'-12' Same as Above Grey, Clayey Silt and Clay, wet			PBOW-98-SO-PRRP-DP02-7260-(0810) 10'	Push 3 (8'-12') 4' Recovery	
	9		NA				
	10						

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP02

(Proponent: CECW-EG)

ENG FORM 5056A-R, AUG 94

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP02

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET [redacted] SHEETS 3 of 3

USCS, STRATA (a)

DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	[redacted] (g)	REMARKS (h)
11	10-12' See pg # 2	Headspace Hnu Readings NA	NA	NA	Sampling Intervals Push 3 (8-12')	Time Start 0745 End 0815
12	Bottom of Boring at 12.0 Ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP02

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP-

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP03
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners	8. HOLE LOCATION: PRRP-	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-8-98	11. DATE COMPLETED: 6-8-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 10.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): ~ 4.0 Ft.	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

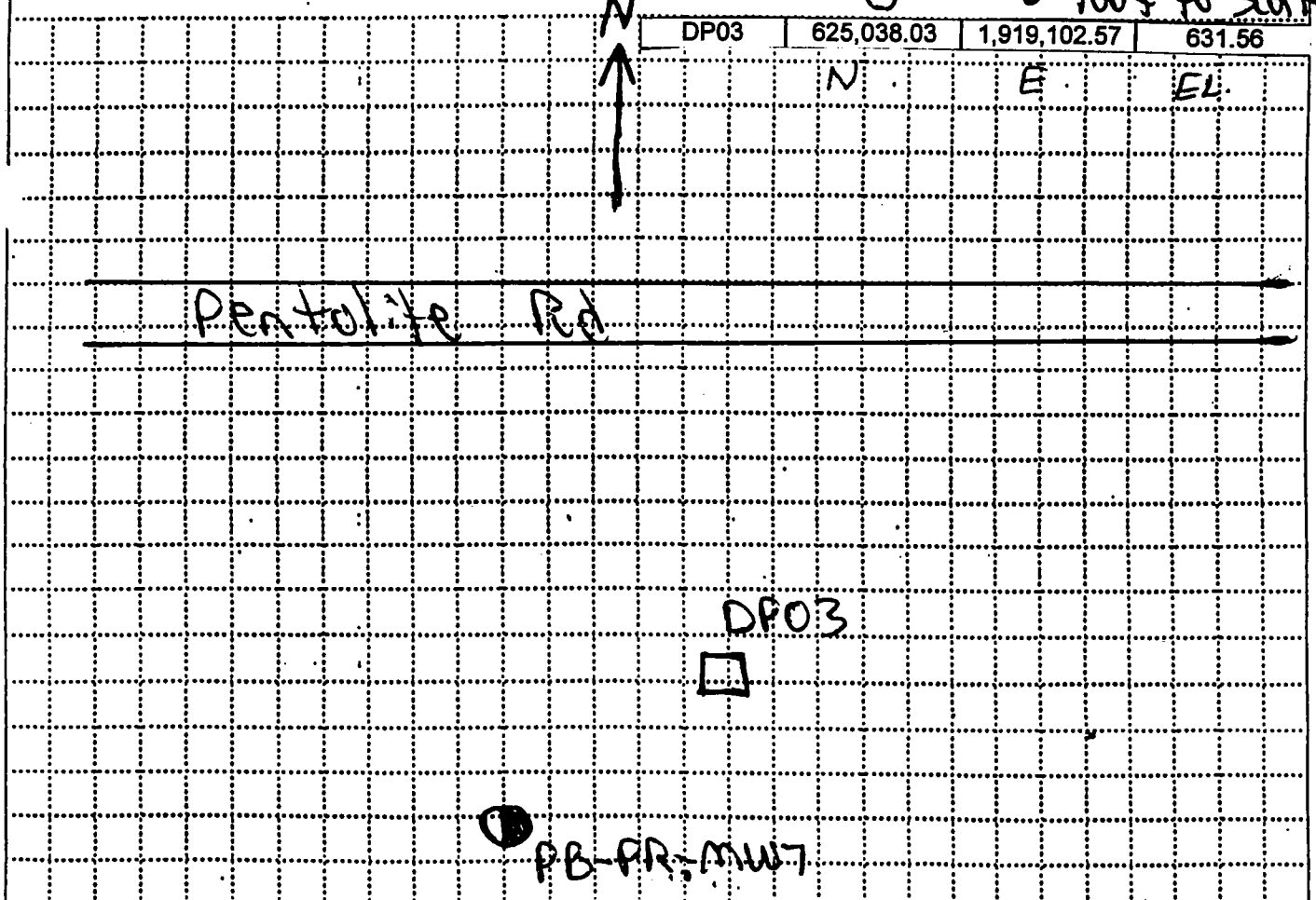
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogedin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

DP03	625,038.03	1,919,102.57	631.56
	N	E	EL



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP03

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP03

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 2 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Interval	REMARKS (h)
SC	1	0-3' Soft, brown and black, v. fine clayey Sand with 30% organic matter, moist	Headspace Hnu Readings		PBOW-98-50-PRRP-DP03-7280-(0002) 2'	Push 1	
	2		3.0 ppm				
	3	3'-4' Same as Above with No organic matter					
4'	4		4'		4'	4'	
SM	5	4'-7' loose, med. brown, v. fine-fine, Silty Sand, wet	2.5 ppm	NA	PBOW-98-50-PRRP-DP03-7290-(0106) 6'	Push 2	Wet from 4'-7'. (Perched Zone ?)
	6						
7'	7						
ML	8	7-8' Soft-Firm, brown and grey, low-med. Plasticity, v. fine Sandy Silt, moist	8'			8' Push 3	No Recovery from 8'-10' (soft soupy mush). Moved Rig 6" N and advanced borehole to 8' Sampled from 8'-10' No Recovery Again.
	9						
	10		10'				

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP03

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

Attempted to Sample From 10'-12'. Still No Recovery

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP04
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners	8. HOLE LOCATION: PRRP-	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-9-98	11. DATE COMPLETED: 6-9-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

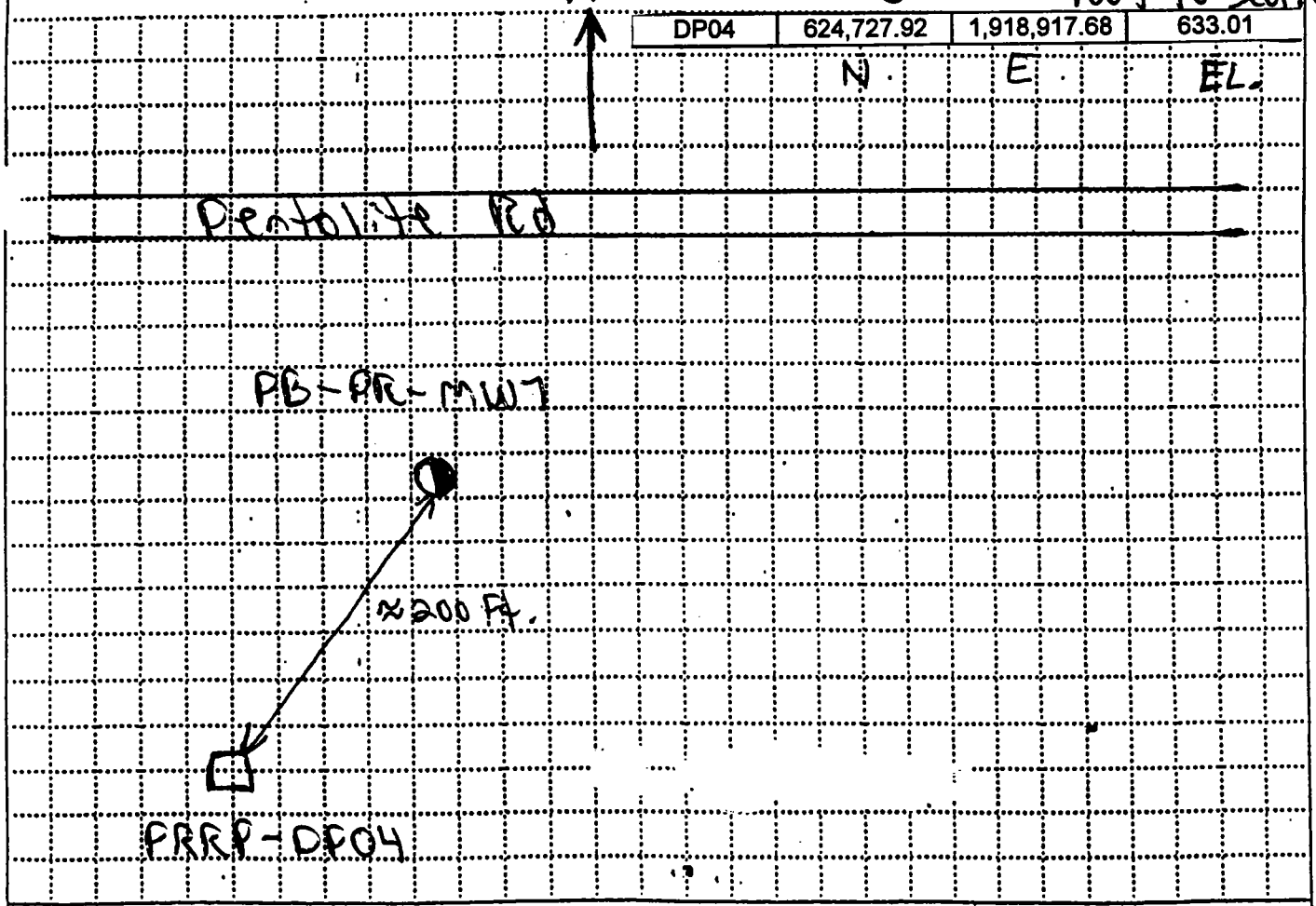
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Voydin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

DP04	624,727.92	1,918,917.68	633.01
	N.	E.	EL.



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP04

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP04

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	[redacted] Sample Interval	REMARKS (h)
Pt / SM	1	0'-1' Loose, dark brown - black, Fine Silty Sand and Topsoil, moist	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP04-7320-(0002) 2'		Time Start 1320 End 1400
SM / SC	2	1'-4' Loose, Med. brown and grey, v. Fine - Fine, Clayey Sand, moist	2.5 ppm			Push 1	
	3	3" perched water at 3.5'					
	4	4'-4.5' Same as Above	4'		4'	4'	
4.5'							
ML / CL	5	5'-8' Soft, brown and grey, low-med. Plasticity, v. Fine, Sandy Silt and Clay, moist with few perched water zones.	2.5 ppm	NA	PBOW-98-SO-PRRP-DP04-7330-(0406) 6'	[redacted] Push 2	
	6						
	7						
	8	8'-12' Same as Above with few 2"-3" Fine Sand zones throughout, wet at 8 ft.	8'			8'	
	9		2.0 ppm		PBOW-98-SO-PRRP-DP04-7340-(0810) 8' 10'	Push 3	
	10						

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP04

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP04

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 3 OF 3

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Interval	REMARKS (h)
ml/cl	11	See Page 2	(8'-12') 2.0 ppm	NA	NA	Push 3 (Cont.)	
		12.0'	12.0'			12'	
	12	Bottom of Boring at 12.0 ft.					

PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP04

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

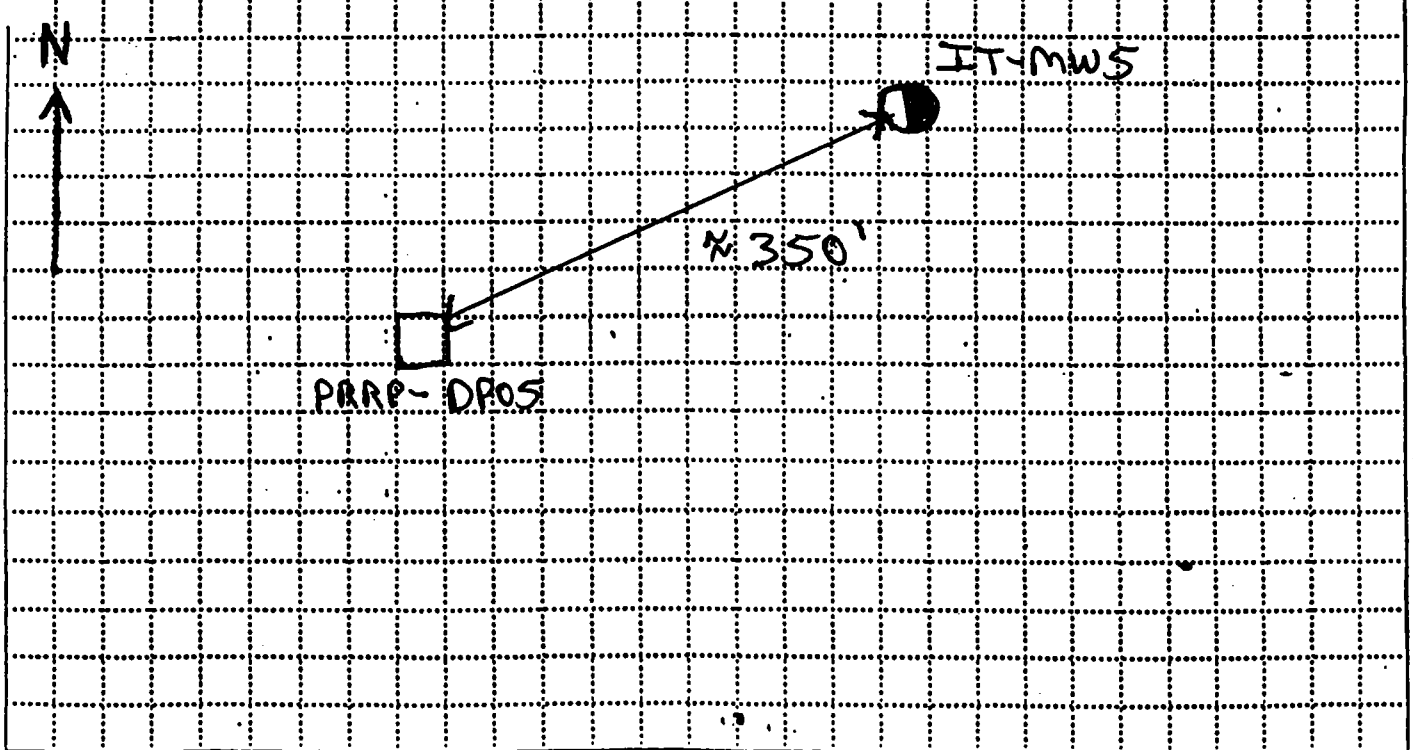
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP05
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo - Environmental Drilling
SHEET	1 OF 3 SHEETS
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig.
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	PRRP - DP05
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-14-98
11. DATE COMPLETED	6-14-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	~ 10 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC ✓ / TAL METALS ✓ / OTHER (SPECIFY) Nitroaromatics / OTHER (SPECIFY) SVOCs / OTHER (SPECIFY) PCBs
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED Grouted / MONITORING WELL — / OTHER (SPECIFY) —
23. SIGNATURE OF INSPECTOR	John Vogeding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP05	625,299.16	1,919,033.56	631.47



PROJECT PBOW - PRRP

HOLE NO. PRRP-DP05

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP05

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/SM		0-0.5' grass and Topsoil	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP05-7360-(0002)		Start 0930 End 1000
SM	1	0.5'-3' Loose, med. brown, V. Fine, Silty Sand, Dry.				Push 1 3.5' Recovery	
	2		NA				
3'	3	3'					
ML/CL	4	3'-4' Soft-M. Firm, brown and grey, V. Fine, Sandy Silt, Slightly moist.	4'		4'	4'	Hnu meter Readings erratic due to Headspace moisture.
	5	4'-8' Same As Above, Sandy Silt grading to Clayey Silt w/ Fine Sand Stringers, Very moist		NA	PBOW-98-SO-PRRP-DP05-7370-(0406)	Push 2 4' Recovery	
	6		NA		6'		
	7						
	8		8'		8'	8'	
Z	9	8'-12' Same As Above, Clayey Silt, high Plasticity, Grey from 10'-12' Trace Free water From 8.5-9 Ft.	NA		PBOW-98-SO-PRRP-DP05-7380-(0810)	Push 3 (8'-12') 4' Recovery	
	10				10'		

PROJECT: PBOW - PRRP

HOLE NO. PRRP - DP05

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP05

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET [redacted] SHEETS 3 of 3

(a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	[redacted] (g)	REMARKS (h)
			Headspace Hnu Readings			Sampling Intervals	Time
	11	10'-12' See pg 2.	NA 12'		NA	Push 3 (8'-12') 12'	Start 0930 End 1000
ml/Cl	12	12'-16' Same As Above Soft, grey, high Plasticity, Clayey Silt and Clay, v. moist - Slightly wet.	NA	NA	NA	Push 4 4' Recovery	
	13						
	14						
	15	16'	16'			16'	
	16	Bottom of Boring at 16.0 Ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - [redacted]

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

DP05

PRRP-

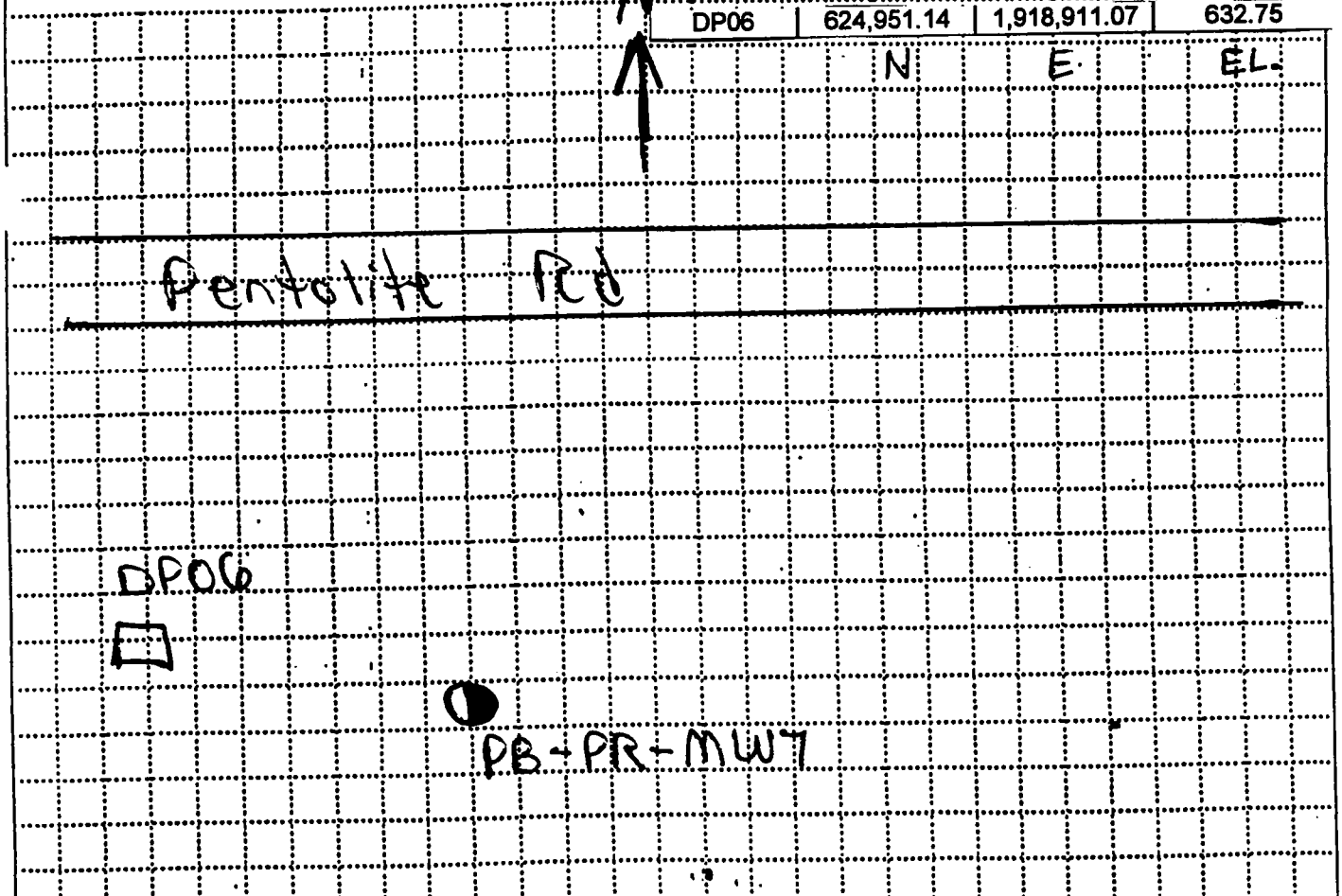
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP06
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo Environmental
SHEET / SHEETS	1 of 2
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' Long x 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners
8. HOLE LOCATION	PRRP-
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-8-98
11. DATE COMPLETED	6-8-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	Ft. BGS.
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	10.0 Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	≈ 8 Ft.
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC ✓
TAL METALS	✓
OTHER (SPECIFY)	Nitroaromatics
OTHER (SPECIFY)	SVOC's
OTHER (SPECIFY)	PCB's
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	Grouted
BACKFILLED	
MONITORING WELL	—
OTHER (SPECIFY)	—
23. SIGNATURE OF INSPECTOR	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

DP06	624,951.14	1,918,911.07	632.75
	N	E	EL.



PROJECT	PBOW - PRRP
HOLE NO.	PRRP-DP06

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP06

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 2 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Interval	REMARKS (h)
SM	1, 2, 3, 4	0-4' Loose, med. brown, v. fine-fine, silty sand, moist	Headspace Hnu Readings 0ppm 4'		PBOW-98-SO-PRRP-DP06-7400-(0002) 2' 4'	Push 1 4'	
ml	5, 6, 7, 8	4'-8' Soft-m. firm, brown and grey, low plasticity, v. fine, sandy silt, moist w/ few minor perched water zones.	0ppm 8'	NA	PBOW-98-SO-PRRP-DP06-7410-(0406) 6' 8'	Push 2 8'	▽ 8'
ml/cl	9, 10	8-10 Soft, grey, med-high plasticity, v. fine sandy silt and clay, wet at 8'	NA		PBOW-98-SO-PRRP-DP06-7420-(0806) 10'	Push 3 10'	Bottom of Boring at 10 ft.

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP06

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP-

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP07
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/ Acetate Liners	8. HOLE LOCATION: PRRP-	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-9-98	11. DATE COMPLETED: 6-9-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: 4-5 Ft and ≈ 8 Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

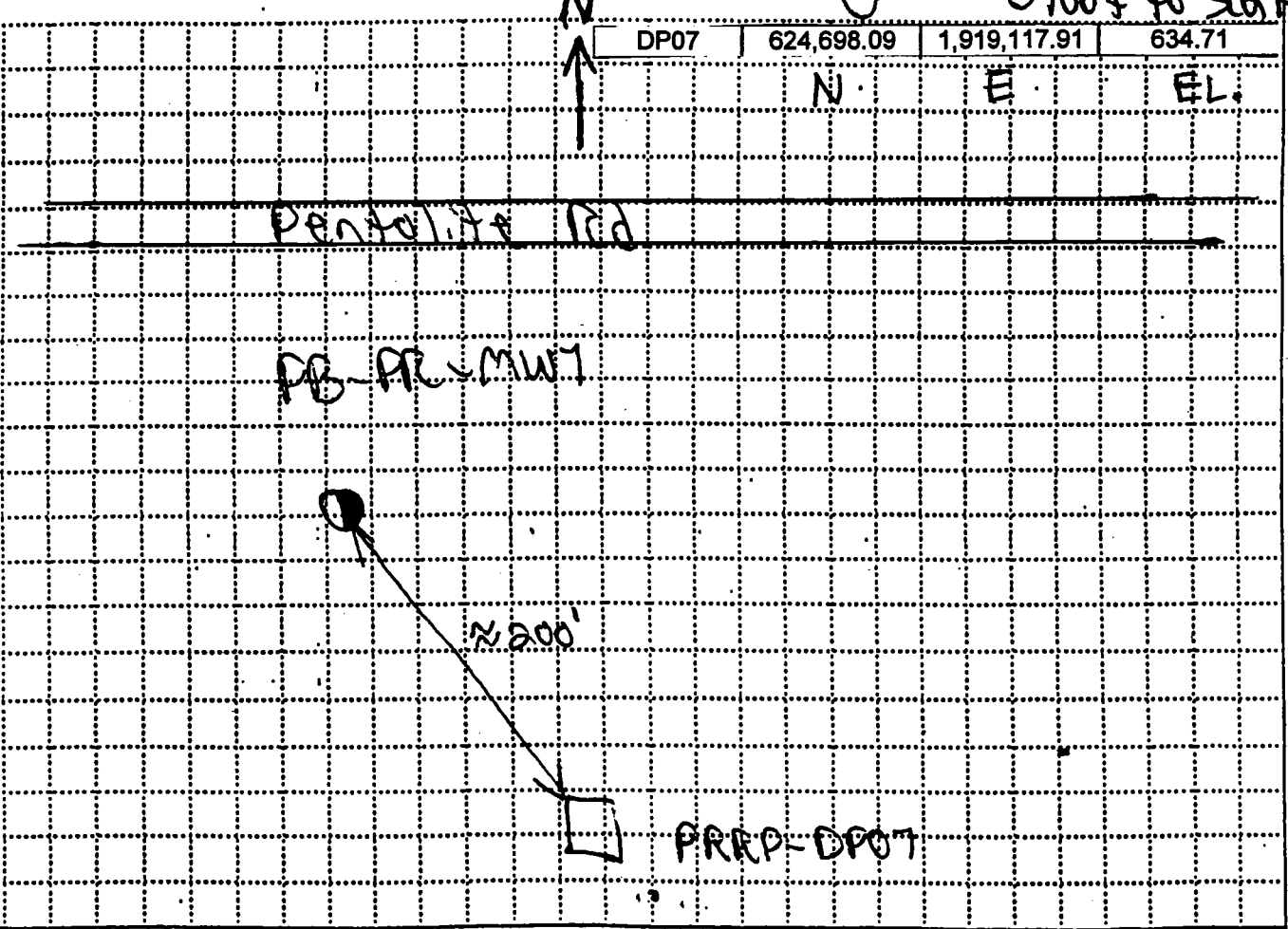
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—		John Vogelsang

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

DP07	624,698.09	1,919,117.91	634.71
	N	E	EL.



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP07

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER PRRP-DP07

PROJECT USCS

INSPECTOR John Voegding

SHEET 2 OF 3 SHEETS

SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Intervals (g)	REMARKS (h)
Sm/pt		0-0.5' Topsoil and grass	Headspace Hnu Readings				Start 1645 End 1715
Sm	1	0.5'-4' Loose, light-med. brown, Fine Sand, moist	2.8 ppm		PBOW-98-SO-PRRP-DP07-7440-(0002) 2'	Push 1 3' Recovery	
	2						
	3		4'		4'	4'	
	4	4-5' Same as Above, wet			PBOW-98-SO-PRRP-DP07-7450-(0406) 6'	Push 2 4' Recovery	wet From 4'-5'
	5	5'		NA			
ml/cl	6	5-8' Soft-M. Firm, brown, grading to grey, med. plasticity, v. Fine Sandy silt and clay, moist	2.8 ppm				
	7						
	8	8-12' Same as Above, Grey, v. Fine, Sandy Silt, moist - Slightly wet.	8' 2.8 ppm		8' PBOW-98-SO-PRRP-DP07-7460-(0810) 10'	8' Push 3 4' Recovery	Some wettness @ ≈ 8 ft.
	9						
	10						

PROJECT PBOW-PRRP

HOLE NO. PRRP-DP07

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP07

PROJECT: PBOW-PRRP

INSPECTOR: John Vogeding

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
n.l / cl	11	10-12' See pg. 2	2.8 ppm	NA	NA	Push #3 (8'-12') 4' Recovery	
	12	12.0'	12.0'				
		Bottom of Boring at 12.0 ft.					

PROJECT: PBOW-PRRP

HOLE NO. PRRP-DP07

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: PRRP-DP08
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: X 1.5" Geoprobe Sample Rods w/Acetate Liners (4' Long)	8. HOLE LOCATION: PRRP-DP08	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-10-98	11. DATE COMPLETED: 6-10-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ~3-4 Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

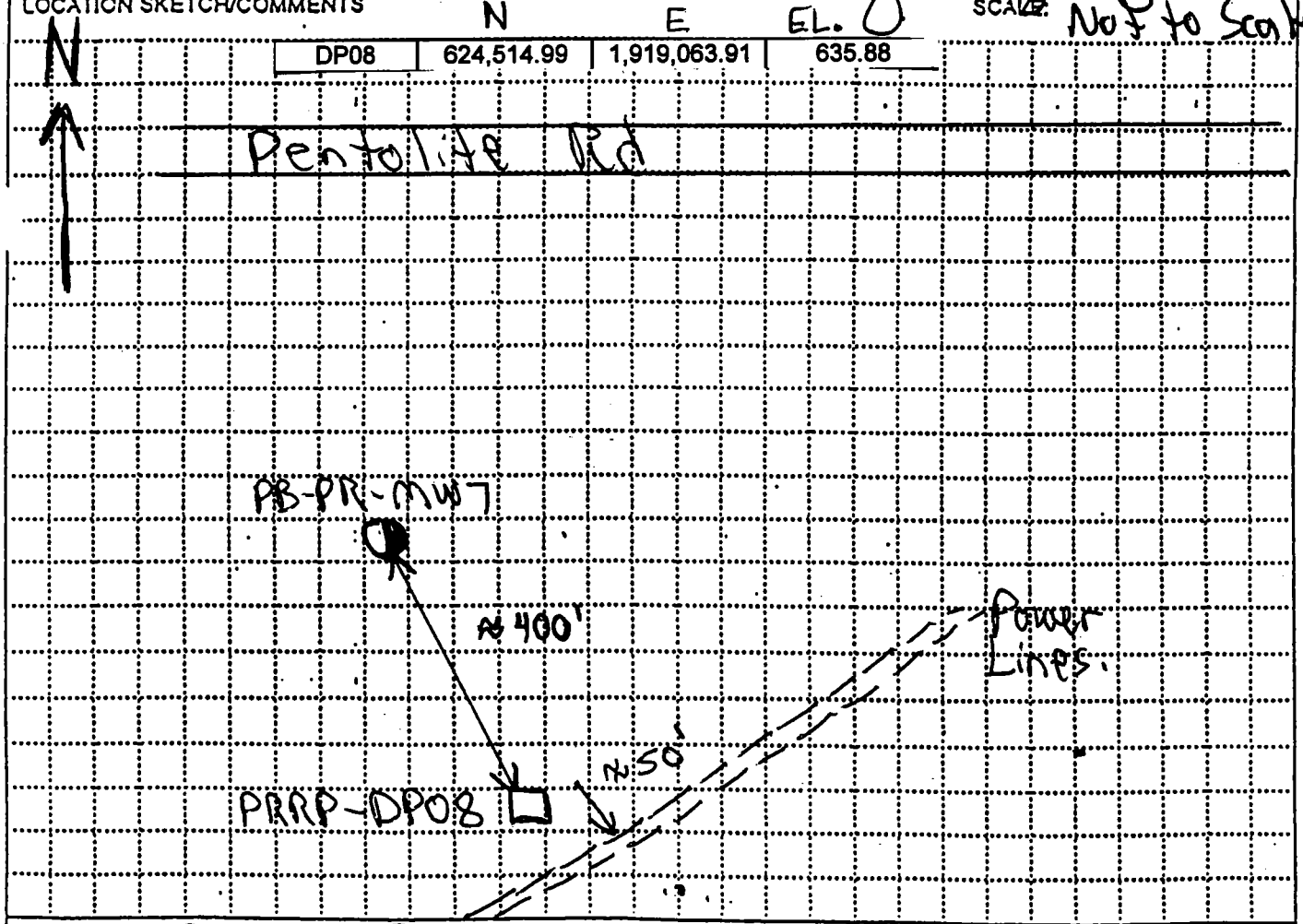
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

N	E	EL.
624,514.99	1,919,063.91	635.88

SCALE: Not to Scale



PROJECT: PBOW - PRRP | HOLE NO: PRRP-DP08

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP08

PROJECT: PBOW-PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	~~PROGRESS~~ Sample Intervals (g)	REMARKS (h)
Pt / SM		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 0930 End 1000
SM	1 2 3 4 5	0.5-4.0' Loose, med-reddish brown, Fine, Silty sand, moist wet from 3'-4'	12 ppm		PBOW-98-SO-PRRP-DP08-7480-(0002) 2'	Push 1 3' Recovery	
		4'-5.5' Same as Above, wet	4'	NA	4	4'	
5.5'		5.5'			PBOW-98-SO-PRRP-DP08-7490-(0406) 6'	Push 2	
ML / CL	6 7 8	5.5'-8' Soft, brown grading to grey, Low-med plasticity, V. Fine Sandy Silt and Clay, moist	8 ppm			4' Recovery	
			8'		8'	8'	
	9 10	8'-12' Same as Above ~~[illegible]~~, Soft-Firm, grey, Clayey Silt and Clay, very moist	10 ppm		PBOW-98-SO-PRRP-DP08-7500-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW-PRRP

HOLE NO. PRRP-DP08

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP08

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
md/cl 12'	11 12	10'-12' See pg 2	10 PPm 12'	NA	NA	Push 3 (8'-12') 4' Recovery	12'
		Bottom of Boring at 12.0 ft.					

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP08

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

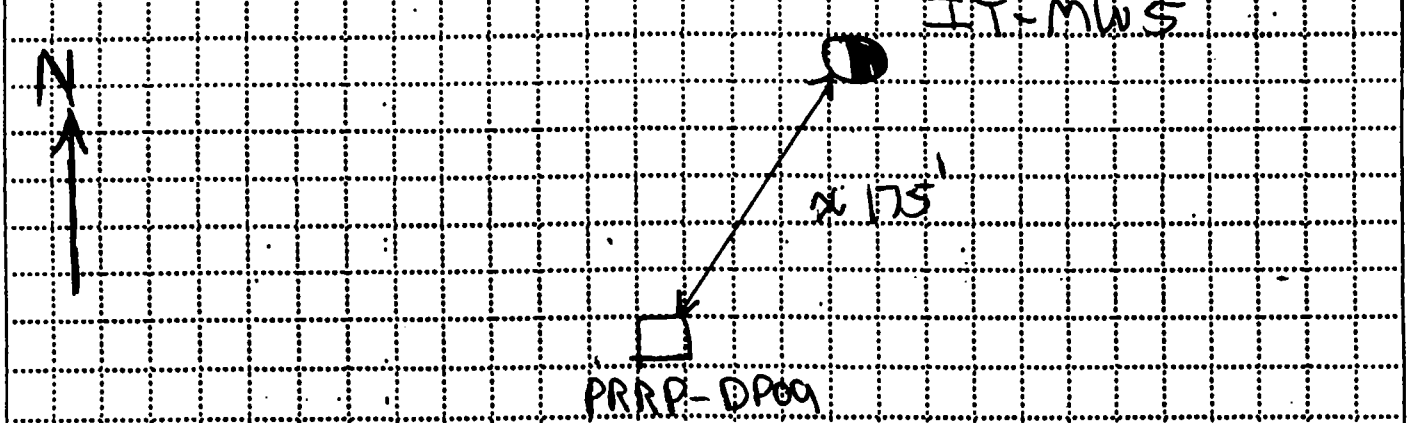
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP09
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo - Environmental Drilling
SHEET	1 OF 3 SHEETS
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig.
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	PRRP - DP09
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-14-98
11. DATE COMPLETED	6-14-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	~3 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	[redacted]
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC ✓ / TAL METALS ✓ / OTHER (SPECIFY) Nitroaromatics / OTHER (SPECIFY) SVOCs / OTHER (SPECIFY) PCBs
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED Grouted / MONITORING WELL — / OTHER (SPECIFY) —
23. SIGNATURE OF INSPECTOR	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP09	625,348.26	1,919,218.20	631.85



PROJECT PBOW - PRRP

HOLE NO. PRRP-DP09

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP09

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	EQUIPMENT (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings			Sampling Intervals	Time Start 1340 End 1445
	1 2	0.5'-4.0' Loose, med brown, Fine, Silty Sand, wet at 3 ft.	NA		PBOW-98-50-PRRP-DP09-7520-(0002) 2'	Push 1 Recovery 4'	
	3 4		4'		4'		
Sm	4 5 6	4'-8' Same as Above with few Clayey Silt Stringers at ≈ 4'-5.5', wet.	NA	NA	PBOW-98-50-PRRP-DP09-7530-(0406) 6'	Push 2 Recovery	
	7 8		8'		8'	8'	
ML/CL	9 10	8'-12' Soft, grey, med-high Plasticity, clayey Silt and clay, wet	NA		PBOW-98-50-PRRP-DP09-7540-(0810) 10'	Push 3 (8'-12') Recovery	

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP09

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP09

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 of 3

CS DO (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	(g) Sampling Intervals	REMARKS (h)	
ml / Cl	11	10'-12' See pg 2	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12')	Start End	Time 1340 1445
	12	Bottom of Boring at 12.0'						

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP09

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: PRRP-DP10
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods Diam. w/Acetate Liners	8. HOLE LOCATION: PRRP-DP10	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-10-98	11. DATE COMPLETED: 6-10-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 13.0 Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

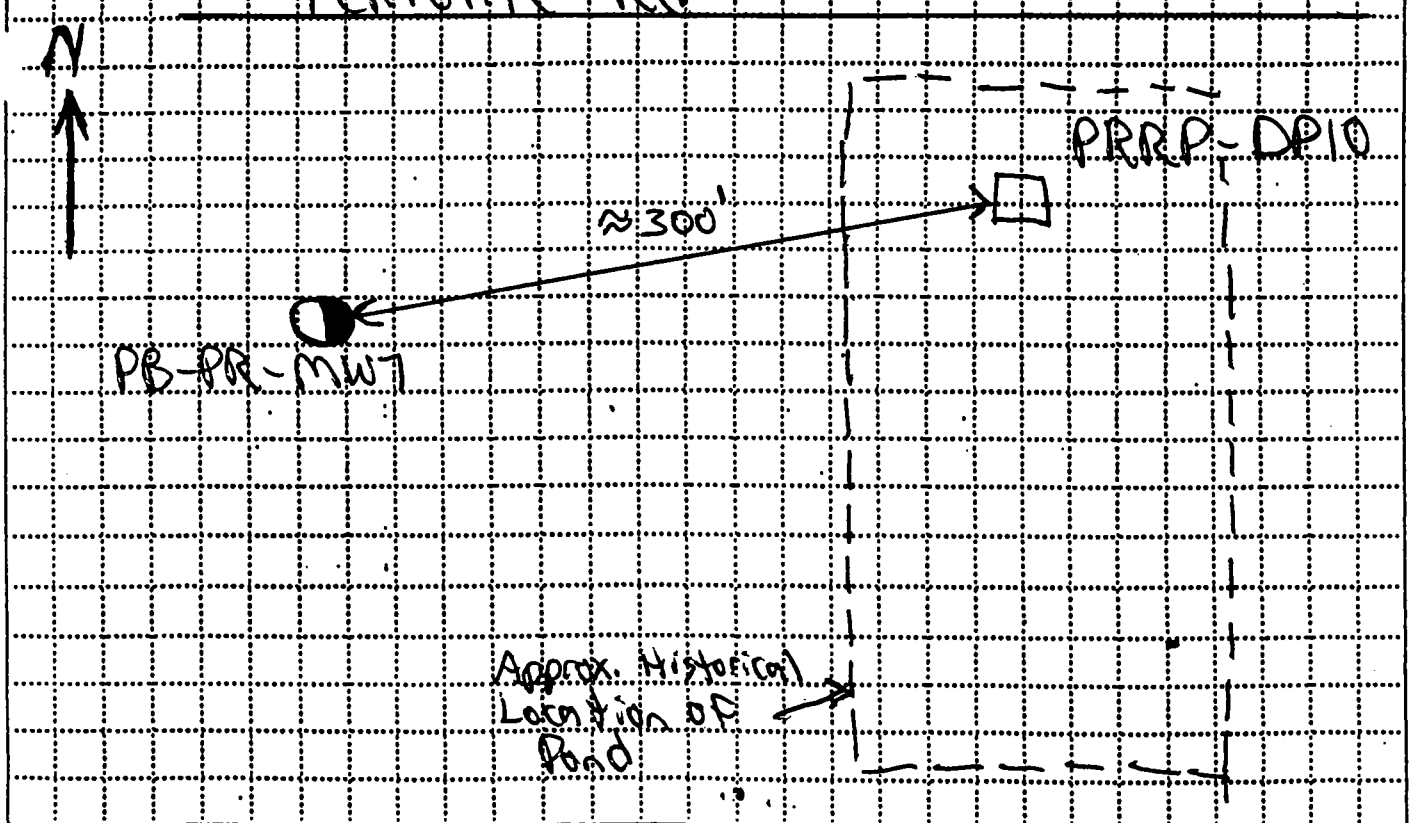
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogel

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP10	625,028.13	1,919,381.06	634.90

SCALE: Not to Scale



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP10

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP10

PROJECT: PBOW-PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3

SCS Symbol (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sample Intervals (g)	REMARKS (h)
PE 5m		0-0.5' grass + Topsoil.	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP10-7560-(0002)		
	1	0.5'-4' Loose, med. brown, Fine, Silty Sand, moist				Push 1	Start 1315 End 1400
	2		100 ppm		2'	4' Recovery	
	3		No odors or visible staining				
Sm	4		4'		4'	4'	
		4'-6' Same as Above, moist		NA	PBOW-98-SO-PRRP-DP10-7570-(0406)		
	5				6'	Push 2	
6'	6	6'	150 ppm			4' Recovery	Black (organic?) From 6-6.5 ft.
		6'-8' Soft-M. Firm, dark brown-black, low-med. Plasticity, v. Fine Sandy Silt and Silty Clay, moist.	No odors				
ml/cl	7				8'	8'	
	8		8'		PBOW-98-SO-PRRP-DP10-7580-(0810)	Push 3	
		8'-12' Same as Above moist-Slightly wet	50 ppm No odors			4' Recovery	
	9						
	10						

PROJECT: PBOW-PRRP

HOLE NO. PRRP-DP10

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP10

PROJECT: PBOW - PRRP

INSPECTOR: John Vegetina

SHEET 3 OF 3

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO (f)	BLOW COUNT (g)	REMARKS (h)
ml/cl	11	10'-12' - See page 1	Headspace HNU Readings 50 ppm			Push 3 (8'-12') 4' Recovery	
	12	12'	12'			12'	
Cl	13	12'-16' Soft-m. Firm, reddish brown-grey, med-high Plasticity, Silty Clay with occasional v. Fine Sand Stringers throughout. Wet at ≈ 13 Ft.	NA (Saturated)	NA	NA	Push 4 4' Recovery	reddish brown gW.
	14						
	15						
	16	16'	16'			16'	
		Bottom of Boring at 16.0 Ft.					

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP10

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

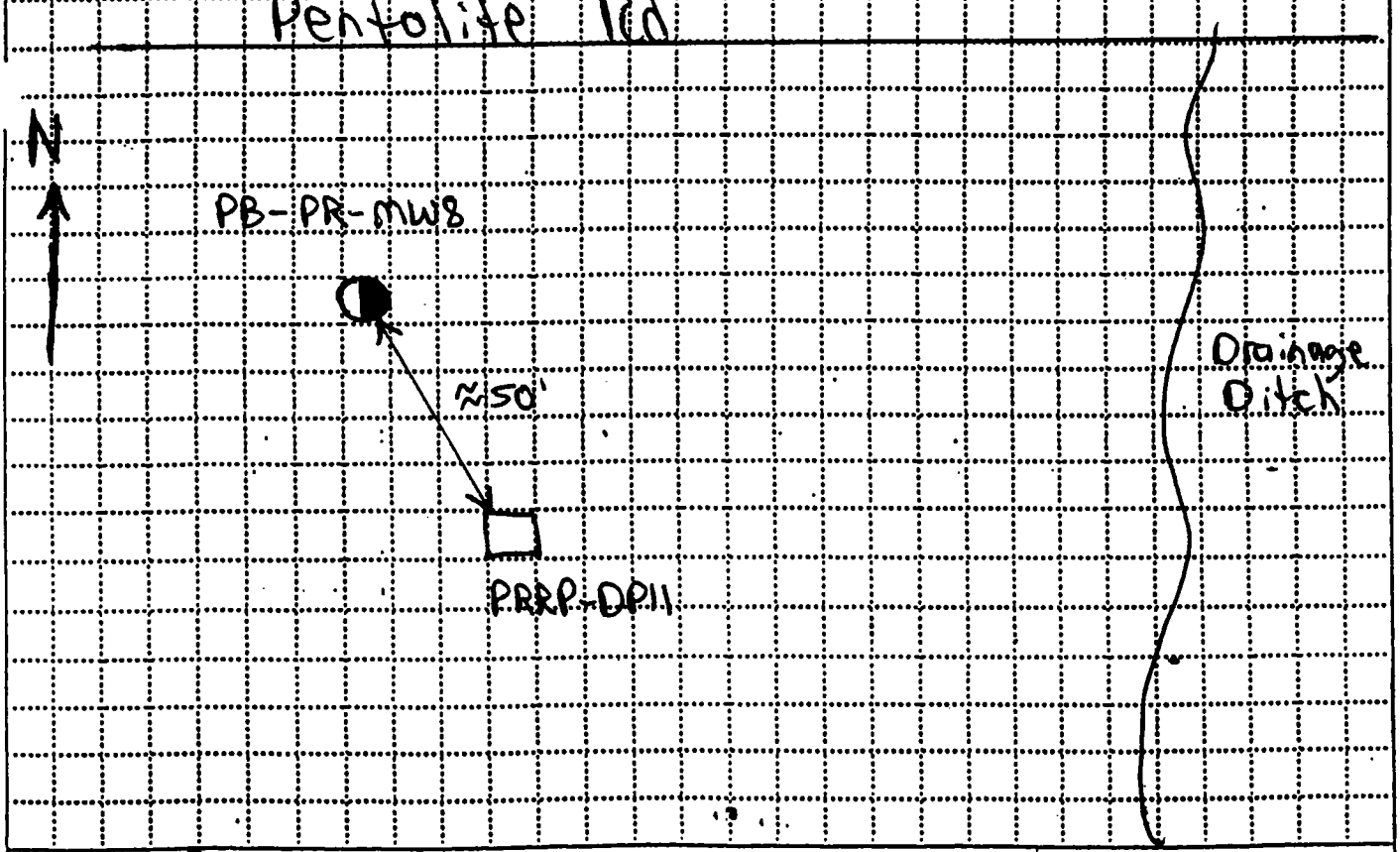
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP11
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo - Environmental Drilling
SHEET	1 OF 3 SHEETS
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig.
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	PRRP - DP11
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-13-98
11. DATE COMPLETED	6-13-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH DRILLED INTO ROCK	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft.
15. DEPTH GROUNDWATER ENCOUNTERED	~ 8 Ft. BGS
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC ✓ / TAL METALS ✓ / OTHER (SPECIFY) Nitroaromatics / OTHER (SPECIFY) SVOCs / OTHER (SPECIFY) PCBs
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED Grouted / MONITORING WELL — / OTHER (SPECIFY) —
23. SIGNATURE OF INSPECTOR	John Vogeding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
SB11	624,840.68	1,919,354.54	631.77



PROJECT PBOW - PRRP

HOLE NO. PRRP-DP11

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP11

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3

SCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ (g) Sampling Intervals	REMARKS (h)
Pt/Sm		[redacted] 0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 1535 End 1555
Sm	1	0.5'-2.0' Loose, med-dark brown, v. Fine Silty Sand, Dry.			PBOW-98-SO-PRRP-DP11-7600-(0002) 2'	Push 1 3' Recovery	
	2	2'-4' Soft, dark brown and grey, low plasticity, v. Fine Sandy Silt and Clayey Silt, moist.	NA 4'		4'	4'	
ML / Cl	3						
	4	4'-8' Same as Above, med-high Plasticity, v. Fine Sandy Silt and Clayey Silt and Clay, moist	NA	NA	PBOW-98-SO-PRRP-DP11-7610-(0406) 6'	Push 2 4' Recovery	
	5						
	6						
	7						
	8	wet at 8'	8'		8'	8'	
	9	8'-12' Same as Above, wet, w/ several thin v. Fine Sand Stringers throughout.	NA		PBOW-98-SO-PRRP-DP11-7620-(0810) 10'	Push 3 (8'-12') 4' Recovery.	
	10						

PROJECT: PBOW - PRRP

HOLE NO. PRRP - DP11

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP11

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3 SHEETS

SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~MOVEMENT~~ (g)	REMARKS (h)
ml / Cl	11	10'-12' See pg 1	Headspace Hnu Readings NA	NA	NA	Sampling Intervals Push 3 (8'-12')	Time Start 1535 End 1555
12'	12	12'				12'	

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP11

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN	HOLE NUMBER: DP12	
1. COMPANY NAME: I T Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods Diam. w/Acetate Liners	8. HOLE LOCATION: PRRP - DP12	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-11-98	11. DATE COMPLETED: 6-11-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 4 Ft. Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

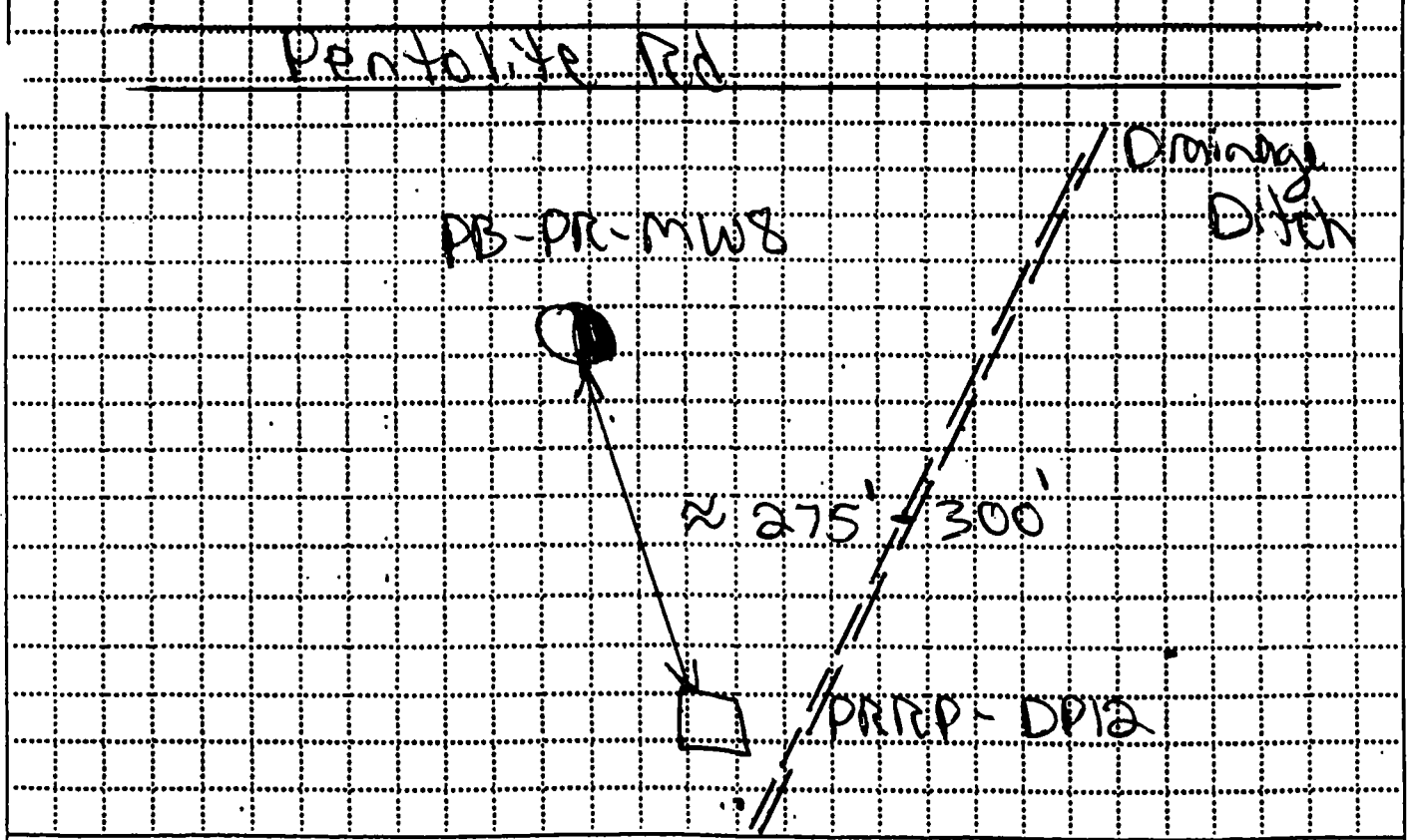
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—		John Vogel

LOCATION SKETCH/COMMENTS

N	E	EL.
624,592.96	1,919,301.87	631.10

SCALE: Not to Scale



PROJECT: PBOW - PRRP

HOLE NO: PRRP - DP12

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP12

PROJECT PBOW - PRRP

INSPECTOR John Voegding

SHEET 2 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP12-7640-(0002) 2'		Time Start 0820 End 0900
SC	1 2 3 4'	0.5'-4.0' Loose, brown and grey, V. Fine Silty and clayey Sand, moist 4'	NA 4'		4'	Push 1 3' Recovery 4'	Hnu meter Not Functioning Properly due to Atmospheric moisture. Slightly wet at ≈ 4' Some Free Water Present.
ml/cl	4 5 6 7 8	4'-8' Soft, brownish grey, med. Plasticity, Clayey Silt and clay, slightly wet, some Free water present.	NA 8'		PBOW-98-SO-PRRP-DP12-7650-(0406) 6' 8'	Push 2 4' Recovery 8'	
	9 10	8'-12' Soft-M. Firm, grey, med-high plasticity, Clayey silt and clay, very moist - slightly wet.	NA		PBOW-98-SO-PRRP-DP12-7660-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP12

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP12

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~BLOWCOUNT~~ Sample Intervals	REMARKS (h)
ML/CL	11	10'-12' See Pg 2	Headspace HNU Readings			Push 3 (8'-12')	
			NA	NA	NA	4' Recovery	
12'	12	12'					
		Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP12

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN	HOLE NUMBER: DP13	
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 [redacted] OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long x 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners	8. HOLE LOCATION: PRRP - DP13	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-12-98	11. DATE COMPLETED: 6-12-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 5-5.5' and 8'-9' Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

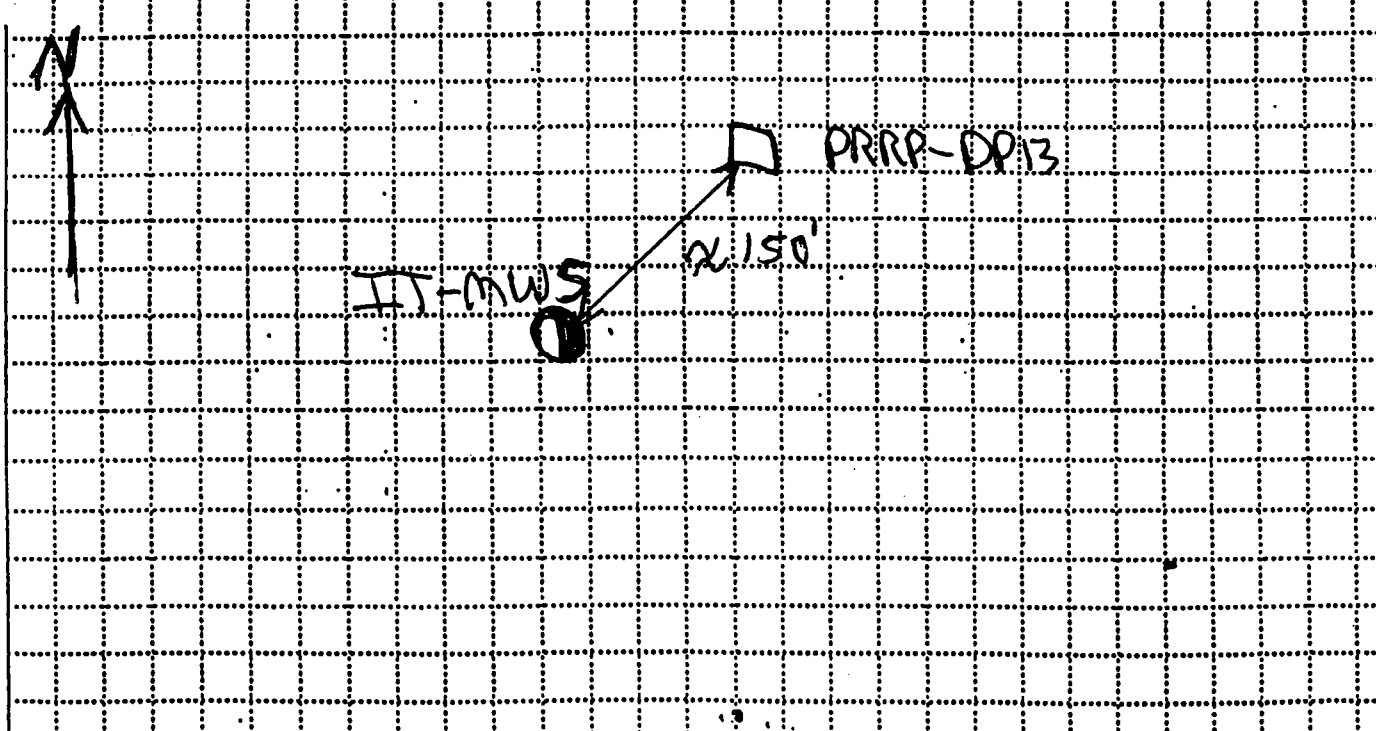
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP13	625,442.21	1,919,550.70	633.36



PROJECT	HOLE NO.
PBOW - PRRP	PRRP-DP13

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP13

PROJECT PBOW - PRRP | INSPECTOR John Vogeding | SHEET 2 OF 3 SHEETS

SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass + Topsoil	Headspace Hnu Readings				Time Start 1030 End 1100
Sm	1 2 3	0.5'-4' Loose, light brown, Fine, Silty Sand, dry - Slightly moist	NA		PBOW-98-SO-PRRP-DP13-7680-(0002) 2' 4'	Push 1 3' Recovery 4'	Hnu meter not working due to high humidity
	4 5	4-5.5' Same as Above, wet from 5-5.5' 5.5'	NA	NA	PBOW-98-SO-PRRP-DP13-7690-(0608) 6' 8'	Push 2 4' Recovery 8'	4'-8' Several trace perched water zones
ml 5.5'	6 7	5.5'-7' Soft, med. brown, V. Fine, Sandy Silt, moist 7'	NA				
SM 7'	8 9	7'-8' Loose, med. brown, V. Fine, Silty Sand, moist - Slightly wet. 8'-9' Same as Above, wet 9'	NA	8'	PBOW-98-SO-PRRP-DP13-7700-(0810) 10'	Push 3 (8'-12') 4' Recovery	
ml	10	9'-12' Soft, grey, low plasticity, V. Fine Sandy Silt, moist - Slightly wet.					

PROJECT PBOW - PRRP | HOLE NO. PRRP - DP13

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP13

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET [redacted] SHEETS 3 of 3

SCS SOIL BOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~INCREMENT~~ (g) Sampling Intervals	REMARKS (h)
		10'-12' See pg 1	Headspace Hnu Readings NA				Time
ML	11			NA	NA	Push 3 (8'-12') 4' Recovery	Start 1030 End 1100
12'	12	12'				12'	
		Bottom of Boring at 12.0'					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP13

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN	HOLE NUMBER: DP14	
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners	8. HOLE LOCATION: PRRP - DP14	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-11-98	11. DATE COMPLETED: 6-11-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 4-5' and 8-9' Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

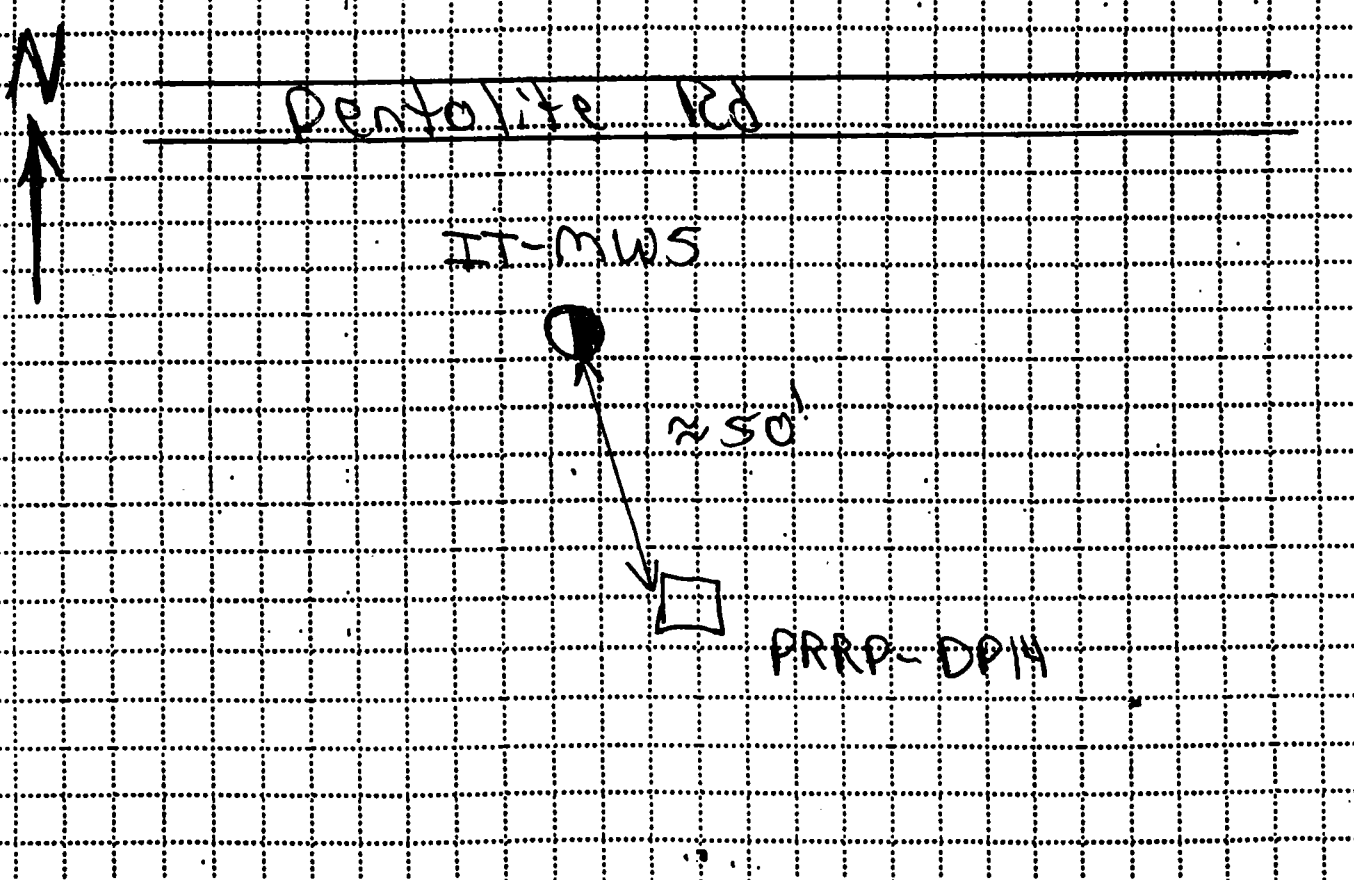
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP14	625,286.03	1,919,485.76	630.96



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP14

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP-

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP14

PROJECT PBOW-PRRP

INSPECTOR John Vogelin

SHEET 2 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sample Interval (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil			PBOW-98-SO-PRRP-DP14-7220-(0002)		Start Time 1615 End 1650
Sm/SC	1	0.5'-4' Loose, medium brown and grey, v. Fine Silty Sand grading to clayey sand, moist-slightly wet.				Push 1	
	2					3' Recovery	Hnu meter Not Functioning Properly due to Atmospheric moisture.
	3						
4.5'	4	4'-4.5' Same as Above			4'	4'	
Ml/Cl	5	4.5'-8' Soft, med brown grading to grey, low-med. plasticity, v. Fine Sandy Silt and Silty Clay, moist.-slightly wet	NA	NA	PBOW-98-SO-PRRP-DP14-7230-(0406) 6'	Push 2	
	6					4' Recovery	Trace amount of free water from 4'-5' and 8'-9'
	7						
	8	8'-12' Soft, grey, v. fine Sandy Silt and Clay (As Above), moist-slightly wet			8'	8'	
	9				PBOW-98-SO-PRRP-DP14-7240-(0810) 10'	Push 3 (4'-12')	
	10					4' Recovery.	

PROJECT PBOW-PRRP

HOLE NO. PRRP-DP14

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP14

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3 SHEETS

USCS 5/2001

(a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~REPRESENT~~ Sample Intervals (g)	REMARKS (h)
		10'-12' See pg 1				Push 3 (8'-12') 4' Recovery	
	11						
						12'	
ml / Cl	12	12'-16' Grey, Silty Clay as Above, moist.	NA	NA	NA		
	13					Push 4	
	14					4' Recovery	
	15						
16'	16					16'	
		Bottom of Boring at 16.0'					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP14

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	DISTRICT: Nashville - TN
		HOLE NUMBER: DP15
		SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners (4' Long)	8. HOLE LOCATION: PRRP - DP15	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-12-98	11. DATE COMPLETED: 6-12-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 3.5' - 4' Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

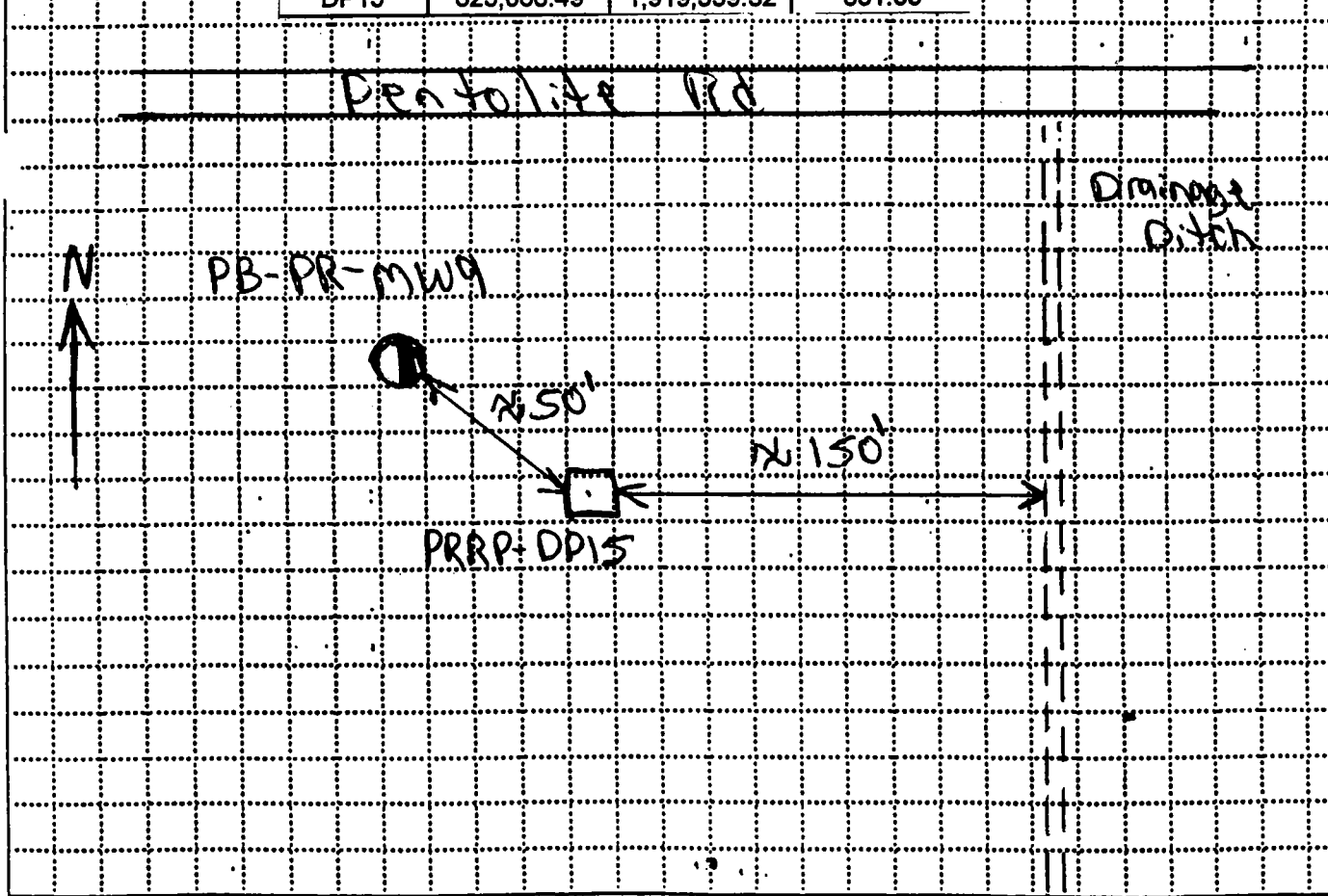
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

N	E	El.
625,066.49	1,919,559.32	631.05



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP15

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP15

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

SCS, ~~USCS~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	~~INCREMENT~~ (g) Sampling Intervals	REMARKS (h)
Pt/Sm		0-0.5' grass + topsoil	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP15-7760-(0002)		Time Start 1300 End 1320
ml/Cl	1	0.5'-3.5' Soft, brown and grey, med Plasticity, V. Fine Sandy Silt and clayey Silt, moist			2'	Push 1	
	2		NA			3' Recovery	Hnu Meter Not Working due to very high humidity
	3						
Sm	4	3.5'-4' Loose, brown, Fine, Silty Sand, wet	4'		4'	4'	
ml/Cl	5	4'-8' Soft-M. Firm, brownish grey, low-med. Plasticity, V. Fine Sandy Silt and clayey Silt, moist-Slightly wet (Trace amounts of free water)	NA	NA	PBOW-98-SO-PRRP-DP15-7770-(0406)	Push 2	
	6				6'	4' Recovery	
	7						
	8		8'		8'	8'	
	9	8'-12' Same as Above with numerous thin fine Sand stringers throughout.	NA		PBOW-98-SO-PRRP-DP15-7780-(0810)	Push 3 (8'-12')	
	10				10'	4' Recovery	

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP15

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP15

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3

CS, ~~BOL~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~DISTURBANCE~~ (g) Sampling Intervals	REMARKS (h)
m.l / Cl	11	10'-12' See pg 1	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12') 4' Recovery	Start Time 1300 End 1320
12'	12	Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP15

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP16
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods Diam. w/ Acetate Liners	8. HOLE LOCATION: PRRP - DP16	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-12-98	11. DATE COMPLETED: 6-12-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ~ 8-12 Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

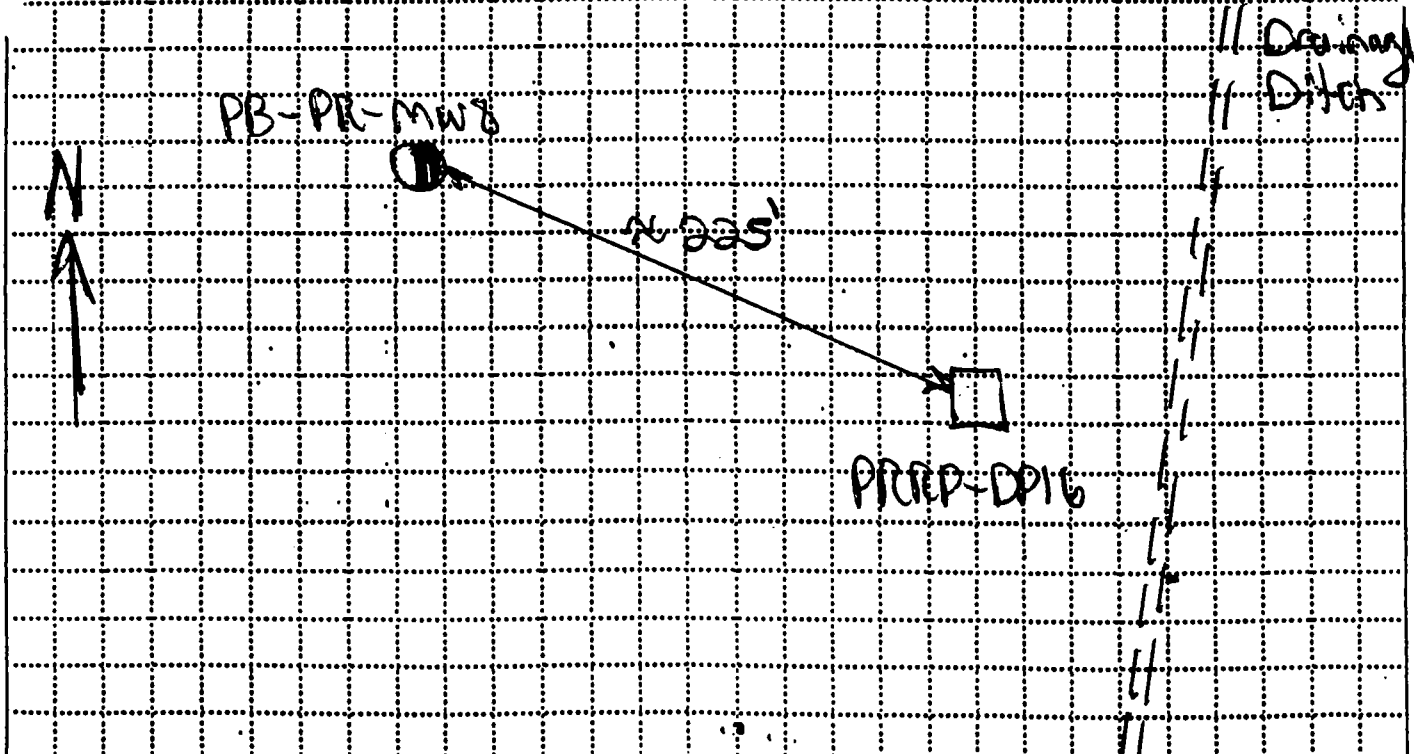
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogelding

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP16	624,825.74	1,919,459.48	632.35

SCALE: Not to Scale



PROJECT: PBOW - PRRP

HOLE NO: PRRP - DP16

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP16

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 2 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
PL/SM		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 1600 End 1630
SM	1 2 3 4	0.5'-4' Loose-m. Dense, med brown grading to dark brown, V. Fine Silty Sand, Dry.	NA		PBOW-98-SO-PRRP-DP16-7800-(0002) 2'	Push 1 4' Recovery	Hnu meter Not working due to high humidity
4.5'		4'-4.5' Same as Above	4'		4'	4'	
ml	5 6 7	4.5'-8' Soft-m. Firm, brownish grey, low Plasticity, V. Fine Sandy Silt, trace clay, dry-Slightly moist	NA	NA	PBOW-98-SO-PRRP-DP16-7810-(0406) 6'	Push 2 2.5' Recovery	
8'	8	8'	8'		8'	8'	
cl	9 10	8'-12' Soft-m. Firm, grey, med-high Plasticity, Silty Clay, moist-Slightly wet.	NA		PBOW-98-SO-PRRP-DP16-7820-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP16

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP16

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET [redacted] SHEETS 3 of 3

SCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	[redacted] (g)	REMARKS (h)
			Headspace Hnu Readings			Sampling Intervals	Time
	11	10'-12' See pg 1	NA 12'			Push 3 (8'-12') 4' Recovery 12'	Start 1600 End 1630
	12	12'-16' Same as Above					
Cl	13	Soft-Firm, grey, high Plasticity, Silty Clay w/ Few well rounded gravel (Till), moist.	NA	NA	NA	Push 4 4' Recovery	
	14						
	15						
16'	16		16'			16'	
		Bottom of Boring at 16.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP16

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: PRRP-DP17
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long x 1.5" Diam. Geoprobe Sample Rods w/Acetate Liners	8. HOLE LOCATION: PRRP-DP17	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-10-98	11. DATE COMPLETED: 6-10-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈5 Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

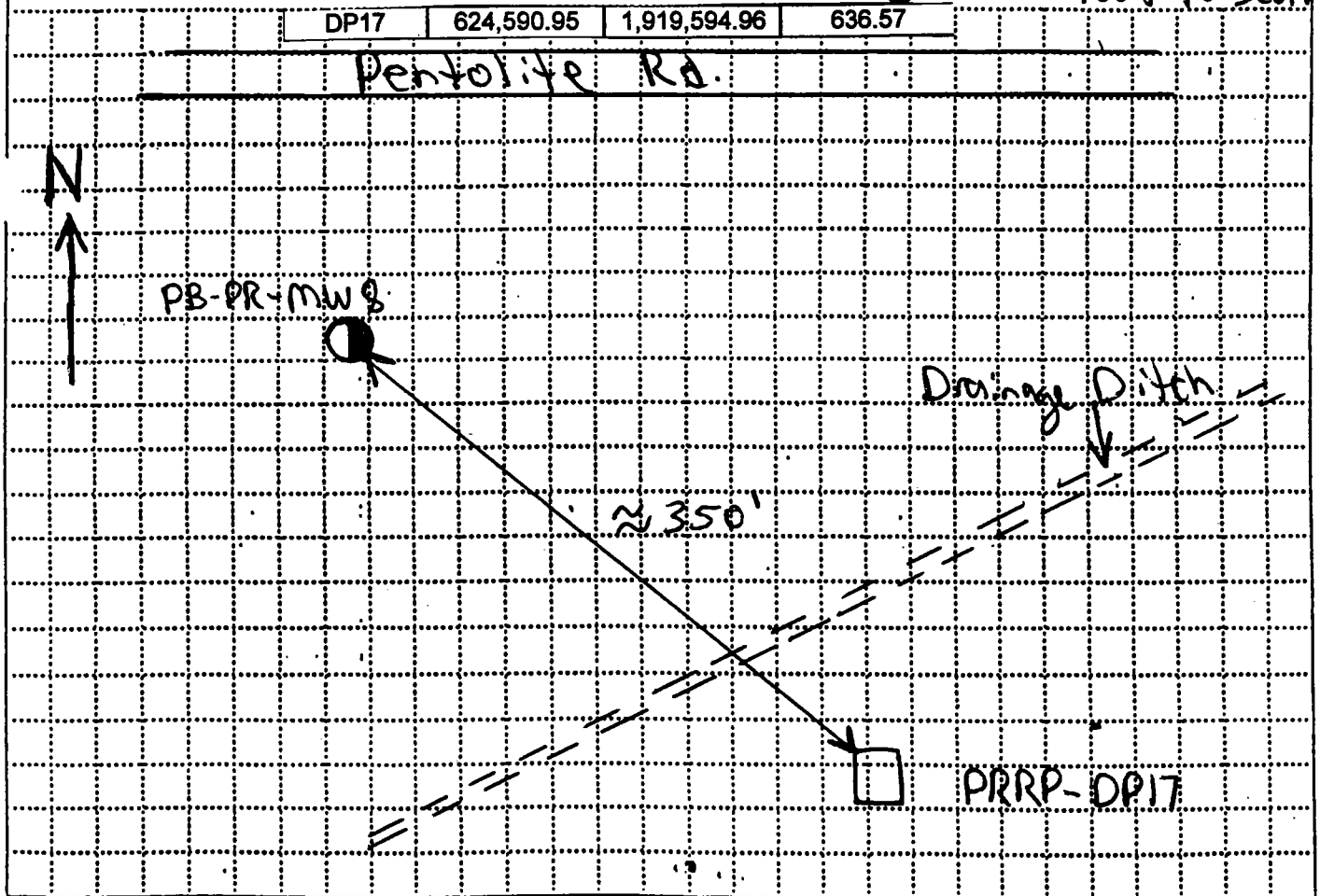
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—		John Vogelding

LOCATION SKETCH/COMMENTS

N	E	EL.
624,590.95	1,919,594.96	636.57

SCALE: Not to Scale



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP17

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: PRRP-DP17

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3

USCS Symbol (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sample Intervals (g)	REMARKS (h)
		0-0.5' grass and Topsoil	Headspace Hnu Readings		PBOW-98-SO-PRRP-DP17-7840-(0002)		Time Begin 1645 End 1715
	1	0.5-4' Loose, light reddish-orangish brown, Fine, Silty Sand, Dry - Slightly moist				Push 1	
	2		NA			3' Recovery	
	3						Hnu meter Not Functioning Properly due to atmospheric moisture.
	4		4		4	4'	
SM	5	4-8' Same as Above, Brown grading to grey, Fine Silty Sand, wet at ≈ 5.0 Ft		NA	PBOW-98-SO-PRRP-DP17-7850-(0406)	Push 2	
	6		NA		6	4' Recovery	
	7						
	8		8'		8	8'	
	9	8'-11' Same as Above, grey, v. Fine, Silty Sand, wet	NA		PBOW-98-SO-PRRP-DP17-7860-(0810)	Push 3 (8-12') 4' Recovery	
	10				10		

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP17

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER PRRP-DP 17

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sample Intervals (g)	REMARKS (h)
SM	11'	10'-11' See pg 2. 11'	Headspace Hnu Readings	NA	NA	Push 3 (8'-12')	
ML/CL	12	11'-12' Soft, grey, med Plasticity, clayey Silt, wet 12'	12'			4' Recovery	
		Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP-DP17

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP18
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: X 1.5" Geoprobe Sample Rods w/ Acetate Liners (4' Long, Diam.)	8. HOLE LOCATION: PRRP - DP18	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-11-98	11. DATE COMPLETED: 6-11-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈4-5.5' and 8-10' Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES: NA	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

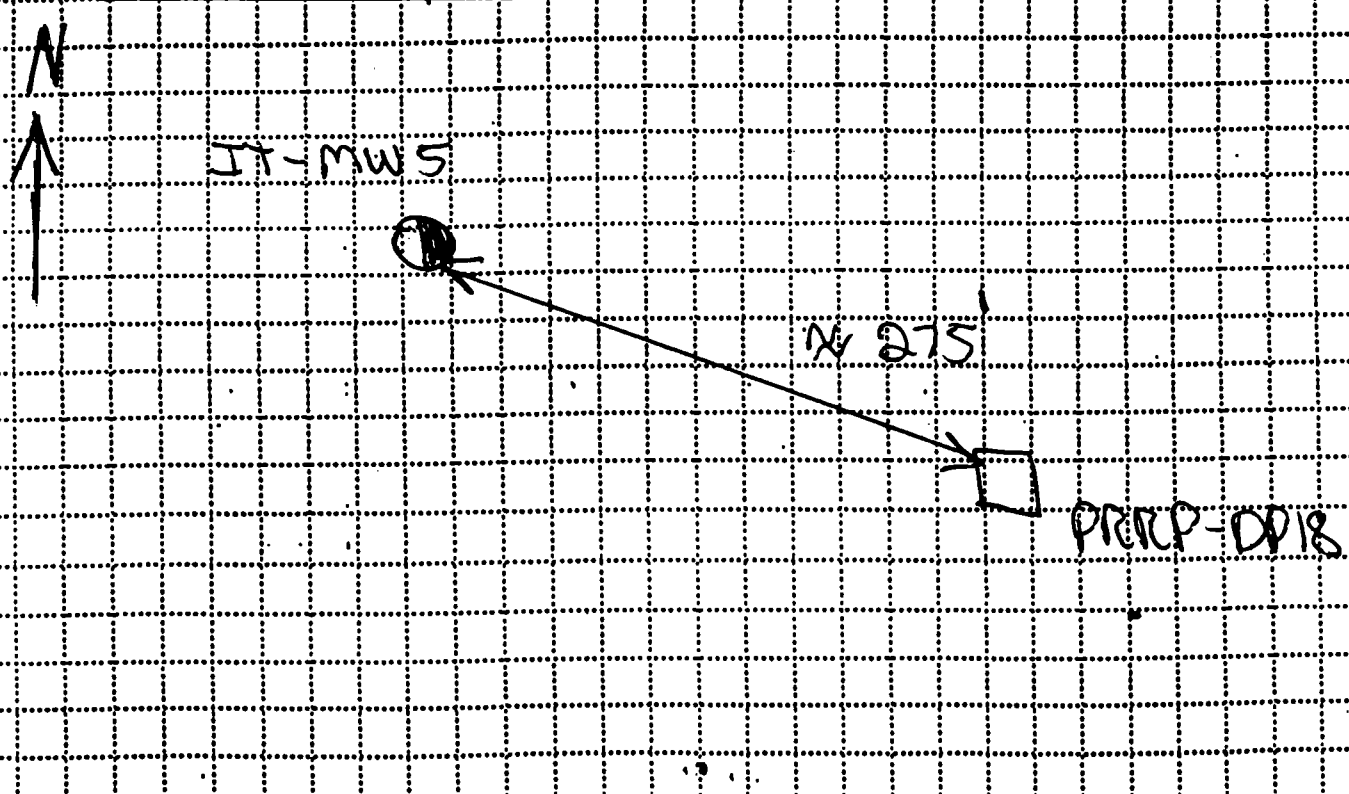
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—		John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

DP18	N	E	EL.
	625,300.98	1,919,638.32	631.78



PROJECT: PBOW - PRRP

HOLE NO: PRRP - DP18

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP18

PROJECT: PBOW - PRRP

INSPECTOR: John Vogeding

SHEET 2 OF 3

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sample Interval (g)	REMARKS (h)
Pt/SM		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 1420 End 1510
SM	1 2 3 3.5	0.5'-3.5' Loose, med. brown, Fine, Silty Sand, moist 3.5'	NA		PBOW-98-SO-PRRP-DP18-7880-(0002) 2'	Push 1 3' recovery	Hnu meter Not Functioning Properly due to Atmospheric moisture.
ML	4 5 6 7 8 9 10	3.5'-4.0 Soft, med. brown and grey, low plasticity, v. Fine, Sandy Silt, moist 4'-8' Same as Above Sandy Silt grading to Silt, wet from 4'-5.5' 8'-12' Same as Above (Silt), grey at 9' wet from 8'-10'. with numerous fine Sand stringers.	4' NA 8' NA	NA	PBOW-98-SO-PRRP-DP18-7890-(0406) 4' 6' PBOW-98-SO-PRRP-DP18-7900-(0810) 8' 10'	4' Push 2 4' Recovery 8' Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW - PRRP

HOLE NO. PRRP - DP18

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP18

PROJECT PBOW - PRRP

INSPECTOR John Vogedin

SHEET 3 OF 3 SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
nl	11	10'-12' See pg 2	NA	NA	NA	Push 3 (8'-12') 4' Recovery	
12'	12	Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP18

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	DISTRICT: Nashville - TN
		HOLE NUMBER: DP19
		SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long x 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners	8. HOLE LOCATION: PRRP - DP19	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-12-98	11. DATE COMPLETED: 6-12-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 12-14 Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

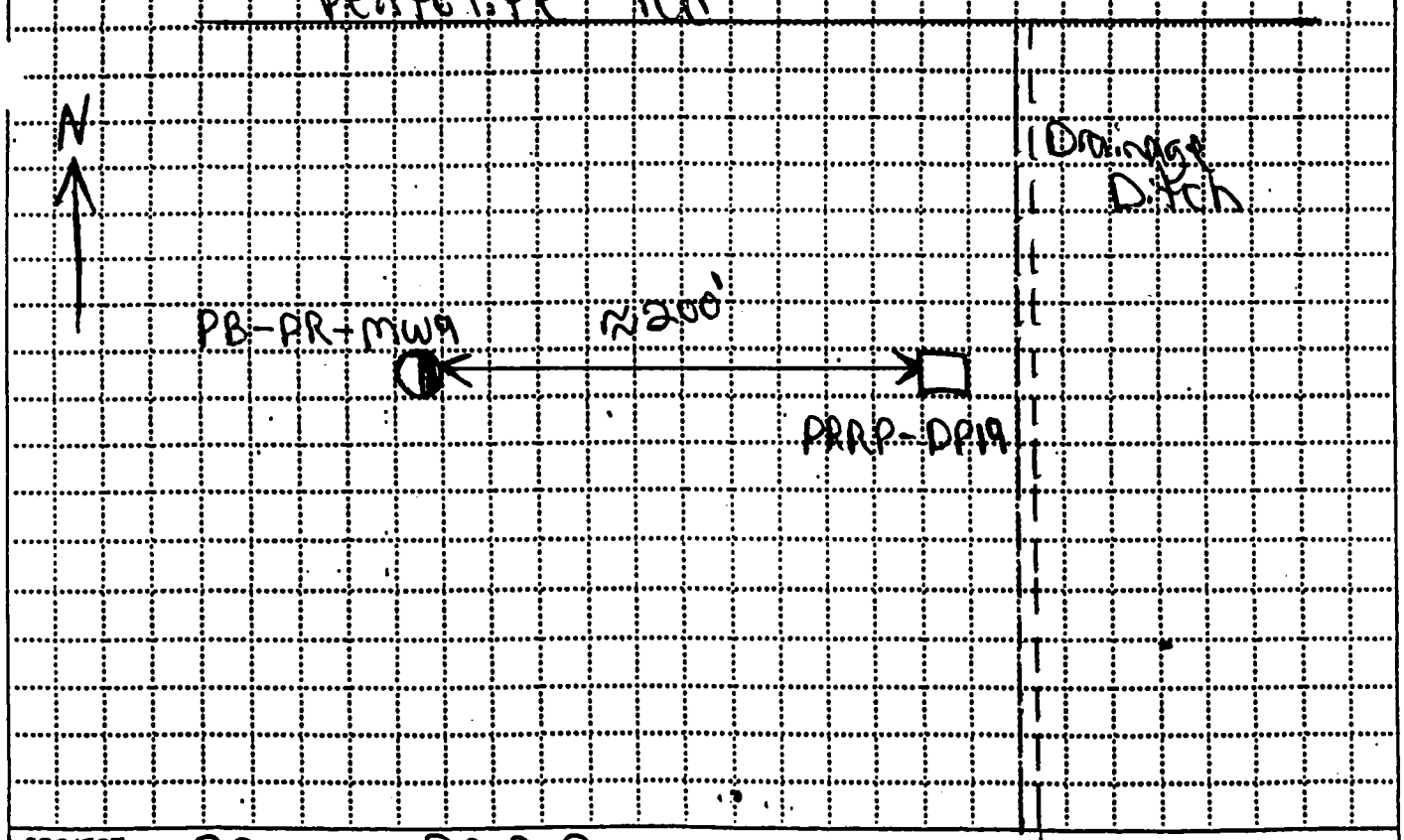
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOC's	PCB's	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vagedes

LOCATION SKETCH/COMMENTS N E EL. SCALE: Not to Scale

DP19	625,047.57	1,919,757.82	632.86



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP19

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP19

PROJECT PBOW - PRRP | INSPECTOR John Vogeding | SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	~~INCREMENT~~ (g) Sampling Intervals	REMARKS (h)
		0-0.5' grass and Topsoil.	Headspace Hnu Readings		PBOW-98-50-PRRP-DP19-7920-(0002)		Time Start 1420 End 1445
	1	0.5'-4.0' Loose, med brown-brownish grey, v. fine Silty Sand, Dry.			2'	Push 1	
	2		NA			3.5' Recovery	
	3						
			4'		4'	4'	
	4	4'-6.5' Same as Above		NA	PBOW-98-50-PRRP-DP19-7930-(0406)		
	5					Push 2	
					6'	4'	
	6		NA			Recovery.	
	7	6.5'-8' Soft-m. Firm, grey, low-med. plasticity, clayey silt and clay, moist					
	8		8'		8'	8'	
		8'-12' Same as Above with few fine sand stringers from 8'-9', moist-slightly wet.	NA		PBOW-98-50-PRRP-DP19-7940-(0810)	Push 3 (8'-12')	
	9					4' Recovery	
	10				10'		

PROJECT PBOW - PRRP | HOLE NO. PRRP-DP19

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP19

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3

ICS SOIL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
ML/CL	11	10'-12' See pg 1.	Headspace Hnu Readings				Start Time 1420 End 1445
12'	12	12'	12'			12'	
SC	13	12'-14' Loose, Brown and grey, fine clayey Sand, wet				Push 4	
14'	14	14'					
CL	15	14'-16' Soft-Med. Firm, grey, med-High Plasticity, Silty Clay, moist-Slightly wet,	NA	NA	NA	4' Recovery	
16'	16	16'	16'			16'	
		Bottom of Boring at 16.0 Ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP19

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo - Environmental Drilling	DISTRICT: Nashville - TN; HOLE NUMBER: DP20; SHEET 1 OF 3
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig.	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: ~~4' x 1.5"~~ Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: PRRP - DP20	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-13-98	11. DATE COMPLETED: 6-13-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ~3 Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

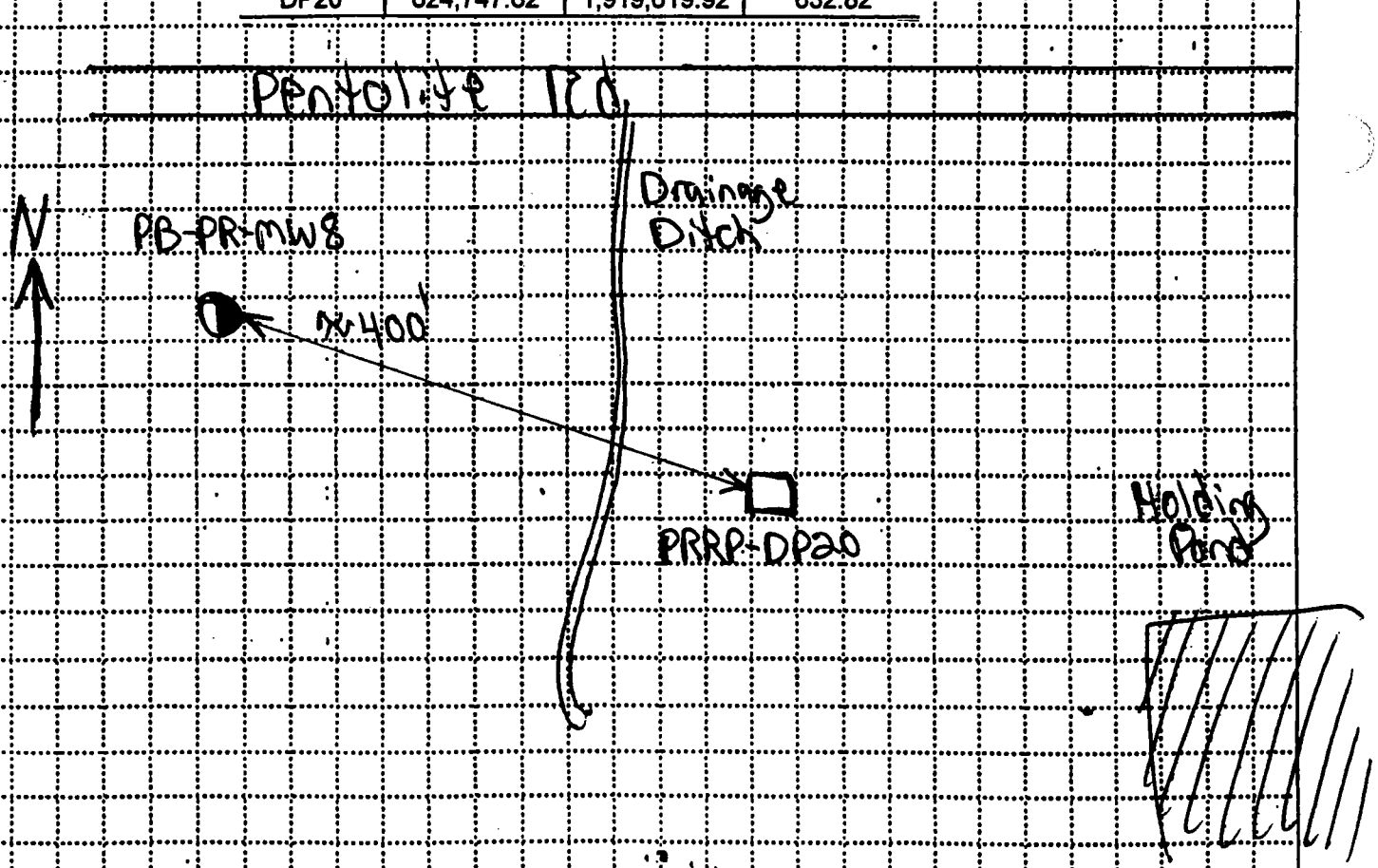
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogel

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP20	624,747.62	1,919,619.92	632.82

SCALE: Not to Scale



PROJECT: PBOW - PRRP

HOLE NO.: PRRP-DP20

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP20

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass + Topsoil	Headspace Hnu Readings				Start Time 1420 End 1445
Sm	1 2 3 4	0.5'-4' Loose, med brown grading to grey, Fine Silty Sand, wet at 3 ft.	NA 4'		PBOW-98-SO-PRRP-DP20-7960-(0002) 2' 4'	Push 1 3.5' Recovery 4'	Hnu Readings erratic due to excessive headspace moisture
6'	4 5 6	4'-6' Same as Above, Grey, Fine Silty Sand, wet. 6'	NA NA	NA	PBOW-98-SO-PRRP-DP20-7970-(0406) 6'	Push 2 4' Recovery	
ml/Cl	7 8 9 10	6'-8' Soft, grey, low-med Plasticity, v. Fine, Sandy Silt grading to Clayey Silt, Slightly wet. 8' 8'-12' Same as Above, wet.	8' NA		8' PBOW-98-SO-PRRP-DP20-7980-(0810) 10'	8' Push 3 (8'-12') 4' Recovery	

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP20

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP20

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
ml/cl 12'	11 12	10'-12' See P51 12'	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12') 12'	Time Start 1420 End 1445
		Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP20

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP21
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	SHEET 1 OF [redacted] 2
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods ~~Diam.~~ w/Acetate Liners	8. HOLE LOCATION: PRRP - DP21	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-13-98	11. DATE COMPLETED: 6-13-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: NA Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 10 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
	(3)	—	

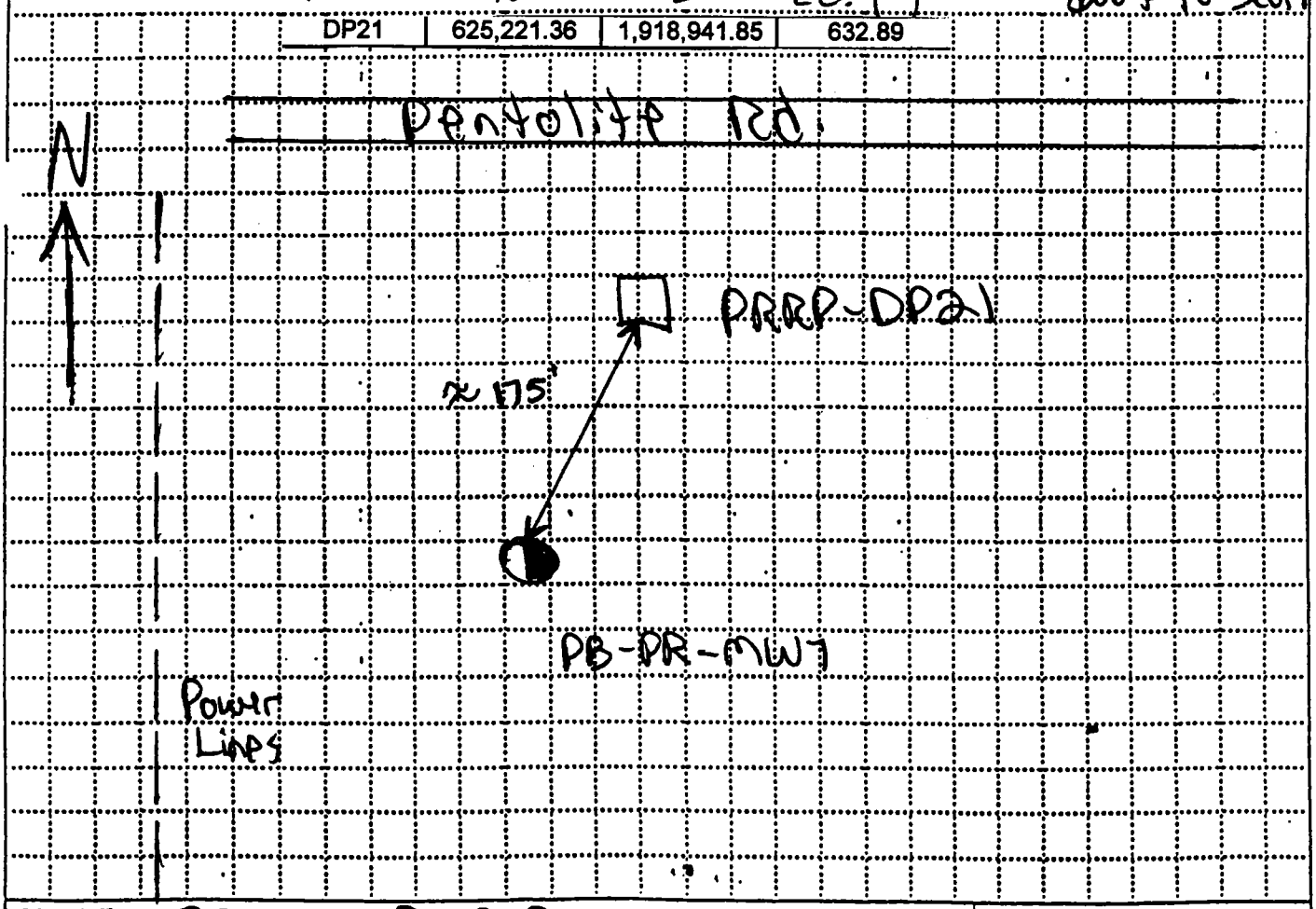
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
None	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP21	625,221.36	1,918,941.85	632.89



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP21

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP21

PROJECT PBOW - PRRP | INSPECTOR John Vogeding | SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 0730 End 0800
	1	0.5'-4' Loose, med. brown, v. fine Silty Sand, moist		2'		Push 1 4' Recovery	
Sm	2			PBOW-PRRP-DP21-GEOT-0204			
	3						
4'	4	4'		4'		4'	
	5	4'-8' Soft, med. brown-grey, v. fine Sandy Silt, wet	NA		NA	Push 2 4' Recovery	
	6			6'			
Ml/Cl	7			PBOW-PRRP-DP21-GEOT-0608			
	8	8'-10' Same as Above, Grey, Sandy Silt to Clayey Silt, wet		8'		8'	
	9			PBOW-PRRP-DP21-GEOT-0810		Push 3 (8-10) 4' Recovery.	Bottom of Boring at 10 Ft.
	10			10'			

PROJECT PBOW - PRRP | HOLE NO. PRRP-DP21

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG

DISTRICT: Nashville - TN	HOLE NUMBER: DP22	SHEET 1 OF 3
1. COMPANY NAME: IT Corp	2. DRILL SUBCONTRACTOR: Geo Environmental	
3. PROJECT: PBOW - PRRP	4. LOCATION: PRRP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4' Long X 1.5" Geoprobe Sample Rods Diam. w/Acetate Liners	8. HOLE LOCATION: PRRP - DP22	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-13-98	11. DATE COMPLETED: 6-13-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: NA Ft. BGS.	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft.	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
	(3)	—	—

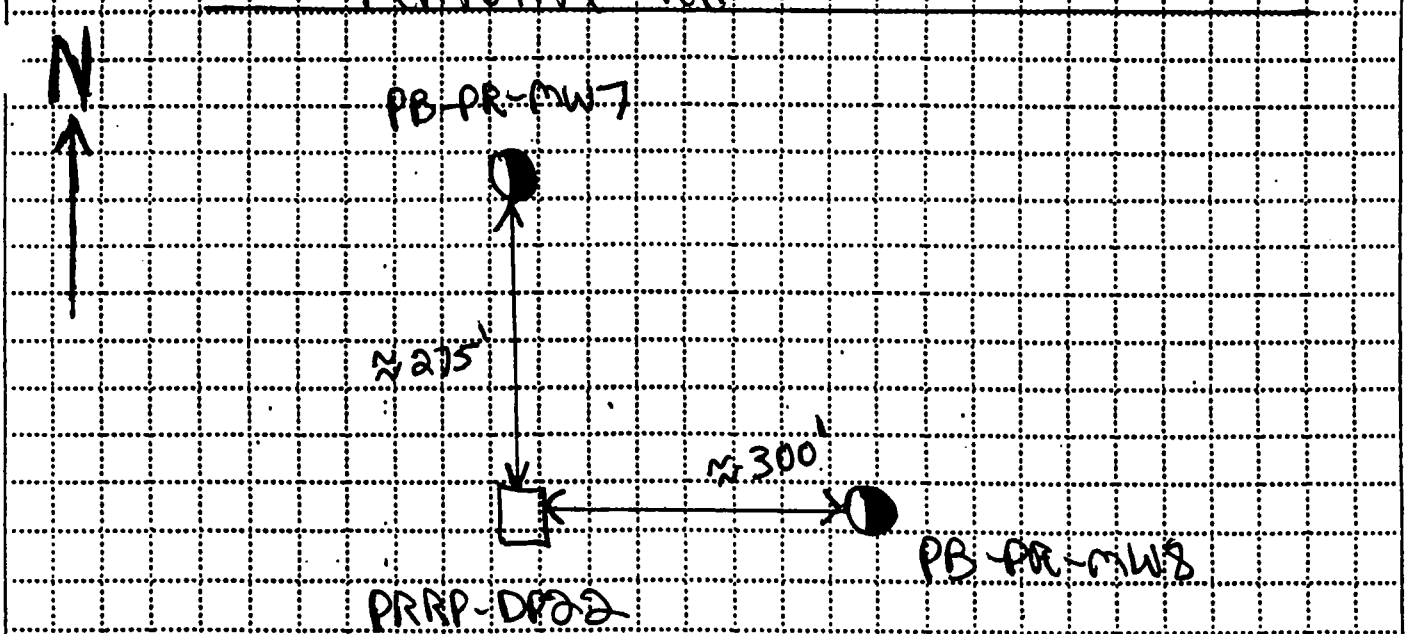
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Grouted	—	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

N E EL. 0. SCALE: Not to Scale

DP22	624,593.46	1,919,004.88	634.80



PROJECT: PBOW - PRRP

HOLE NO: PRRP-DP22

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP22

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 2 OF 3 SHEETS

SCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 0915 End 0930
Sm	1 2	0.5'-3' Loose, med. brown, v. Fine-Fine, Silty Sand, moist		2' PBOW-PRRP-DP22-GEOT-0204		Push 1 3.5' Recovery.	
ml/Cl	3 4	3'-4' Soft, m. brown-grey, v. Fine Sandy Silt-Clayey silt, moist		4'		4'	
	5 6	4'-8' Same as Above, med-high Plasticity Slightly wet.	NA	6' PBOW-PRRP-DP22-GEOT-0608	NA	Push 2 4' Recovery	
	7 8	8'-12 Same as Above Grey, Silty Clay and Clay, Slightly wet		8'		8' Push 3 (8'-12') 4' Recovery	
	9 10			10'			

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP22

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP22

PROJECT SCS PBOW - PRRP

INSPECTOR John Vogeding

SHEET [redacted] SHEETS 3 of 3

[redacted] (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	[redacted] (g)	REMARKS (h)
ml / cl	11	10'-12' See pg 1	Headspace Hnu Readings NA	PBOW-PRRP-DP22-GEOT-10'-12'	NA	Sampling Intervals Push 3 (8'-12')	Time Start 0915 End 0930
12'	12	Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP22

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

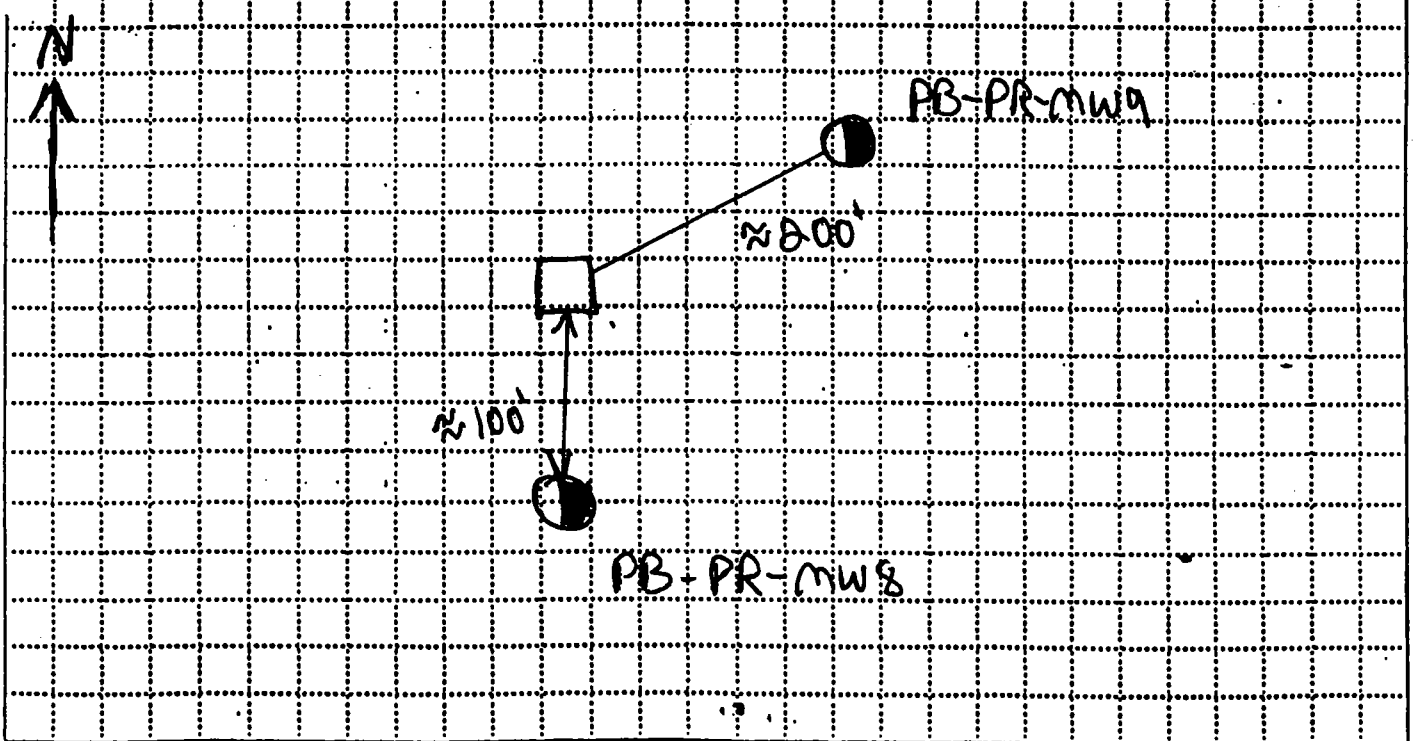
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP23
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo - Environmental Drilling
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig.
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	PRRP - DP23
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-13-98
11. DATE COMPLETED	6-13-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	(3) DISTURBED; UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: [redacted]; TAL METALS: [redacted]; OTHER (SPECIFY): [redacted]; OTHER (SPECIFY): [redacted]; OTHER (SPECIFY): [redacted]
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED: Grouted; MONITORING WELL: — ; OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR	John Vogeding

LOCATION SKETCH/COMMENTS

N	E	EL.
624,953.28	1,919,383.04	634.36

SCALE: Not to Scale



PROJECT PBOW - PRRP

HOLE NO. PRRP-DP23

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP23

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 2 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	~~INCREMENT~~ Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 0835 End 0900
Sm	1	0.5'-4' Loose, med. brown, v. fine, Silty Sand, moist		2'		Push 1	
	2			PBOW-PRRP-DP23-GEOT-0204		4' Recovery	
	3						
	4	4'-6' Soft, brown and grey, v. fine Sandy Silt and clayey Silt, moist.		4'		4'	
ml/Cl	5		NA		NA	Push 2	
	6	6-8 Same as Above, grading to clayey Sand, moist.		6'		4' Recovery	
SC	7			PBOW-PRRP-DP23-GEOT-0608			
	8			8'		8'	
ml	9	8-10' Soft, brown and grey, v. fine Sandy Silt, wet				Push 3 (8'-12') 4' Recovery	
	10			10'			

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP23

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP23

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 of 3

SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	(g) Sampling Intervals	REMARKS (h)
ml/Cl	11 12	10'-12' Soft, grey, high Plasticity, Clayey Silt and Clay, wet	Headspace Hnu Readings NA	PBOW-PRRP-DP23-GEOT-1012 12'	NA	Push 3 (8-12) 12'	Start Time 0835 End 0900
		Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP-DP23

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

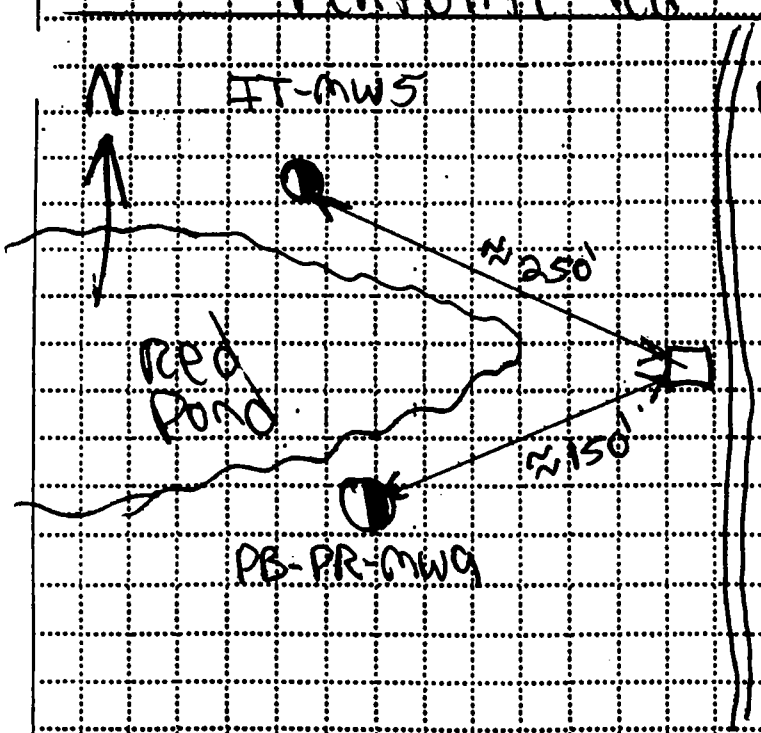
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP24
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo - Environmental Drilling
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig.
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	PRRP - DP24
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-13-98
11. DATE COMPLETED	6-13-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	(3) DISTURBED; UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	None
VOC	[redacted]
TAL METALS	[redacted]
OTHER (SPECIFY)	[redacted]
OTHER (SPECIFY)	[redacted]
OTHER (SPECIFY)	[redacted]
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED: Grouted; MONITORING WELL: — ; OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR	John Vogeding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP24	625,170.69	1,919,685.68	630.80



PROJECT PBOW - PRRP

HOLE NO. PRRP-DP24

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP24

PROJECT PBOW - PRRP | INSPECTOR John Vogeding | SHEET 2 OF 3

USCS ~~SYMBOL~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	~~INCREMENT~~ (g) Sampling Intervals	REMARKS (h)
Pt/Sm		0-0.5' grass + Topsoil	Headspace Hnu Readings				Time Start 1300 End 1320
Sm	1 2	0.5'-3.0' Loose, med. brown, v. fine, Silty Sand, moist		2'		Push 1 4' Recovery	
3'	3	3'-4' Soft, brownish grey, low Plasticity, v. fine Sandy Silt, moist		PBOW-98-PRRP-DP24-Geot-0204 4'		4'	
ML/CL	4 5 6 7 8	4'-8' Same as Above, v. fine Sandy Silt grading to clayey Silt and clay, slightly wet.	NA	6' PBOW-98-PRRP-DP24-Geot-0608 8'	NA	Push 2 4' Recovery 8'	
	9 10	8'-12' Same as Above w/ few fine Sand stringers throughout, slightly wet		10'		Push 3 (8'-12') 4' Recovery	

PROJECT PBOW - PRRP | HOLE NO. PRRP - DP24

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP24

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET [redacted] SHEETS 3 of 3

(a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	(g) Sampling Intervals	REMARKS (h)
ML/CL	11	10'-12' Seeps 1	Headspace Hnu Readings NA	PBOW-98-PRRP-DP24-Geot-1012	NA	Push 3 (8'-12')	Start 1300 End 1320
	12	Bottom of Boring at 12.0 ft.					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP24

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

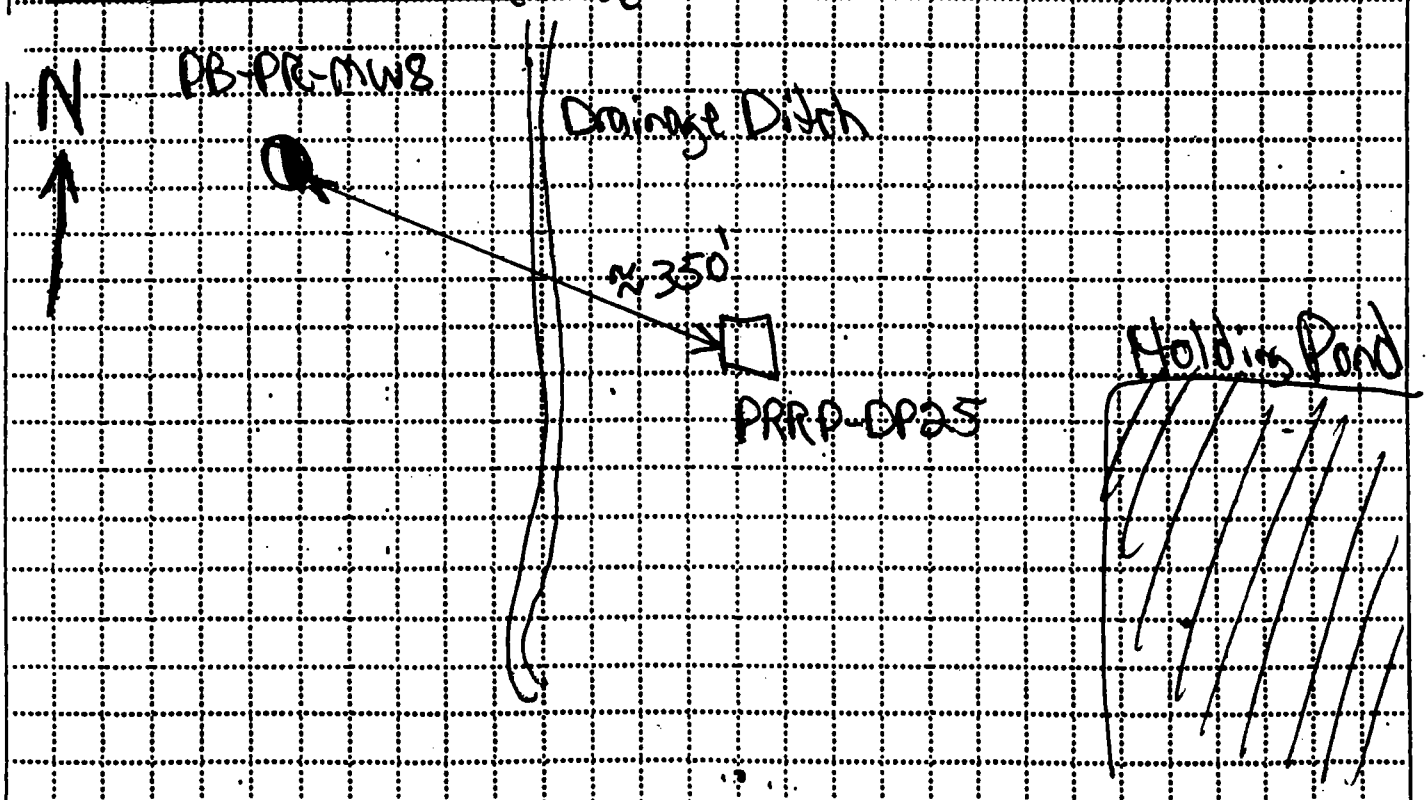
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP25
1. COMPANY NAME	IT Corp
2. DRILL SUBCONTRACTOR	Geo - Environmental Drilling
SHEET	1 OF 3 SHEETS
3. PROJECT	PBOW - PRRP
4. LOCATION	PRRP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig.
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4' x 1.5" Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	PRRP - DP25
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-13-08
11. DATE COMPLETED	6-13-08
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft.
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	(3) DISTURBED; UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	None; VOC; TAL METALS; OTHER (SPECIFY); OTHER (SPECIFY); OTHER (SPECIFY)
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED: Grouted; MONITORING WELL: — ; OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR	John Voegli

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

N	E	EL.
624,687.56	1,919,500.10	632.48



PROJECT PBOW - PRRP

HOLE NO. PRRP-DP25

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP25

PROJECT: PBOW - PRRP (SCS)

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

(a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 1055 End 1125
Sm	1 2	0.5'-3' Loose-M.Dense, brown and grey, v. Fine, Silty Sand, moist		2' PBOW-98-PRRP-DP25-Geot-0608		Push 1 3.5' Recovery	
3'	3	3'-4' Soft, brownish grey, low Plasticity, v. Fine, Sandy Silt, moist		4'		4'	
nl/Cl	4 5 6 7	4'-8' Same As Above brownish grey grading to grey, v. Fine Sandy Silt grading to clayey Silt and Clay, slightly wet	NA	6' PBOW-98-PRRP-DP25-Geot-0608	NA	Push 2 4' Recovery	
8'	8	8'-12' Loose, grey, v. Fine, Silty Sand, wet		8'		8'	
SM	9 10			10'		Push 3 (8'-12') 3' Recovery	

PROJECT: PBOW - PRRP

HOLE NO. PRRP-DP25

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

PRRP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP25

PROJECT PBOW - PRRP

INSPECTOR John Vogeding

SHEET 3 OF 3 SHEETS

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
SM	11	10-12' See psl	Headspace Hnu Readings NA	PBOW-98-PRRP-DP25-Geot-1012	NA	Push 3 (8'-12')	Start 1055 End 1125
12'	12	12'		12'			
		Bottom of Boring at 12.0 ft					

PROJECT PBOW - PRRP

HOLE NO. PRRP - DP25

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP01
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Scott [redacted] Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP01	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-23-98	11. DATE COMPLETED: 6-23-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 8.5-9.5 and 12-14 Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

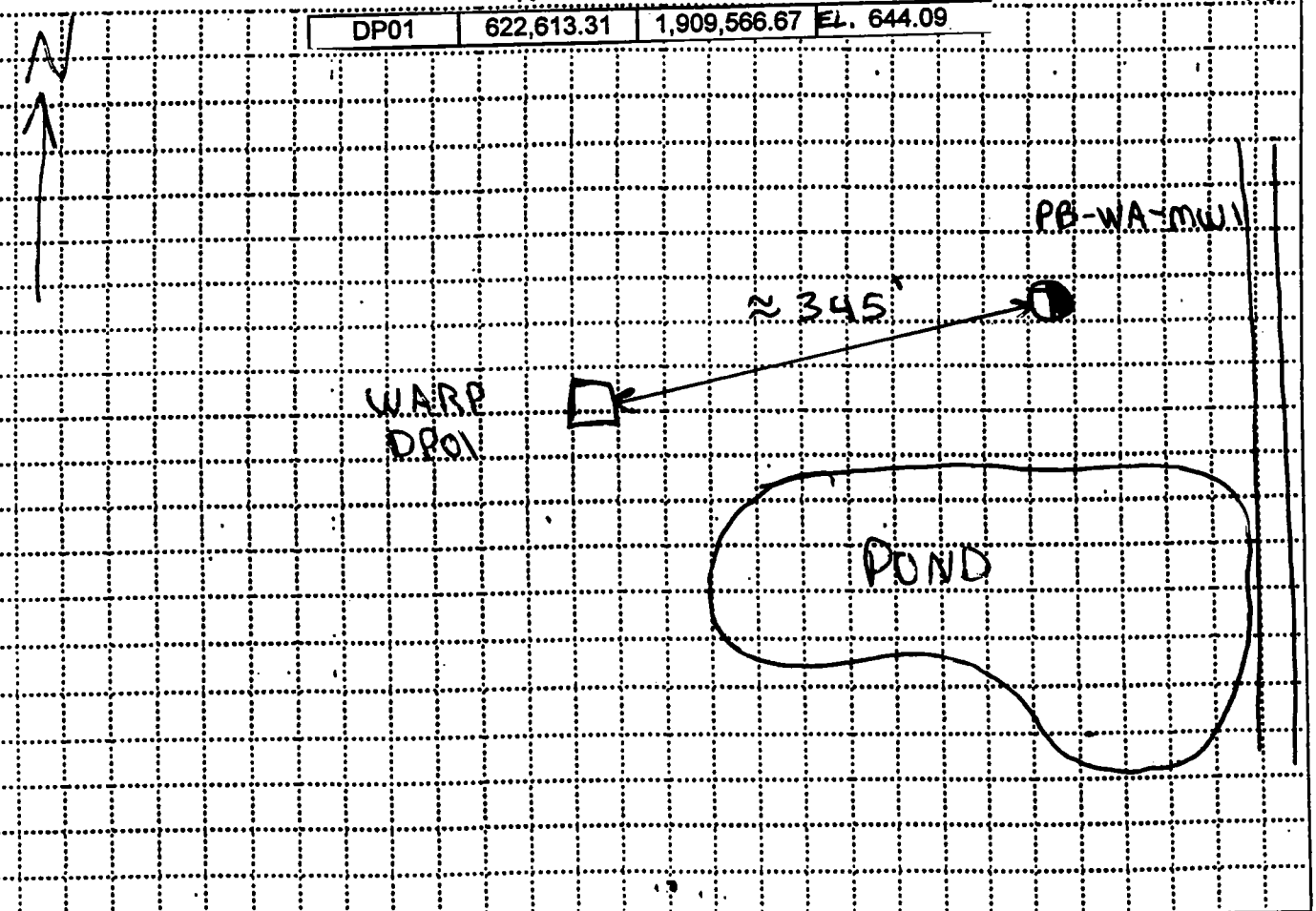
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogedin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP01	622,613.31	1,909,566.67	644.09



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP01

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP01

PROJECT: PBOW - WARP

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals	REMARKS (h)
Pt/SM		0-0.5' grass and Topsoil	Headspace Hnu Readings		PBOW-98-SO-WARP-DP01-8100-(0002)		Start Time 1045 End 1110
SM	1	0.5'-3.5' Loose, Light yellowish brown, Fine Sand, moist			2'	Push 1 3' Recovery	
	2		NA				
	3	3.5'					Hnu meter Not Functioning Properly due to high Ambient and Headspace moisture.
SC	4	3.5'-4' m. Brown, Fine, Clayey Sand, moist	4'		5'	4'	
4.5'		4'-4.5' Same as Above					
ML	5	4.5'-8' Soft, med brown and grey, low Plasticity, v. Fine Sandy Silt, moist	NA	NA	PBOW-98-SO-WARP-DP01-8110-(0406) 6'	Push 2 4' Recovery	
	6						
	7						
	8	8-8.5' Same as Above	8'		8'	8'	
8.5'		8.5'					
SM	9	8.5'-9.5' Loose, orangish brown, Fine Sand, wet	NA		PBOW-98-SO-WARP-DP01-8120-(0810) 10'	Push 3 (8'-12')	
9.5'		9.5'					
ML	10						

PROJECT: PBOW - WARP

HOLE NO. WARP - DP01

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP01

PROJECT PBOW - WARP

INSPECTOR John Voegeding

SHEET 3 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
ML 12'	11 12	9.5'-12' Soft, brown and grey, low plasticity, v. fine, Sandy Silt, moist - Slightly wet. 12'	Headspace HNU Readings NA		NA	Push 3 (8'-12')	Start 1045 End 1110
SM 14'	13 14	12'-14' Loose, orangish brown, Fine Sand, wet. 14'	NA	NA	NA	Push 4 4' Recovery	
CL 16'	15 16	14'-16' Soft, grey, high plasticity Clay, moist. 16'				16'	
		Bottom of Boring at 16.0 Ft.					

PROJECT PBOW - WARP

HOLE NO. WARP-DP01

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp.	DISTRICT: Nashville - TN	HOLE NUMBER: DP02
2. PROJECT: PBOW - WARP	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. NAME OF DRILLER: Scott [redacted] Beal	4. LOCATION: PBOW - WARP	
5. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
	7. HOLE LOCATION: WARP-DP02	
	8. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-23-98	11. DATE COMPLETED: 6-23-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: 5-5.5' and 13-14 Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

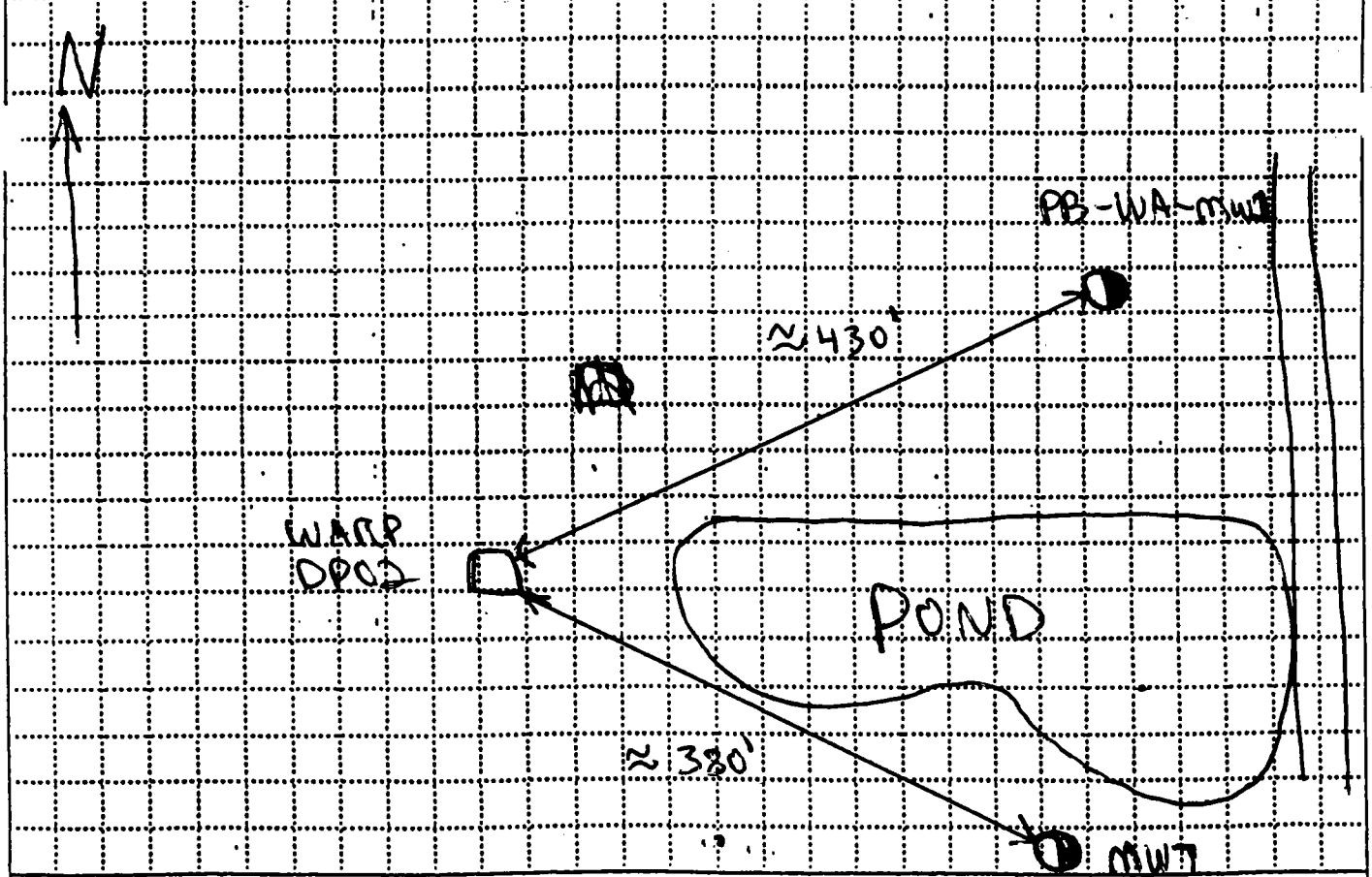
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogedin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP02	622,379.43	1,909,598.56	636.50



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP02

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP02

PROJECT: SCS, PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3 SHEETS

~~ADD DO~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~Recovery~~ Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Time Start 1135 End 1200
ml	1 2 3 4	0.5'-4' Soft-m. Firm, dark brown, v. Fine Sandy Silt, dry	NA		PBOW-98-SO-WARP-DP02-8140-(0002) 2' 4'	Push 1 3.5' Recovery 4'	0.5'-1' Some reddish staining
5' Sm 5.5'	5	4'-5' Same as Above 5' 5'-5.5' Loose, light brown, Fine Sand, wet	NA	NA	PBOW-98-SO-WARP-DP02-8150-(0406) 6'	Push 2 4' Recovery	
ml/Cl	6 7 8	5.5'-8' m. Firm, brown and grey, low plasticity, clayey Silt and Clay, moist	NA		8'	8'	
	9 10	8'-12' Same as Above, w/ Several Fine Sand Stringers throughout, moist.	NA		PBOW-98-SO-WARP-DP02-8160-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW - WARP

HOLE NO. WARP - DP02

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP02

PROJECT PBOW-WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
ml/Cl 12'	11 12	10'-12' See pg. 2 12'	Headspace Hnu Readings NA 12'		NA	Push 3 (8'-12') 12'	Start 1135 End 1200
SC 13'	12 13	12'-13' Loose, greyish brown, Fine Clayey Sand, moist-Slightly wet.		NA		Push 4	
SM 14'	13 14	13'-14' Loose, med. brown, F-M Sand, wet 14'	NA		NA		
Cl 16'	14 15 16	14'-16' Soft, grey, med. Plasticity, Clay, moist-Slightly wet 16'	16'			16'	
		Bottom of Boring at 16.0 Ft					

PROJECT PBOW-WARP

HOLE NO. WARP-DP02

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP03
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott ~~[illegible]~~ Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP03
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-23-98
11. DATE COMPLETED	6-23-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	5-7 Ft and 8-9.5 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. TOTAL DEPTH OF HOLE	16.0 Ft. BGS
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

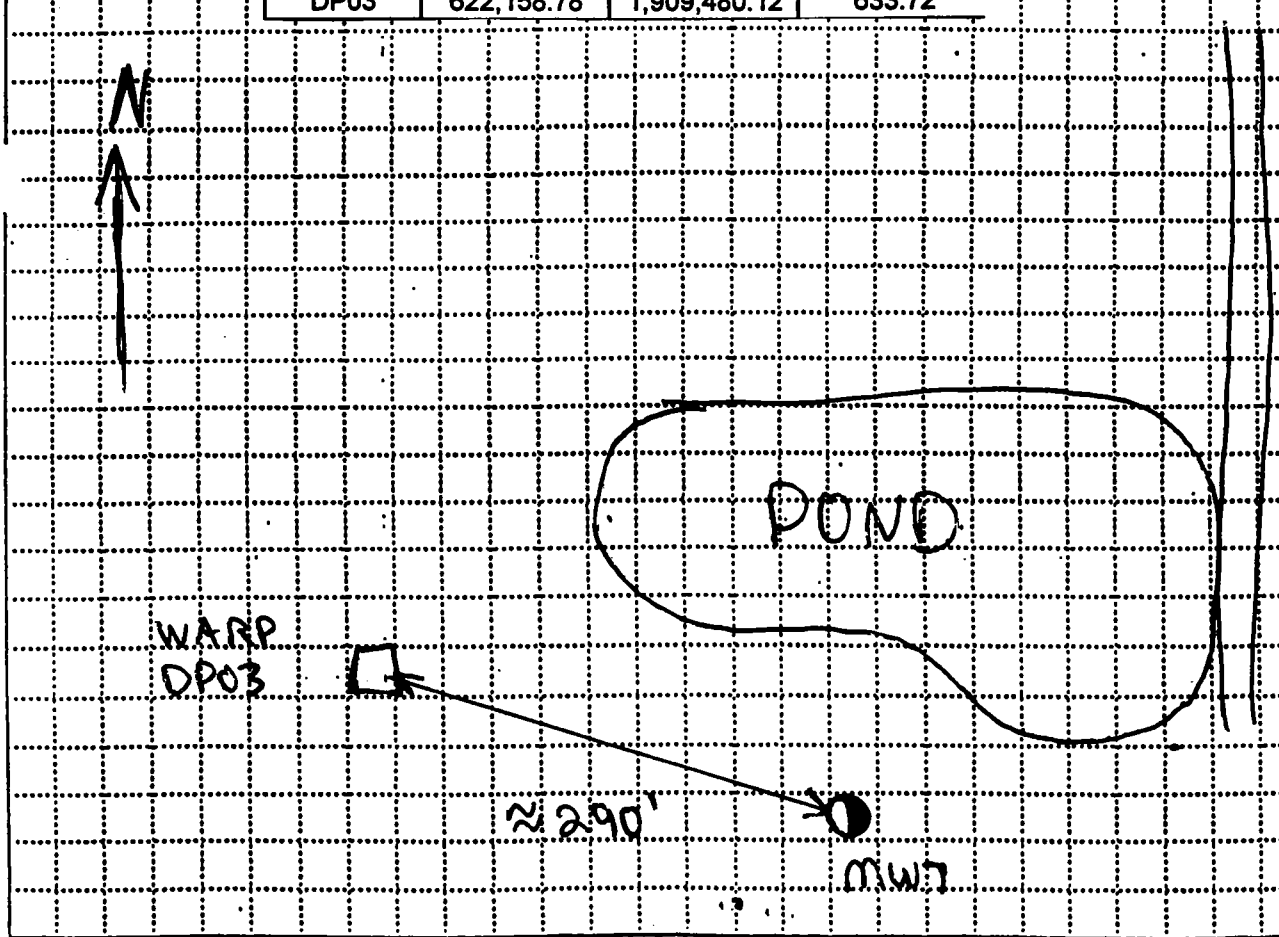
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vaughn

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP03	622,158.78	1,909,480.12	633.72



PROJECT PBOW - WARP

HOLE NO. WARP-DP03

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP03

PROJECT PBOW - WARP | INSPECTOR John Voegding | SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals	REMARKS (h)
Pt/Sm		0-0.5' Weeds and Topsoil	Headspace Hnu Readings				Start Time 1415 End 1450
ml/cl	1 2	0.5'-3' Firm, m. brown, low plasticity clayey Silt and clay, moist 3'	NA		PBOW-98-SO-WARP-DP03-8180-(0002) 2'	Push 1 3.5' Recovery	
SC	3 4 5 6	3'-4' Loose, m. brown, Fine-med. clayey Sand, moist 4'-7' Same as Above wet from 5-7 ft. 7'	4' NA	NA	4' PBOW-98-SO-WARP-DP03-8190-(0406) 6'	4' Push 2 4' Recovery	Hnu meter Readings are erratic Due to High ambient and Headspace Moisture.
ml/cl	7 8	7'-8' Soft-m. Firm, Brown and grey, low-med. plasticity Clayey Silt and clay, moist 8'	8'		8'	8'	Collected FD/FS and MS/MSD Samples from 0-2 ft.
SC	9	8-9.5' Loose, m. Brown, Fine, Clayey sand, wet 9.5'	NA		PBOW-98-SO-WARP-DP03-8200-(0810) 10'	Push 3 (8'-12') 4' Recovery	
9.5' Cl	10						

PROJECT PBOW - WARP | HOLE NO. WARP - DP03

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP03

PROJECT USCS PBOW-WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
		9.5'-12'	Headspace Hnu Readings			Push 3	Start 1415
	11	Soft, grey, med-high Plasticity, Clay, moist-slightly wet.	NA		NA	(8'-12')	End 1450
			12'			12'	
	12						
Cl		12'-15' Same as Above				Push 4	
	13			NA		4'	
			NA		NA	Recovery	
	14						
15'	15	15'					
Cl (Till)		15-16' Hard, grey, low plasticity. clay w/ 50% sand + gravel (TILL)	16'			16'	
	16	Bottom of Boring at 16.0 ft.					

PROJECT PBOW-WARP

HOLE NO. WARP-DP03

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP04
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 OF 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott [redacted] Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP04
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-23-98
11. DATE COMPLETED	6-[redacted]23-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

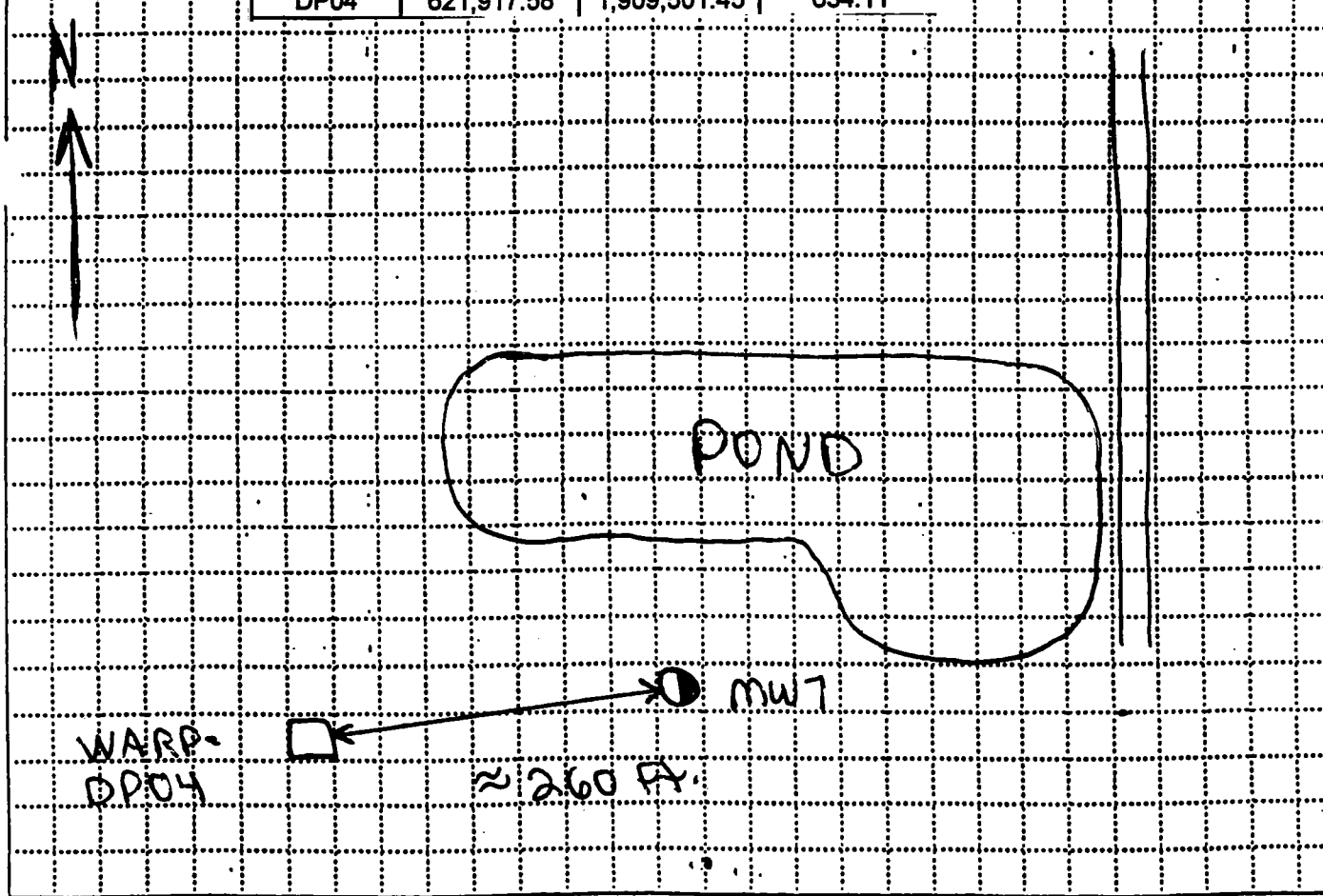
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP04	621,917.58	1,909,501.45	634.11



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP04

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP04

PROJECT: USCS, PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				
ml	1 2 3	0.5'-3.5' Firm, light brown, low Plasticity V. Fine, Sandy Silt, Dry 3.5'	NA		PBOW-98-50-WARP-DP04-8220-(0000) 2'	Push 1 3.5' Recovery	Start 1540 End 1615 Hnu meter ~~[illegible]~~ Readings Erratic Due to High Ambient and headspace moisture.
Sm	4 5 6	3.5'-4' Loose, med greyish brown, ~~[illegible]~~ F-m, Silty Sand, moist 4-6.5' Same as Above 6.5'	4' NA	NA	PBOW-98-50-WARP-DP04-8230-(0400) 4' 6'	4' Push 2 4' Recovery	
ml/Cl	7 8	6.5'-8' Soft-Firm, med brown and grey, low Plasticity, Clayey Silt and clay, moist	8'		8'	8'	
	9 10	8'-10' Same as Above, grey, moist	NA		PBOW-98-50-WARP-DP04-8240-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW - WARP

HOLE NO. WARP - DP04

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP04

PROJECT PBOW - WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

ISCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
ML/CL	11	10'-12' Same as Above, Firm-Hard, grey, with 30% Fine, angular gravel, (Till), Slightly wet	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12')	Start 1540 End 1615 Sampler Refusal at 12 Ft.
	12	Trace weathered shale at 12 Ft.	12'				
	13	Bottom of Boring at 12.0 Ft.					
	14						
	15						

PROJECT PBOW - WARP

HOLE NO. WARP - DP04

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP05
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP05
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-16-98
11. DATE COMPLETED	6-16-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	16.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

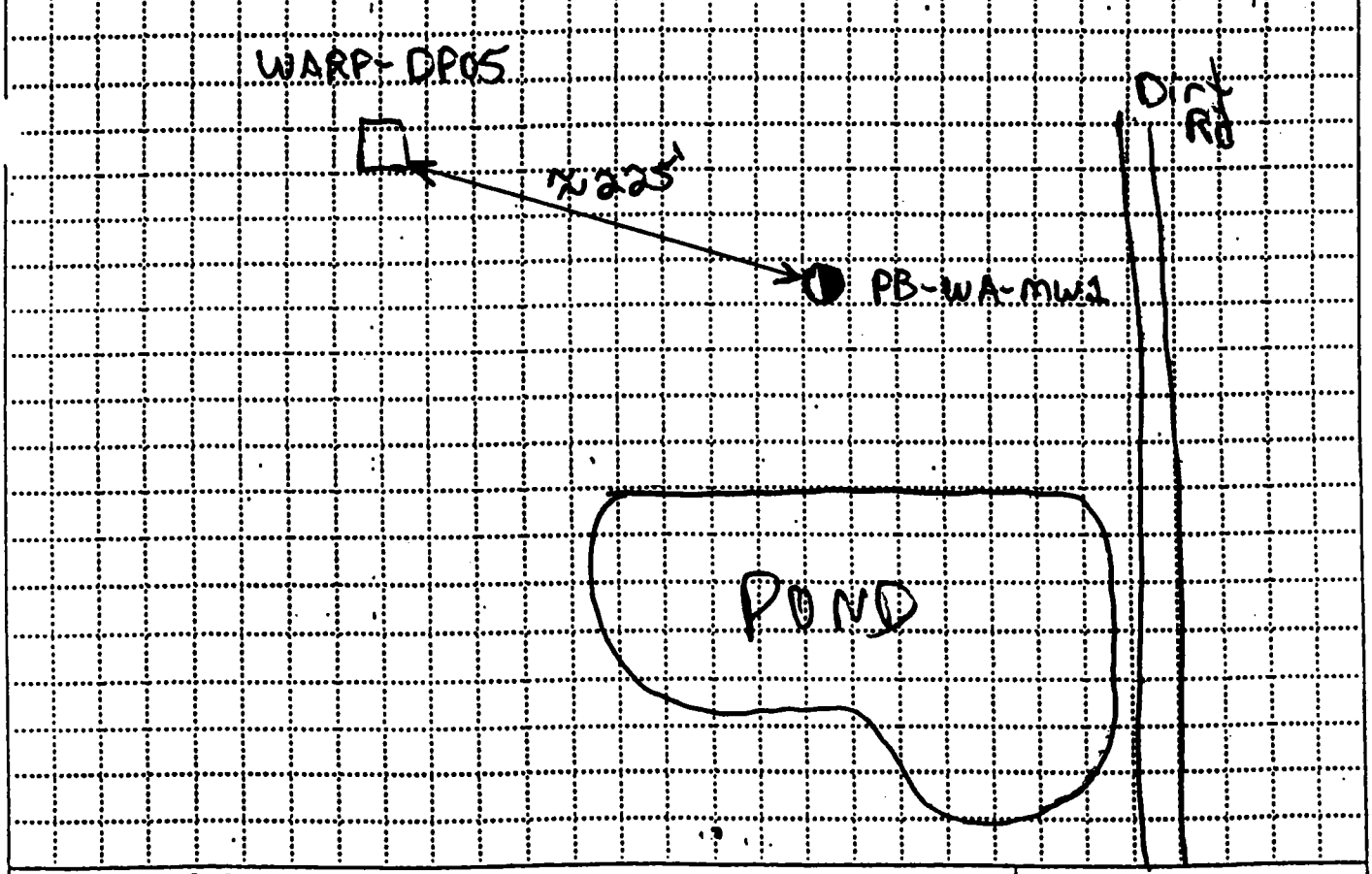
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP05	622,820.86	1,909,789.37	643.60



PROJECT PBOW - WARP

HOLE NO. WARP-DP05

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP05

PROJECT: USCS, PBOW - WARP

INSPECTOR: John Vogeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	EQUIPMENT (g) Sampling Intervals	REMARKS (h)
		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Time Start 1100 End 1120
SM / SC	1 2 3 4	0.5'-4' Loose, Light-med. brown, Fine Silty Sand, moist. grading to clayey Sand	NA 4'		PBOW-SO-98-WARP-DP05-8260-(0812) 2'	Push 1 3.5' Recovery 4'	
ML / CL	5 6 7 8	4'-8' Soft, brown and grey, low Plasticity, v. Fine Sandy Silt and Clayey Silt w/ v. Fine Sand stringers throughout, very moist	NA NA 8'	NA	PBOW-98-SO-WARP-DP05-8270-(0906) 6'	Push 2 4' Recovery 8'	Hnu meter Not working Properly due to high humidity and headspace moisture
	9 10	8'-12' Same as Above, grey from 10.5'-12' Some trace Free Water from 9'-9.5'. Slightly wet	NA		PBOW-98-SO-WARP-DP05-8280-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW - WARP

HOLE NO. WARP - DP05

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP05

PROJECT ~~ICS~~ PBOW - WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

~~ELEVATION~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~SEDIMENT~~ Sampling Intervals (g)	REMARKS (h)
↑ ml/cl	11	10-12' See pg 2	Headspace HNU Readings NA	NA	NA	Push 3 (8-12') 12'	Start 1100 End 1120
	12						
	13	Bottom of Boring at 16.0 Ft. 12-16' Clayey Silt and Clay as Above	NA	NA	NA	Push 4 4' Recovery 16'	Note: Initially Advanced borehole to 12 Ft and Installed Temp. well for gw collection Due to lack of gw borehole was advanced further to 16 Ft. and Temp. well re-Installed.
	14						
	15						
	16						

PROJECT PBOW - WARP

HOLE NO. WARP - DP05

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP06
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott [redacted] Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP06
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-23-98
11. DATE COMPLETED	6-23-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	14-15 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	16.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

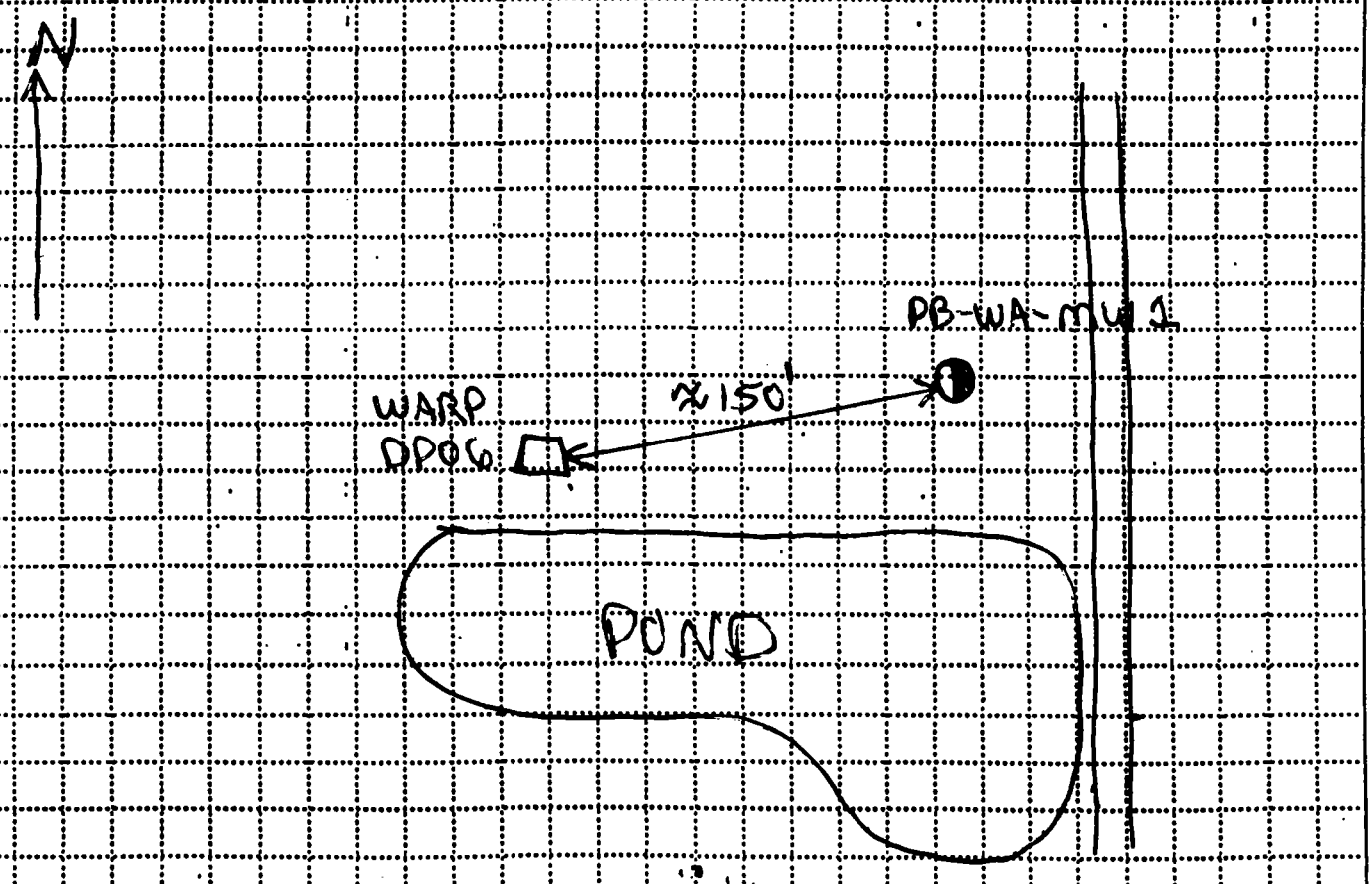
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Voegding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP06	622,610.42	1,909,780.55	643.32



PROJECT PBOW - WARP

HOLE NO. WARP-DP06

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP06

PROJECT: PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3 SHEETS

USCS (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	FIELD SCREENING RESULTS (D)	GEOTECH SAMPLE OR CORE BOX NO. (E)	ANALYTICAL SAMPLE NO. (F)	Sampling Intervals (G)	REMARKS (H)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings		PBOW-98-SO-WARP-DP06-8300-(0002)		Start Time 0910 End 0930
SM	1	0.5'-4' Loose, light yellowish brown, Fine Sand, Dry - Slightly Moist	NA		2'	Push 1 3' Recovery	
	2						
	3						Hnu Meter Not Functioning Properly due to high ambient and headspace Humidity
4.5'	4	4'-4.5' Same as Above 4.5'	4'		4'	4'	
Ml/Cl	5	4.5-8' Soft, med brown and grey, low plasticity, Clayey Silt and Clay, moist	NA	NA	PBOW-98-SO-WARP-DP06-8310-(0406) 6'	Push 2 4' Recovery	
	6						
	7		8'		8'	8'	
	8	8'-12' Same as Above, with V. Fine Sand Stringers throughout, moist - Slightly wet	NA		PBOW-98-SO-WARP-DP06-8320-(0810) 10'	Push 3 (8'-12') 4' Recovery	Few Minor wet Perched Zones from 10'-12'
	9						
	10						

PROJECT: PBOW - WARP

HOLE NO. WARP-DP06

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP06

PROJECT: PBOW - WARP

INSPECTOR: John Voegeding

SHEET 3 OF 3 SHEETS

SCS ~~USCS~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
		10'-12' See pg 2	Headspace Hnu Readings			Push 3 (8'-12')	Start 0910 End 0930
	11		NA				
			12'		12'	12'	
ML/CL	12	12'-16'				Push 4	
	13	v. soft, grey, med plasticity, Clayey Silt and clay, slightly wet-wet from 14-15 ft.		NA		4' Recovery	
	14		NA		NA		
	15						
16'	16		16'			16'	
		Bottom of Boring at 16.0 Ft.					

PROJECT: PBOW - WARP

HOLE NO. WARP - DP06

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	DISTRICT: Nashville - TN
		HOLE NUMBER: DP07
		SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Scott [redacted] Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP07	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-25-98	11. DATE COMPLETED: 6-25-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: NA Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

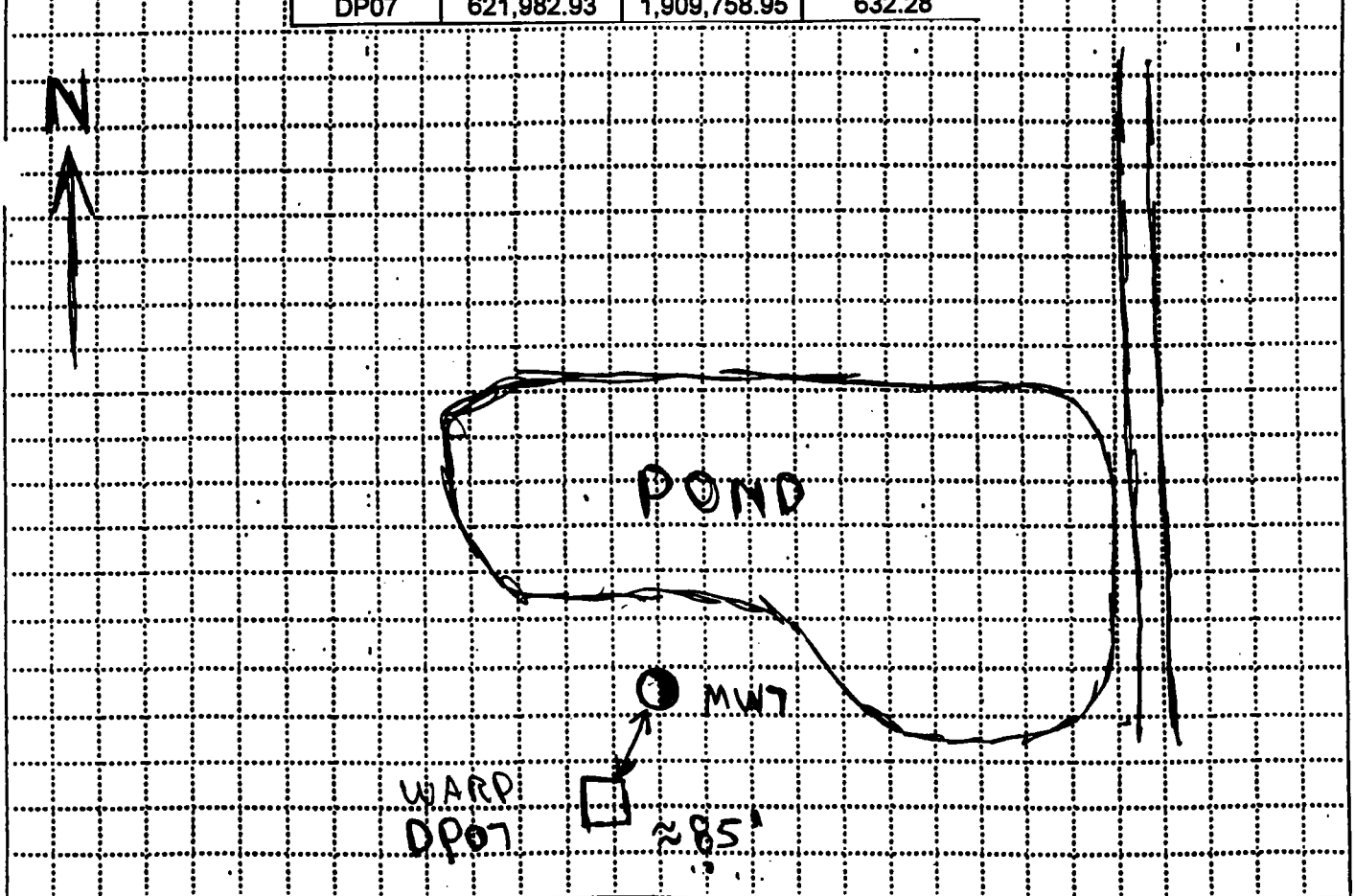
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

N	E	EL.
DP07	621,982.93	1,909,758.95	632.28

SCALE: Not to Scale



PROJECT: PBOW - WARP

HOLE NO. WARP-DP07

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP07

PROJECT PBOW - WARP | INSPECTOR John Voegding | SHEET 2 OF 3

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings		PBOW-98-50-WARP-DP07-8340-(0002)		Start Time 1545 End 1555
ml/Cl	1 2 3 4'	0.5-4' Soft, dark-light brown, low plasticity, clayey silt and clay, moist.	NA		2'	Push 1 3.5' Recovery	Hnu meter Not working properly due to high ambient and headspace moisture.
SC	4 5 6 7'	4'-7' Loose/soft, brown and grey, F-m, clayey sand, moist	NA	NA	PBOW-98-50-WARP-DP07-8350-(0406) 6'	Push 2 4' Recovery	
Cl	7 8 9 10	7'-8' Hard, med. brown and grey Silty clay w/ 30% F-m, angular gravel, (TILL), moist 8'-10' Same as Above	NA		8' PBOW-98-50-WARP-DP07-8360-(0810) 10'	Push 3 (8-12') 4' Recovery	

PROJECT PBOW - WARP | HOLE NO. WARP - DP07

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP07

PROJECT SCS, PBOW - WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

~~DATE~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
NA	11	8'-12' Hard, grey, weathered shale, Dry.	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12'	Start Time 1545 End 1555
	12	Bottom of Boring at 12.0 Ft.					

PROJECT PBOW - WARP

HOLE NO. WARP - DP07

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: WARP DP08
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP08	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-15-98	11. DATE COMPLETED: 6-15-98
12. OVERBURDEN THICKNESS: NA	15. DEPTH GROUNDWATER ENCOUNTERED: NA Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

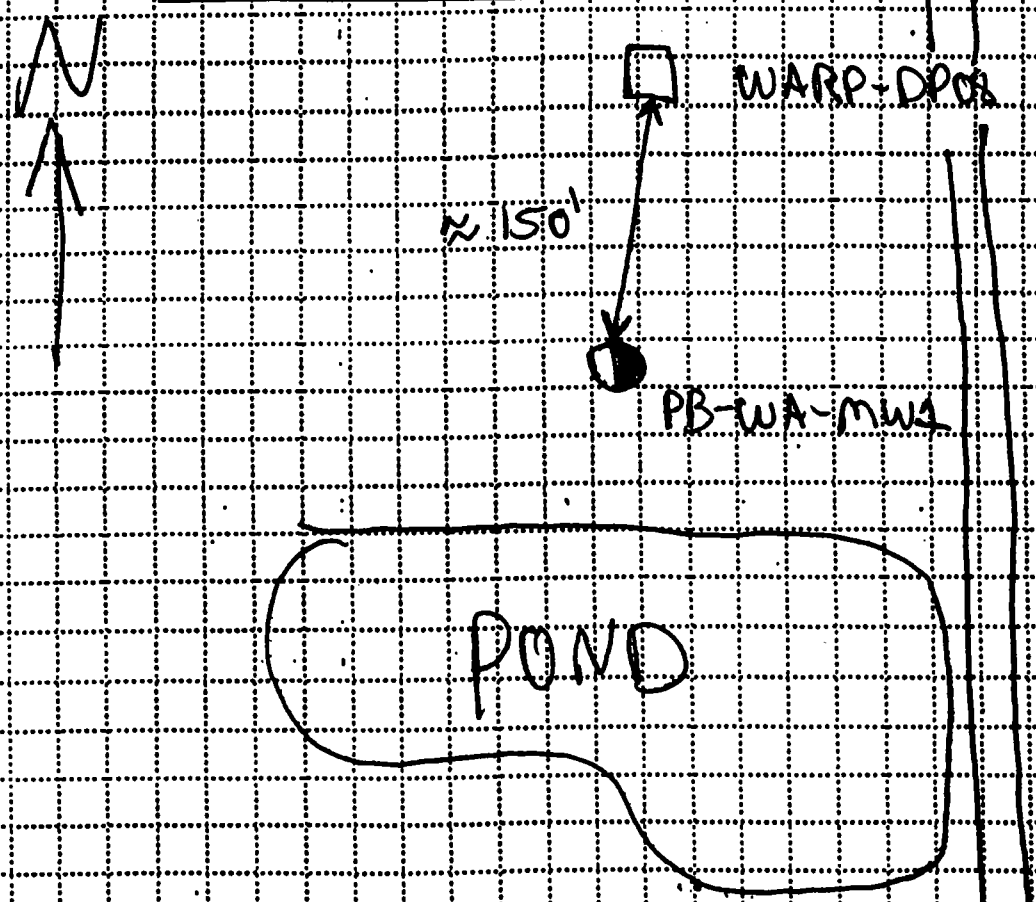
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogelin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP08	622,727.47	1,909,986.13	642.69



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP08

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP08

PROJECT PBOW - WARP

INSPECTOR John Voegding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals	REMARKS (h)
Pt/Sm		0-0.5' grass + Topsoil	Headspace Hnu Readings				Start 1345 End 1410
Sm	1	0.5'-3' Loose, Light-dark brown, v. Fine, Silty Sand, Dry			PBOW-98-SO-WARP-DP08-8380-(0002) 2'	Push 1 3.5' Recovery	
	2		NA				
3'	3	3'					
ml/Cl	4	3'-4' Soft, med. brown, low Plasticity, v. Fine Sandy Silt, moist	4'		4'	4'	Hnu meter not working due to high humidity
	5	4'-8' Same as Above grey, Sandy Silt and clayey Silt w/ v. Fine Sand Stringers throughout. Trace amount of free water within Sand Stringers.		NA	PBOW-98-SO-WARP-DP08-8390-(0006) 6'	Push 2 4' Recovery	
	6		NA				
	7						
	8	8-9' Same as Above, moist	8'		8'	8'	
9'	9	9-9.5' Loose, med. brown, Fine silty Sand, wet 9.5'	NA		PBOW-98-SO-WARP-DP08-8400-(0010) 10'	Push 3 (8'-12') 4' Recovery	
Sm 9.5'							
ml/Cl	10	9.5'-12' Soft, grey, med. Plasticity Clayey Silt + Clay, moist					

PROJECT PBOW - WARP

HOLE NO. WARP - DP08

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP08

PROJECT 2SCS PBOW-WARP

INSPECTOR John Voegding

SHEET 3 OF 3 SHEETS

~~MATERIAL~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
Ml / Cl	11	10-12' See pg 2	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12')	Start 1345 End 1410
12'	12	12'				12'	
	13	Bottom of Boring at ~~[illegible]~~ Ft. 16.0	NA	Note: Initially advanced borehole to 12 ft. and Installed Temp. Well for gw Collection. Due to lack of 8" borehole was advanced further to 16 ft. and Temp. Well re-Installed		Push 4 4' recovery	
	14						
	15						
	16	16'					

PROJECT PBOW-WARP

HOLE NO. WARP-DP08

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

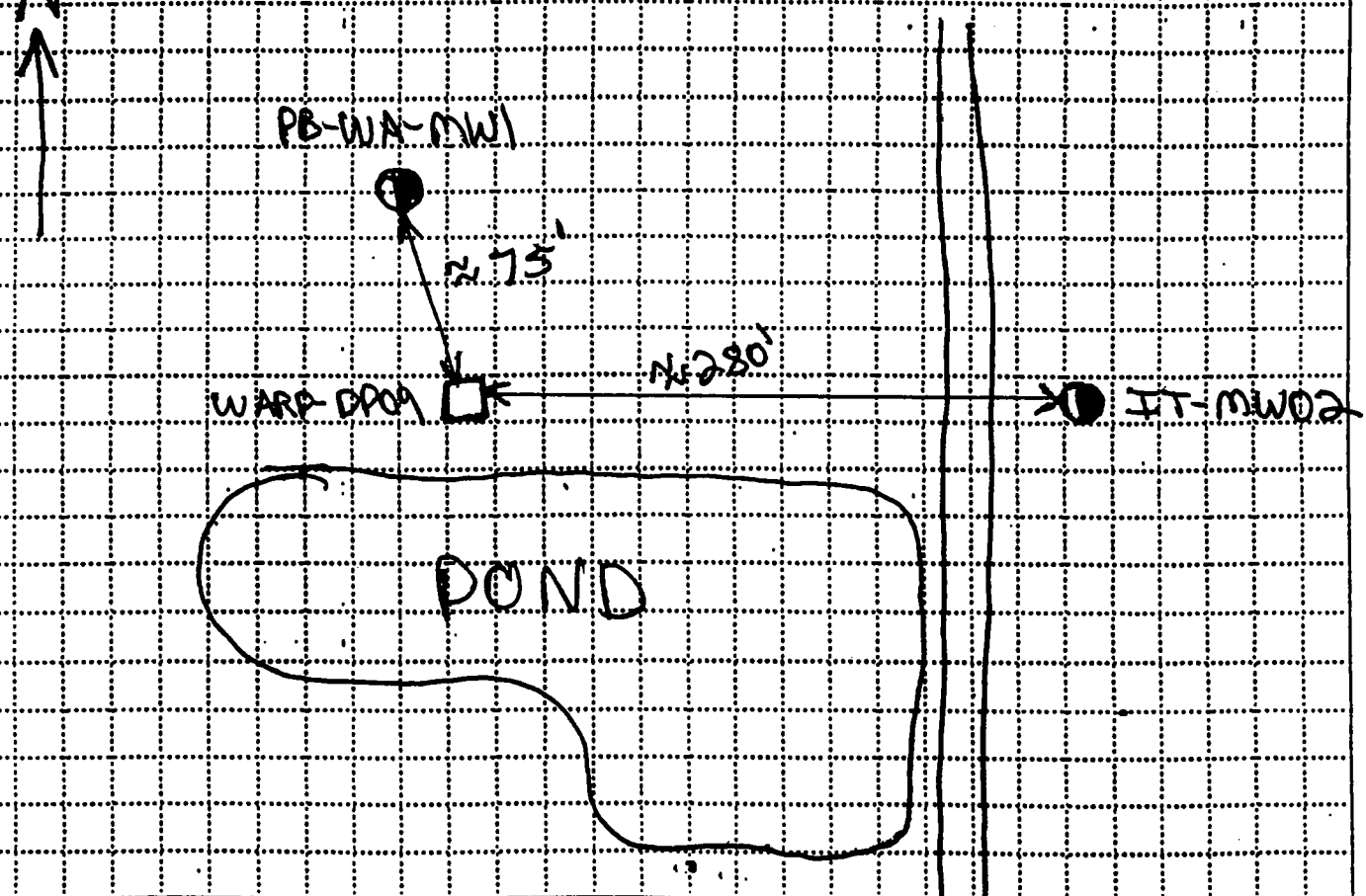
DISTRICT	Nashville - TN
HOLE NUMBER	DP09
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP09
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-16-98
11. DATE COMPLETED	6-16-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	≈ 6-8 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	Grouted	—	—	Josh Voegeding		

LOCATION SKETCH/COMMENTS

SCALE Not to Scale

	N	E	EL.
DP09	622,546.61	1,909,995.23	639.02



PROJECT PBOW - WARP

HOLE NO. WARP-DP09

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP09

PROJECT USCS PBOW - WARP | INSPECTOR John Voegding | SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Time Start 0800 End 0850
Sm	1 2	0.5'-3.0' Loose, med-dark brown, v. fine, Silty Sand, Dry - Slightly moist	NA		PBOW-98-SO-WARP-DP09-8420-(0002) 2'	Push 1 3.5' Recovery	
ml/Cl	3 4	3'-4' Soft, med brown-White, low plasticity, Clayey Silt and Clay, moist 4'-5' Same as Above	4'		4'	4'	Hnu meter Not working properly due to high humidity and Headspace moisture.
Pt	5 6	5'-6' Soft, Black, Sandy Peat, moist	NA	NA	PBOW-98-SO-WARP-DP09-8430-(0406) 6'	Push 2 4' Recovery	
SC	7 8	6'-8' Loose, med-dark brown, Silty and Clayey Fine Sand, moist - Slightly wet.	8'		8'	8'	
Cl	9 10	8'-12' Soft-m. Firm, m. brown and grey, low Plasticity, Silty Clay, moist	NA		PBOW-98-SO-WARP-DP09-8440-(0810) 10'	Push 3 (8'-12') 4' Recovery	

PROJECT PBOW - WARP | HOLE NO. WARP - DP09

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP09

PROJECT SCS PBOW-WARP

INSPECTOR John Voegding

SHEET 3 OF 3 SHEETS

~~DATO~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ (g) Sampling Intervals	REMARKS (h)
Cl	11	10'-12' See pg 2	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12')	Start 0800 End 0850 (Time)
	12	Bottom of Boring at 12.0'					

PROJECT PBOW-WARP

HOLE NO. WARP-DP09

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT Nashville - TN		HOLE NUMBER DP10
1. COMPANY NAME IT Corp.	2. DRILL SUBCONTRACTOR Geo-Environmental Drilling Co.	SHEET 1 OF SHEETS 2
3. PROJECT PBOW - WARP	4. LOCATION PBOW - WARP	
5. NAME OF DRILLER Scott ~~[illegible]~~ Beal	6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION WARP-DP10	
	9. SURFACE ELEVATION ~~NA~~ See below	
	10. DATE STARTED 6-26-98	11. DATE COMPLETED 6-26-98
12. OVERBURDEN THICKNESS NA	13. DEPTH GROUNDWATER ENCOUNTERED 5.5' - 6.5 Ft. BGS	
13. DEPTH DRILLED INTO ROCK NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA	
14. TOTAL DEPTH OF HOLE 8.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

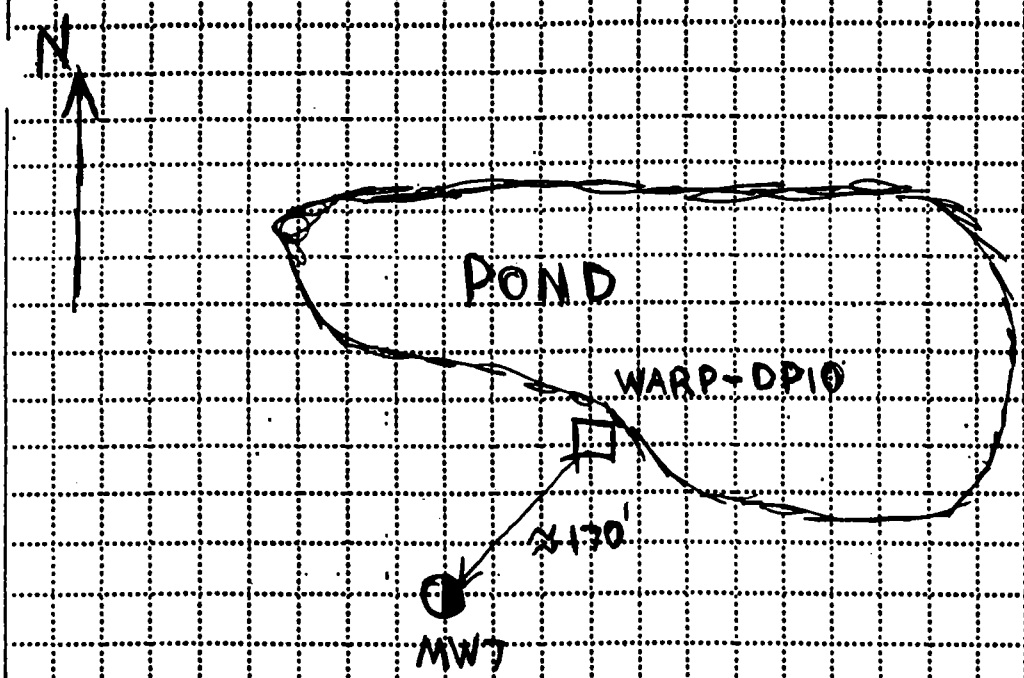
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP10	622,147.23	1,910,023.31	633.34

SCALE: Not to Scale



PROJECT PBOW - WARP

HOLE NO. WARP-DP10

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP10

PROJECT SCS PBOW - WARP

INSPECTOR John Voeding

SHEET 2 OF 2

SOIL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sn		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Start 1025 End 1045
ml/Cl	1	0.5'-4' Soft-m. Firm, Light-dark brown, low plasticity, Clayey silt and clay, Dry			PBOW-98-50-WARP-DP10-8460-(0002) 2'	Push 1 3.5' Recovery	
	2						
	3		NA				
	4		4'		4'	4'	
	5	4-5.5' Same as Above, reddish brown, moist 5.5'		NA	PBOW-98-50-WARP-DP10-8470-(0406) 6'	Push 2 4' Recovery	
Cl 6.5'	6	5.5'-6.5' Soft, reddish brown, F-m Sandy Clay, wet. 6.5'	NA				
ml/Cl 8'	7	6.5-8' Firm, reddish brown, low Plasticity, clayey Silt, moist 8'			8'	8'	
	8		8'				
	9	Bottom of Boring at 8.0 ft.				[redacted]	Rig Broke Down at 8'
	10				10'		

PROJECT PBOW - WARP

HOLE NO. WARP - DP10

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	DISTRICT: Nashville - TN
		HOLE NUMBER: DP11
		SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Scott [redacted] Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP11	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-25-98	11. DATE COMPLETED: 6-25-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 4-7 FT. [redacted] Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

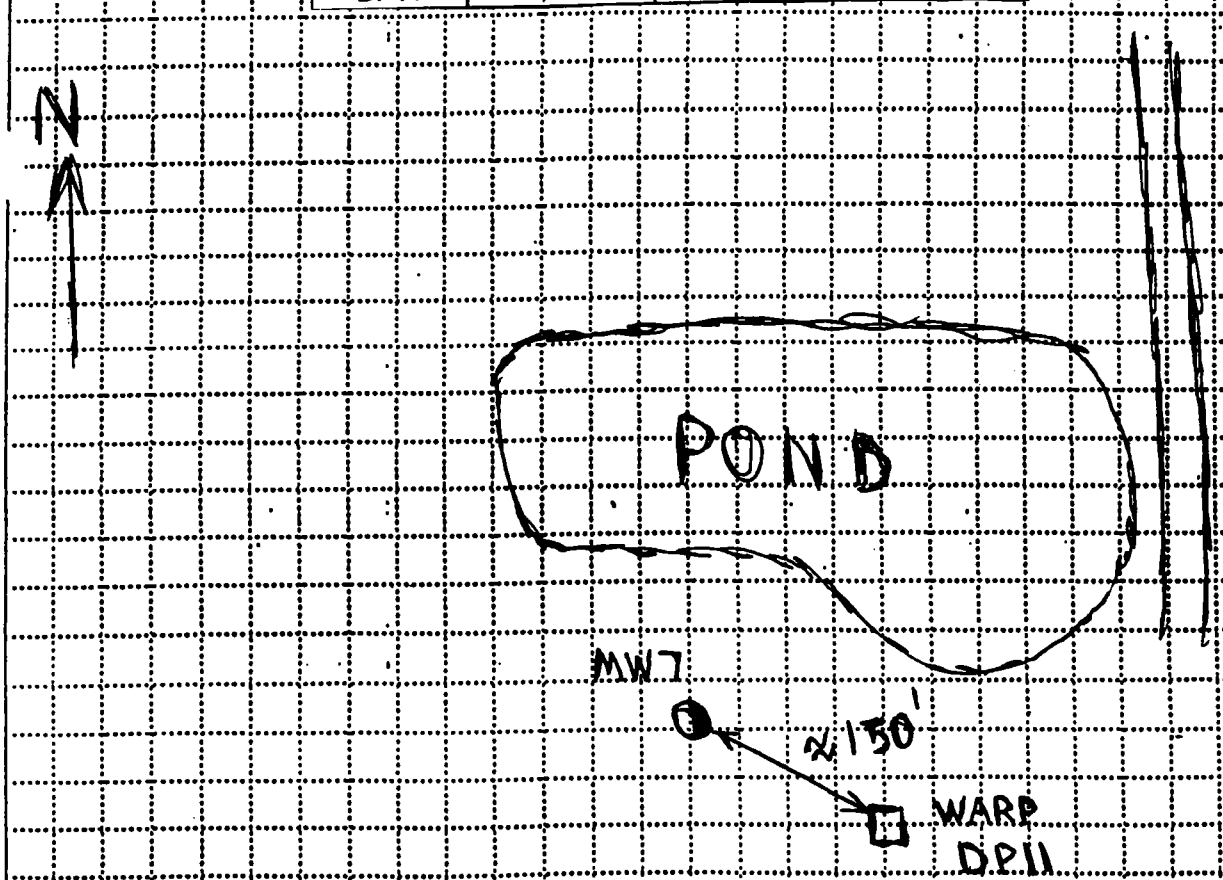
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP11	622,016.75	1,909,999.70	632.04



PROJECT: PBOW - WARP

HOLE NO. WARP-DP11

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP11

PROJECT: USCS PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3 SHEETS

~~USCS~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil.	Headspace Hnu Readings				Start Time 1615 End 1630
Sm	1 2 3'	0.5'-3' Loose, Light-dark brown, Fine Silty Sand, dry-Slightly moist 3'	NA		PBOW-98-SO-WARP-DP11-8500-(0002) 2'	Push 1 3' Recovery	
ml	3 4 4'	3'-4' Soft, m. brown and grey, low plasticity, Clayey Silt, moist. 4'	4'		4'	4'	Hnu Meter Not working Due to high ambient and headspace moisture.
SC	5 6 7'	4-7' Loose/Soft, m. brown and grey, F-m, Clayey Sand, wet. 7'	NA	NA	PBOW-98-SO-WARP-DP11-8510-(0406) 6'	Push 2 4' Recovery	
ml / Cl	7 8 9 10	7'-8' Firm, brownish grey, low Plasticity, Clayey Silt and Clay w/ 30% F-m angular gravel, (Till), moist 8' 8'-11' Same as Above, Hard, grey, moist	8' NA		PBOW-98-SO-WARP-DP11-8520-(0810) 10'	8' Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW - WARP

HOLE NO. WARP - DP11

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP11

PROJECT: PBOW-WARP

INSPECTOR: John Voeding

SHEET 3 OF 3 SHEETS

~~SOIL~~ CLASS. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~SEDIMENT~~ Sampling Intervals (g)	REMARKS (h)
cl 11'	11	10'-11' See pg. 2 11'	Headspace Hnu Readings			Ash 3 (8-12')	Start Time 1615 End 1630
NA 12'	12	11-12' Hard, grey, weathered Shale, Dry.	NA	NA	NA		
		Bottom of Boring at 12.0 Ft.					

PROJECT: PBOW-WARP

HOLE NO. WARP-DP11

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP12
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP12	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-15-98	11. DATE COMPLETED: 6-15-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: ≈ 4.5-5 Ft and 8-10 Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

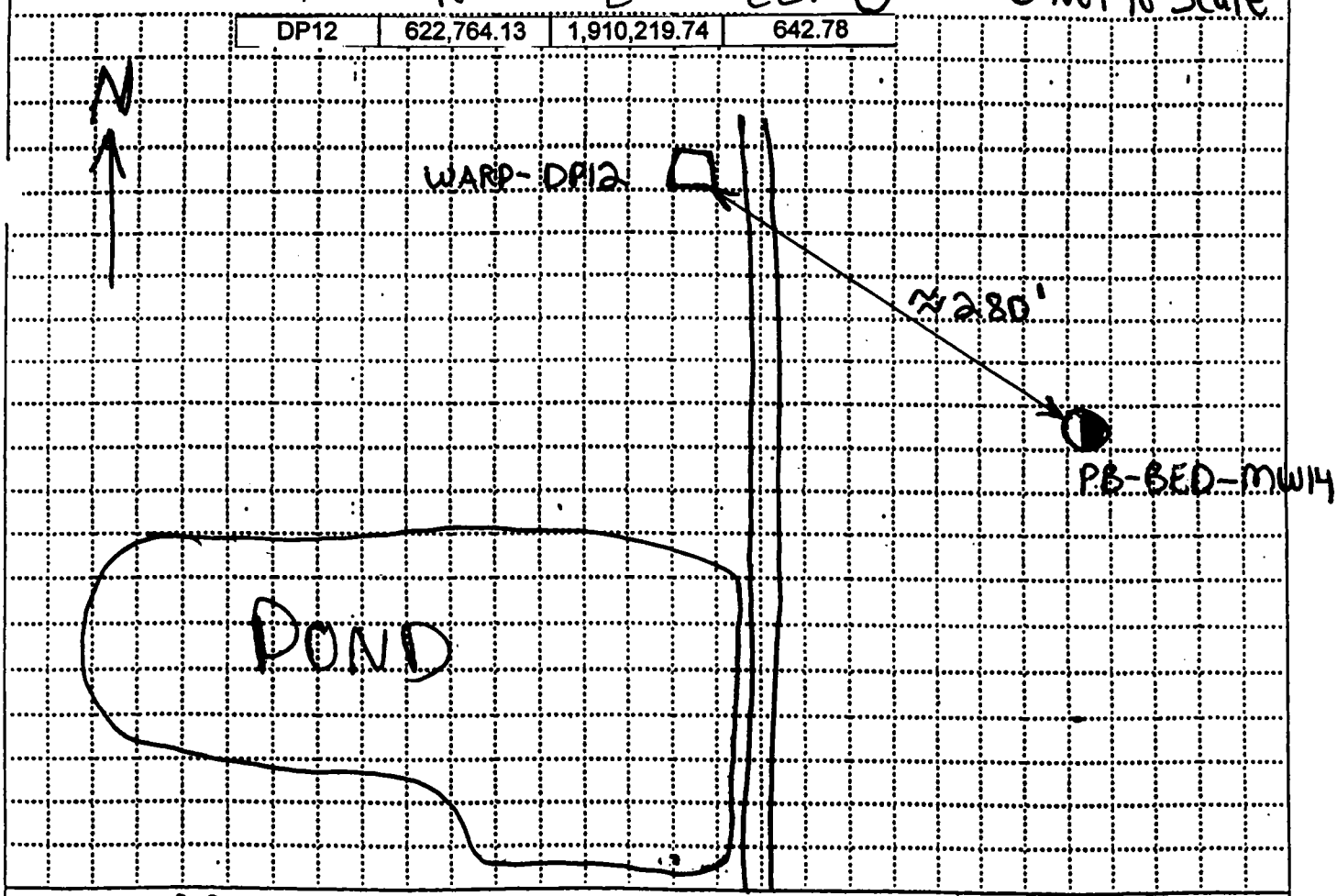
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogeding

LOCATION SKETCH/COMMENTS

N	E	EL.
DP12	622,764.13	1,910,219.74	642.78

SCALE: Not to Scale



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP12

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP12

PROJECT: PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/SM		0-0.5' grass and Topsoil	Headspace Hnu Readings				Start Time 0905 End 0935
SM	1	0.5'-3' Loose, Light-med brown, Fine, Silty Sand, Dry-Slightly moist			PBOW-98-SO-WARP-DP12-8540-(0002) 2'	Push 1	
	2		NA			4' Recovery	
3'	3	3'					
ml	4	3'-4' Soft, greyish brown, low Plasticity, Sandy Silt, moist 4-4.5' Same as Above	4'		4'	4'	Hnu meter Not working due to excessive Headspace moisture.
4.5'							
SM 5'	5	4.5'-5' Loose, Silty Fine Sand, wet 5'		NA			
ml / Cl	6	5'-8' Soft, brown-grey, low Plasticity, v. Fine Sandy Silt w/ Few Fine Sand stringers throughout, Slightly wet.			PBOW-98-SO-WARP-DP12-8550-(0406) 6'	Push 2 4' Recovery	
	7		NA				
	8		8'		8'	8'	
	9	8-10' Loose, med. brown, Fine, Clayey Sand, wet.	NA		PBOW-98-SO-WARP-DP12-8560-(0806) 10'	Push 3 (8-12) 4' Recovery	
	10						

PROJECT: PBOW - WARP

HOLE NO. WARP-DP12

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP12

SHEET 3 OF 3 SHEETS

PROJECT PBOW - WARP

INSPECTOR John Voegding

USCS SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~COMMENT~~ Sampling Intervals (g)	REMARKS (h)
ml/Cl	11	10-12' Soft-M. Firm, grey, med Plasticity, Clayey Silt and clay, moist. 12'	Headspace Hnu Readings NA 12'	NA	NA	Push 3 (8'-12') 12'	Start Time 0905 End 0935
	12	Bottom of Boring at 12.0 ft.					

PROJECT PBOW - WARP

HOLE NO. WARP - DP12

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP13
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Jack Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP13	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-15-98	11. DATE COMPLETED: 6-15-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: Ft. BGS	
15. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

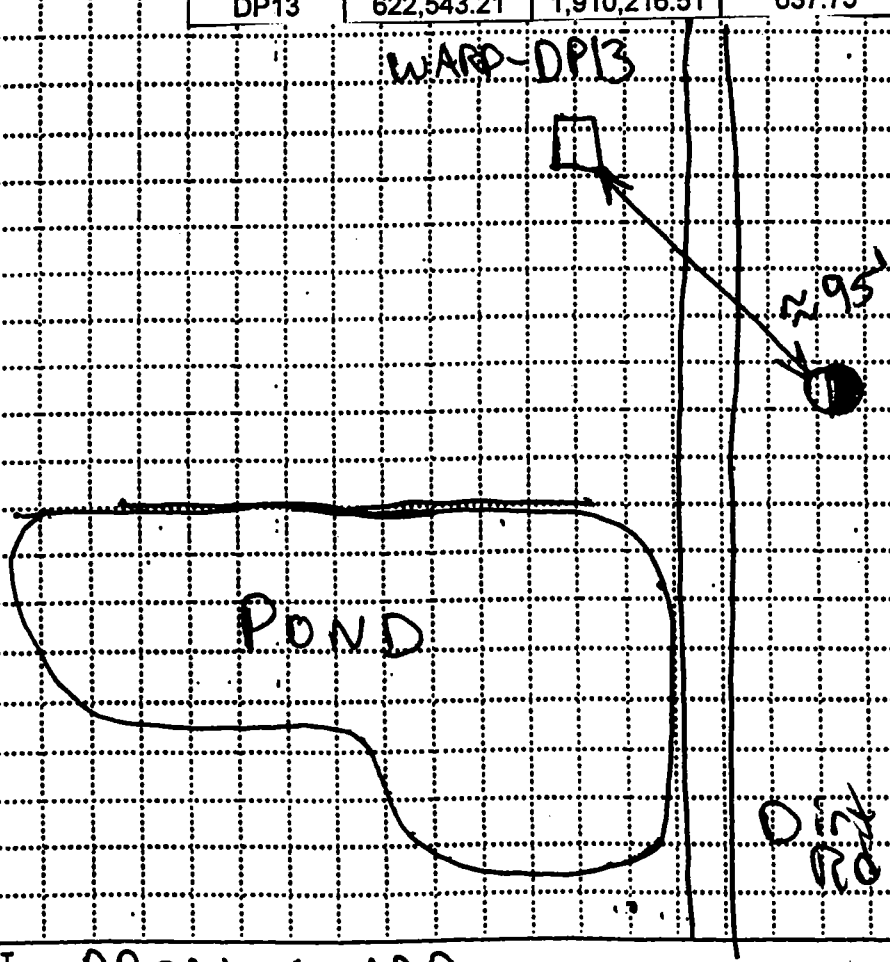
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogelin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP13	622,543.21	1,910,216.51	637.75



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP13

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP13

PROJECT: PBOW - WARP

INSPECTOR: John Voegding

SHEET 2 OF 3 SHEETS

SCS ~~USCS~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
ML	1, 2, 3, 4'	0-0.5' grass and Topsoil 0.5'-4' M. Firm, v. dark brown, Fine Sandy Silt, Dry.	Headspace Hnu Readings NA		PBOW-98-SO-WARP-DP13-8580-(0002) 2'	Push 1 3.5' Recovery 3' Recovery.	Start Time 1045 End 1115
SM	5, 6'	4'-8' Loose, light-dark brown, v. Fine Silty Sand grading to Clayey v. Fine Sand, Moist	NA	NA	PBOW-98-SO-WARP-DP13-8590-(0406) 6'	Push 2 3' Recovery	
SC	7, 8, 8.5'	Slightly wet at ≈ 8' 8'-8.5' Same as Above	NA				
ML/CL	9, 10	8.5'-12' Soft-M. Firm, Med. Plasticity, Brown and Grey Clayey Silt and Clay, moist	NA		PBOW-98-SO-WARP-DP13-8600-(0810) 10'	Push 3 (8-12') 4' Recovery	

PROJECT: PBOW - WARP

HOLE NO. WARP - DP13

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP13

PROJECT USCS PBOW-WARP

INSPECTOR John Voegding

SHEET 3 OF 3 SHEETS

~~MATERIAL~~ USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~Recovery~~ Sampling Intervals (g)	REMARKS (h)
			Headspace Hnu Readings			Push 3	Start 1045
	11	10-12' See pg 2	NA		NA	(8'-12')	End 1115
			12'			12'	
ML	12						
CL		12'-16' Same as Above				Push 4	
	13	Trace Amount of free water from ≈ 13'-14'.		NA		4' Recovery	
	14	All other intervals are moist	NA		NA		
	15						
			16'			16'	
	16	Bottom of Boring At 16.0 Ft.					

PROJECT PBOW-WARP

HOLE NO. WARP-DP13

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP15
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP15
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-24-98
11. DATE COMPLETED	6-24-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	16.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA; DISTURBED; UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	

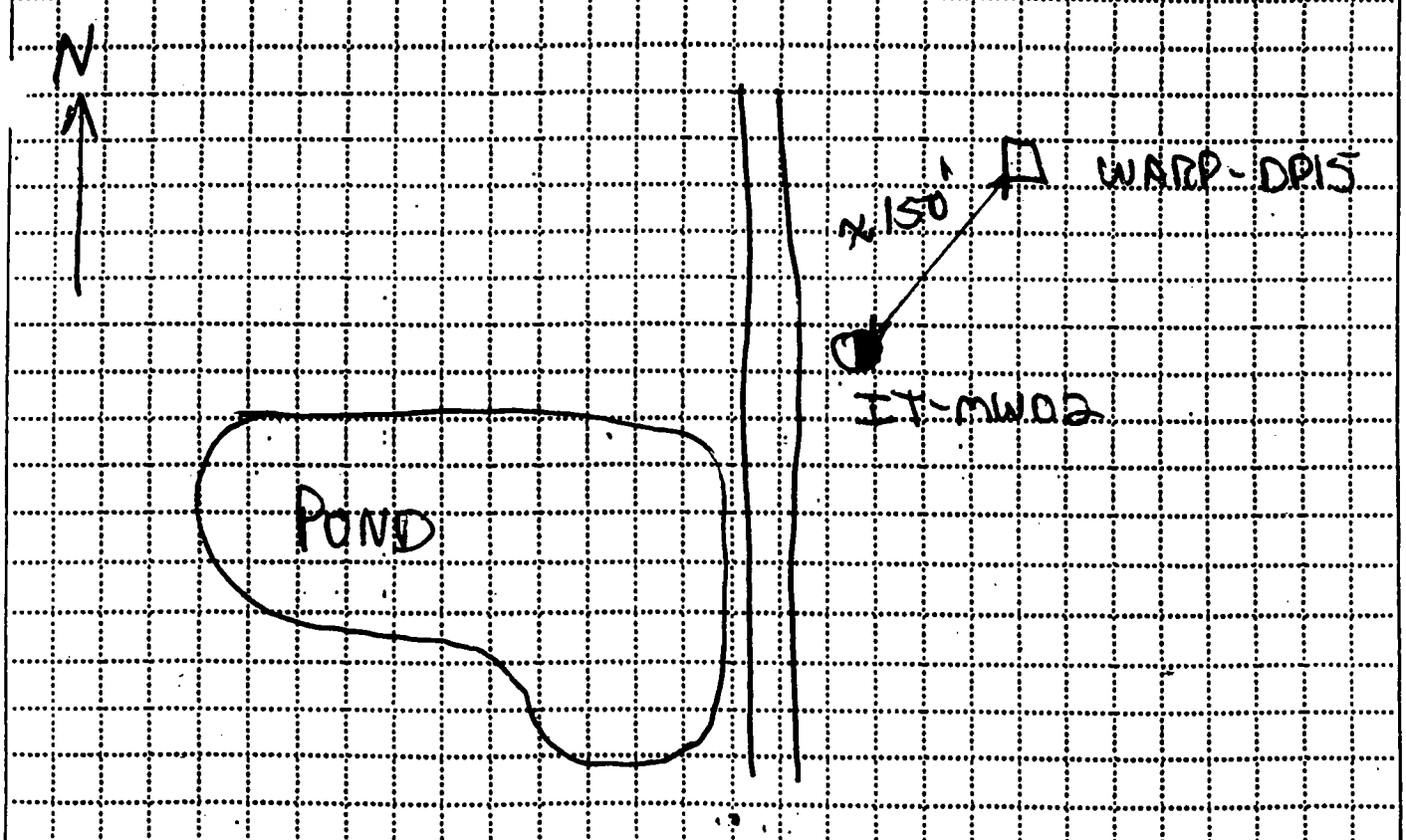
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vaggelis

LOCATION SKETCH/COMMENTS

	N	E	EL.
DB15	622,601.84	1,910,385.32	637.86

SCALE: Not to Scale



PROJECT PBOW - WARP

HOLE NO. WARP-DP15

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP15

PROJECT: PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE ✓ OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Start Time 1045 End 1105
ml	1, 2, 3, 4'	0.5'-4' Soft-m. Firm, Light-dark brown, low plasticity, v. Fine Sandy Silt, Dry-Slightly moist	NA 4'		PBOW-98-SO-WARP-DP15-8660-(0002) 2' 4'	Push 1 3.5' Recovery 4'	Hnu Meter Reading: erratic Due to High Ambient and headspace moisture
Sm	5, 6	4'-6.5' Loose, light-dark brown, v. Fine, Silty Sand, Dry-Slightly moist.	NA	NA	PBOW-98-SO-WARP-DP15-8670-(0406) 6'	Push 2 4' Recovery	
ml/Cl	7, 8, 9, 10	6.5'-8' m. Firm, med brown and grey, low plasticity, Clayey Silt, Dry. 8'-12' Same as Above Clayey Silt and Clay	8' NA		PBOW-98-SO-WARP-DP15-8680-(0810) 8' 10'	Push 3 (8'-12') 4' Recovery	

PROJECT: PBOW - WARP

HOLE NO. WARP - DP15

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP15

PROJECT SCS, PBOW - WARP

INSPECTOR John Voegding

SHEET 3 OF 3 SHEETS

~~MATERIAL~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
		10-12' See ps 2	Headspace Hnu Readings			Push 3	Start Time 1045
	11	Clayey Silt and Clay, Dry-Slightly moist.	NA		NA	(8-12')	End 1105
			12'		12'	12'	
	12						
ml		12'-16' grey,				Push 4	
cl	13	Clayey Silt and Clay (As Above)		NA		4' Recovery	
		med-high Plasticity,					
	14	moist	NA		NA		
							No Noticable gw encountered.
	15						
		16'	16'			16'	
16'	16	Bottom of Boring at 16.0 Ft.					

PROJECT PBOW - WARP

HOLE NO. WARP - DP15

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

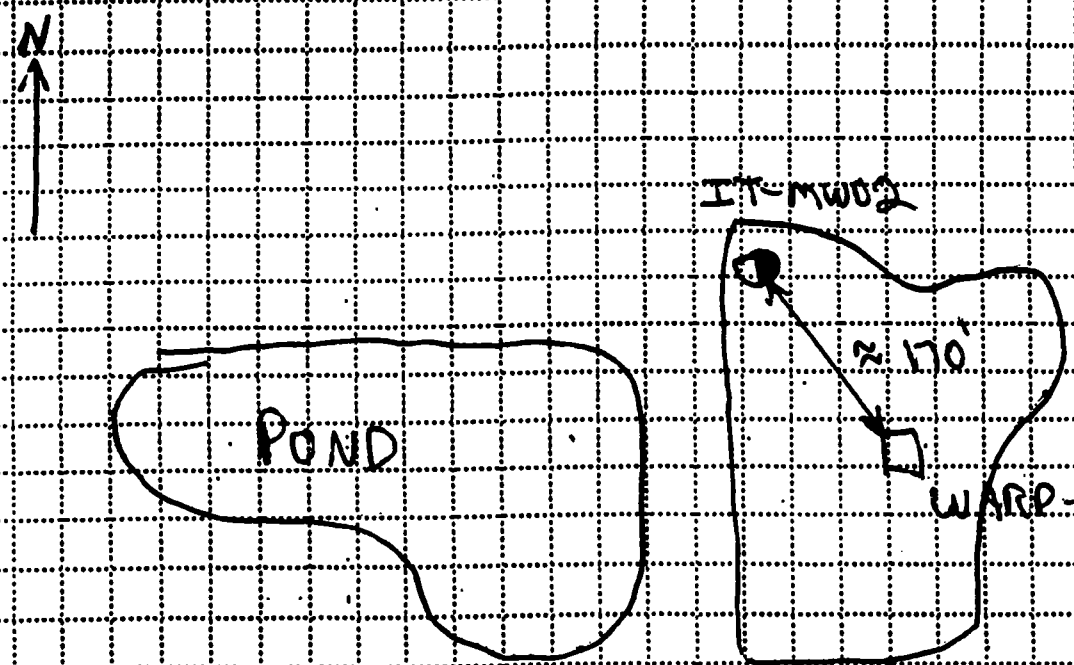
DISTRICT	Nashville - TN
HOLE NUMBER	DP16
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott ~~[illegible]~~ Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP16
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-24-98
11. DATE COMPLETED	6-24-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	5.5-7.0 Ft. and 9-10 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vicardi

LOCATION SKETCH/COMMENTS N E EL. SCALE: Not to Scale

DP16	622,425.11	1,910,395.07	632.83



PROJECT PBOW - WARP

HOLE NO. WARP-DP16

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP16

PROJECT PBOW - WARP

INSPECTOR John Voegding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	EQUIPMENT (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings			Sampling Intervals	Time Start 1330 End 1350
ml/Cl	1 2 3 4	0.5'-4' m. Firm, m. Brown and grey, low plasticity, Clayey Silt and Clay, Dry-Slightly moist.	NA 4'		PBOW-98-SO-WARP-DP16-8700-(0002) 2' 4'	Push 1 4' Recovery 4'	Hnu meter readings erratic due to high Ambient and headspace moisture.
5.5'	5	4-5.5' Same as Above 5.5'		NA			
SC 7'	6 7	5.5'-7' Loose/Soft, m. brown, F-m, Clayey Sand, wet 7'	NA		PBOW-98-SO-WARP-DP16-8710-(0406) 6'	Push 2 4' Recovery	
ml/Cl 9'	8 9	7'-8' m. Firm, m. brown and grey, low plasticity, Clayey Silt and Clay, moist 8'-9' Same as Above 9'	8' NA		8' PBOW-98-SO-WARP-DP16-8720-(0806)	8' Push 3 (8'-12') 4' Recovery	
SC 10'	10	9'-10' Loose/Soft, m. brown, F-m, Clayey Sand, wet. 10'					

PROJECT PBOW - WARP

HOLE NO. WARP - DP16

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP16

PROJECT PBOW-WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

CS. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	FIELD SCREENING RESULTS (D)	GEOTECH SAMPLE OR CORE BOX NO. (E)	ANALYTICAL SAMPLE NO. (F)	Sampling Intervals (G)	REMARKS (H)
ml/cl	11	10'-12' Soft, grey, med. Plasticity, Clayey Silt, wet 12'	Headspace Hnu Readings NA	NA	NA	Push 3 (8'-12') 12'	Start Time 1330 End 1350
	12	Bottom of Boring at 12.0 ft.					
	13						
	14						
	15						
	16						

PROJECT PBOW-WARP

HOLE NO. WARP-DP16

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP17
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP17
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-24-98
11. DATE COMPLETED	6-24-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	5-6.5 Ft. and 8-10 Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

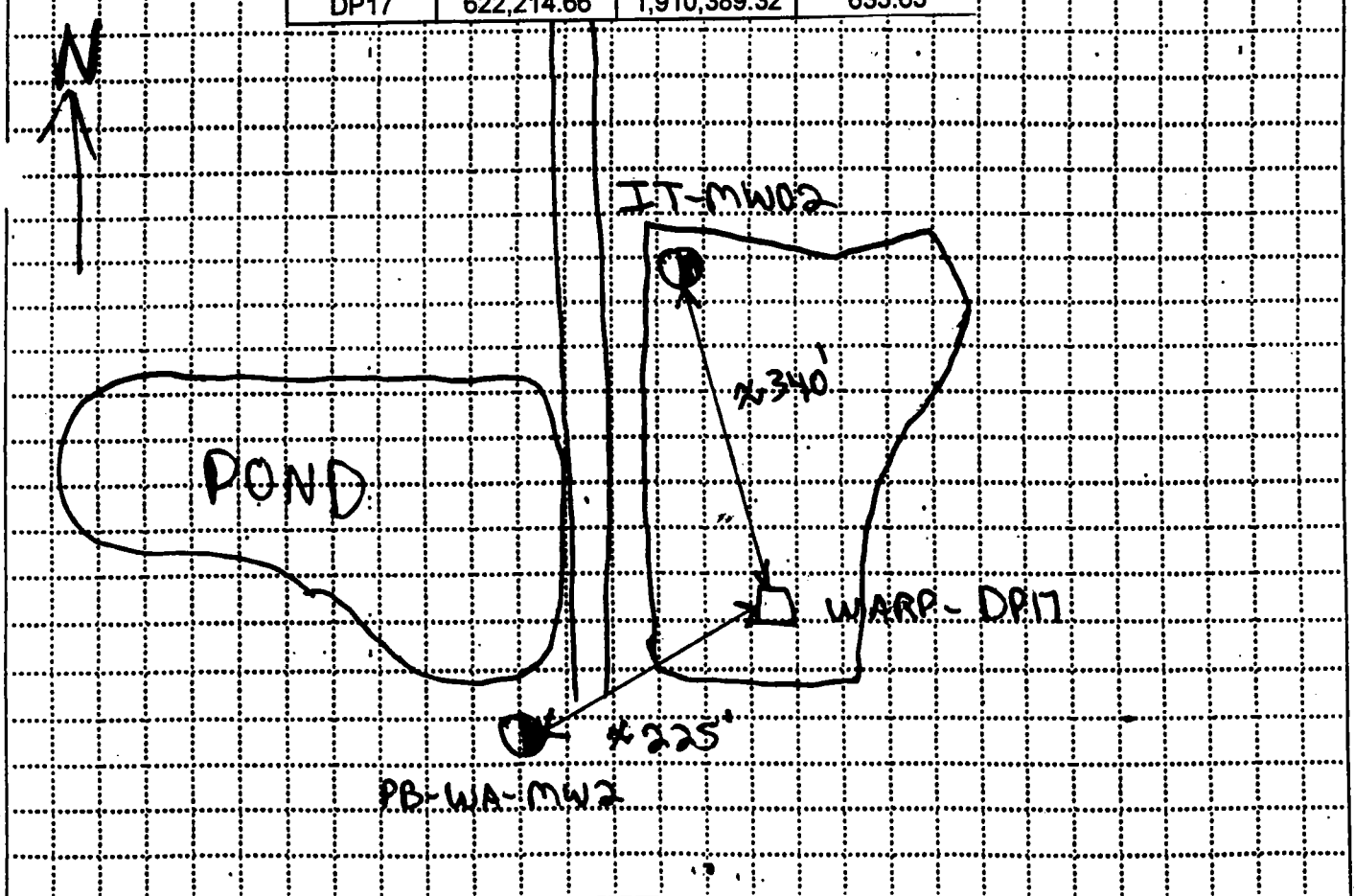
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogel

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP17	622,214.66	1,910,389.32	633.63

SCALE: Not to Scale



PROJECT PBOW - WARP

HOLE NO. WARP-DP17

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP17

PROJECT PBOW-WARP

INSPECTOR John Voegeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	EQUIPMENT Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Start Time 1410 End 1430
ml	1	0.5'-4' m. Firm, light-dark brown, low plasticity, Clayey Silt, Dry	NA		PBOW-98-SO-WARP-DP17-8740-(0002) 2'	Push 1 3.5' Recovery	
	2						
	3						
	4	4'-5' Same as Above, Soft, moist. 5'	4'		4'	4'	Hnu Meter Readings erratic due to high Ambient and Headspace moisture
5'	5						
SC	6	5-6.5' Loose/Soft, m. brown, F-m, Clayey Sand, moist-slightly wet. 6.5'	NA	NA	PBOW-98-SO-WARP-DP17-8750-(0406) 6'	Push 2 4' Recovery	
6.5'							
ml/Cl	7	6.5'-8' Firm, m. brown and grey, low-med. plasticity, Clayey Silt and Clay, moist	8'		8'	8'	
	8						
	9	8'-10' Same as Above, Sandy Clay, wet 10'	NA		PBOW-98-SO-WARP-DP17-8760-(0806) 10'	Push 3 (8'-12') 4' Recovery	
10'	10						

PROJECT PBOW-WARP

HOLE NO. WARP-DP17

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP17

PROJECT USCS PBOW-WARP

INSPECTOR John Voegding

SHEET 3 OF 3 SHEETS

~~LOG~~ USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~TREATMENT~~ Sampling Intervals	REMARKS (h)
			Headspace				
		10'-12'	Hnu Readings			Push 3	Start Time 1410
Cl	11	Soft, grey, high Plasticity		NA	NA	(8'-12')	End 1430
		Silty Clay, moist.	NA				
		Slightly wet					
	12		12'		12'	12'	
		Bottom of Boring at					
	13	12.0 ft.					
	14						
	15						
	16						

PROJECT PBOW-WARP

HOLE NO. WARP-DP17

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT: Nashville - TN	HOLE NUMBER: DP18	
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Scott ~~[illegible]~~ Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP18	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-24-98	11. DATE COMPLETED: 6-24-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: 6-6.5 Ft. Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

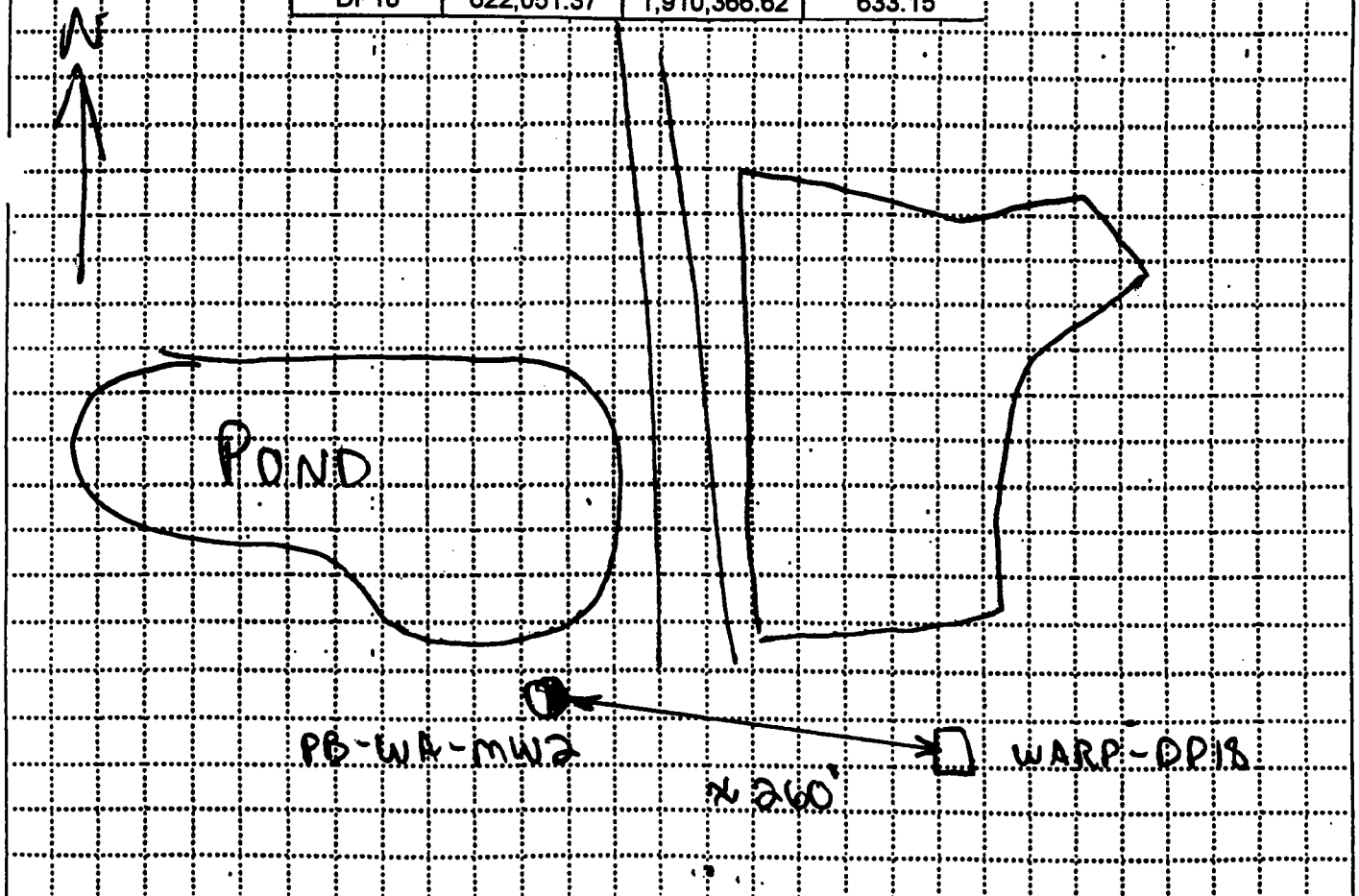
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogel

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP18	622,051.37	1,910,366.62	633.15

SCALE: Not to Scale



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP18

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP18

PROJECT PBOW - WARP

INSPECTOR John Voeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	EQUIPMENT (g) Sampling Intervals	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Start Time 1520 End 1600
ml	1	0.5'-4' Soft/Loose, light-dark brown, V. Fine, Sandy Silt, Dry			PBOW-98-SO-WARP-DP18-8780-(0001) 2'	Push 1 4' Recovery	
	2						
	3		NA				Hnu Meter Readings erratic Due to High Ambient and headspace moisture.
4'	4	4'	4'		4'	4'	
SC	5	4-7.5' Loose, med-dark brown, F-m, Clayey Sand, V. moist.	NA	NA	PBOW-98-SO-WARP-DP18-8790-(0960) 6'	Push 2 4' Recovery	
	6	wet from 6-6.5'					
	7						
7.5'		7.5'					
ml/cl	8	7.5-8' m. Firm, brownish grey, med. Plasticity, Clayey Silt and clay, moist	8'		8'	8'	
	9	8'-11' Same as Above grey, Clayey Silt and Clay, moist	NA		PBOW-98-SO-WARP-DP18-8800-(0810) 10'	Push 3 (8'-12') 4' Recovery	
	10						

PROJECT PBOW - WARP

HOLE NO. WARP-DP18

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP18

PROJECT: PBOW - WARP

INSPECTOR: John Voegeding

SHEET 3 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
ml cl. 11	11	10'-11' See pg 2. 11'	Headspace Hnu Readings	NA	NA	Push 3 (8'-12')	Start 1520 End 1600
NA 12'	12	11'-12' Highly weathered grey shale 12'	NA 12'	12'	12'	12'	
	13	Bottom of Boring at 12.0 ft.					

PROJECT: PBOW - WARP

HOLE NO. WARP - DP18

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

1. COMPANY NAME: IT Corp.	5. DISTRICT: Nashville - TN	8. HOLE NUMBER: WARP DP19
2. PROJECT: PBOW - WARP	6. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. NAME OF DRILLER: Scott [redacted]k Beal	4. LOCATION: PBOW - WARP	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
	9. HOLE LOCATION: WARP-DP19	
	8. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-24-98	11. DATE COMPLETED: 6-24-98
12. OVERBURDEN THICKNESS: NA	15. DEPTH GROUNDWATER ENCOUNTERED: NA Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

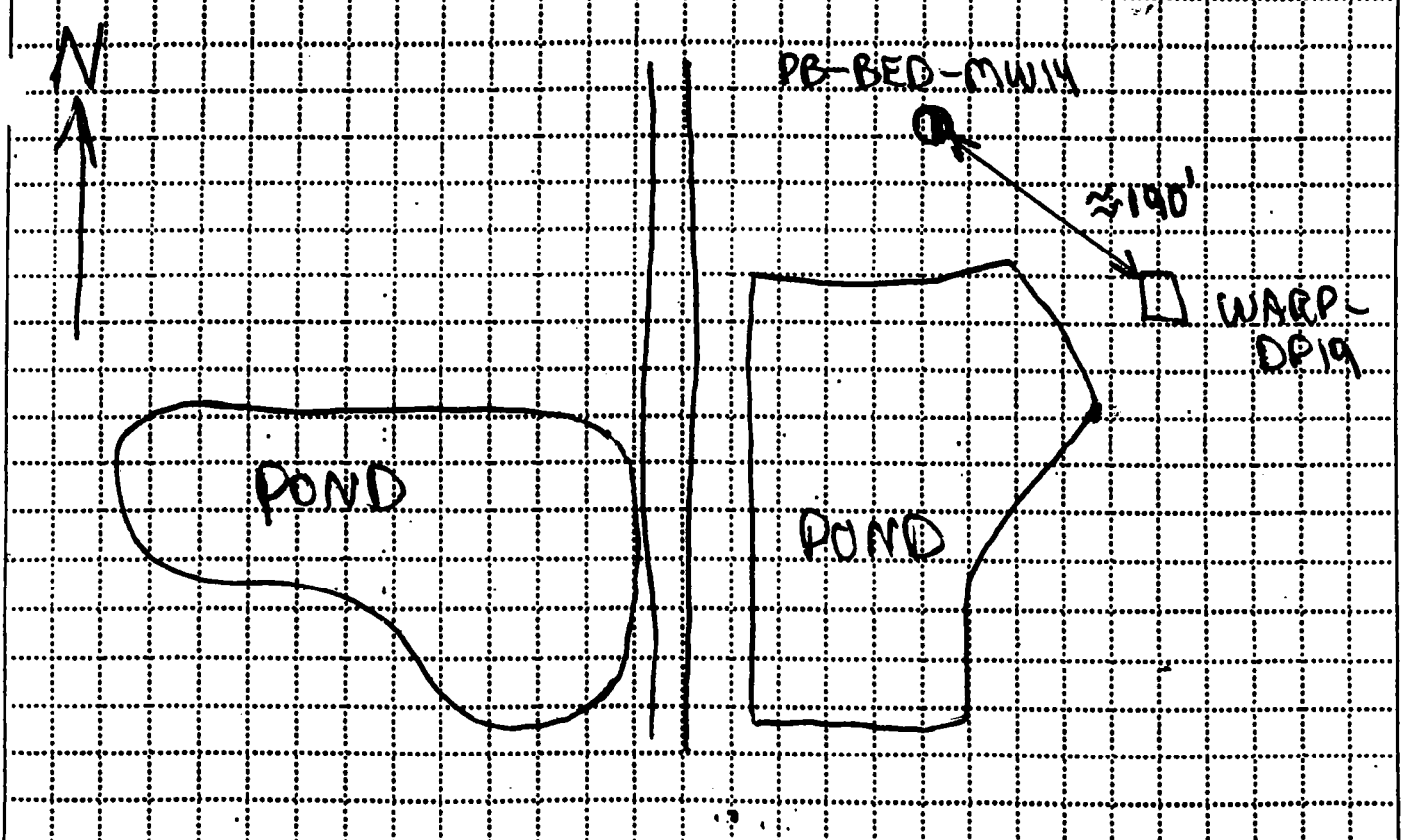
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogedin

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP19	622,689.12	1,910,553.60	638.96



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP19

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP19

PROJECT SCS PBOW - WARP | INSPECTOR John Voegding | SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Start 0900 End 0920
SM	1	0.5'-3.5' Loose, med. brown, Fine Silty Sand, moist			PBOW-98-SO-WARP-DP19-8820-(0002) 2'	Push 1	
	2		NA			3.5' Recovery	
	3	3.5'					
3.5'							
ML/CL	4	3.5'-4' Soft, Brown and grey, low plasticity, v. Fine, Sandy Silt, moist	4'		4'	4'	Hnu meter Readings erratic due to high ambient and headspace Moistu
	5	4'-8' Same as Above, grading to clayey Silt and Clay, moist.		NA	PBOW-98-SO-WARP-DP19-8830-(0916) 6'	Push 2 4' Recovery	
	6		NA				
	7						
	8		8'		8'	8'	
	9	8'-12' Soft-m. Firm, brownish grey, Clayey Silt and Clay (As Above), Moist	NA		PBOW-98-SO-WARP-DP19-8840-(0810) 10'	Push 3 (8'-12')	
	10						

PROJECT PBOW - WARP | HOLE NO. WARP - DP 19

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP19

PROJECT PBOW - WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

~~RDO~~ ES (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
		10'-12' See pg 2.	Headspace Hnu Readings			Push 3 (8'-12')	Start 0900 End 0920
	11		NA		NA		
						12'	
Md Cl	12	12'-14' Grey, Clayey Silt and Clay (As Above), med.-high Plasticity, moist, with several v. fine Sand stringers throughout.					
	13			NA		Push 4	
			NA			4' Recovery	
	14				NA		
	15						No Noticable gw encountered.
		16'				16'	
16'	16	Bottom of Boring at 16.0 Ft.					

PROJECT PBOW - WARP

HOLE NO. WARP - DP19

(Proponent: CECW-EG)

ENG FORM 5056A-R, AUG 94

WARP

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: DP20
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Scott [redacted] Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP20	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-24-98	11. DATE COMPLETED: 6-24-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: 10-12 Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 16.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			

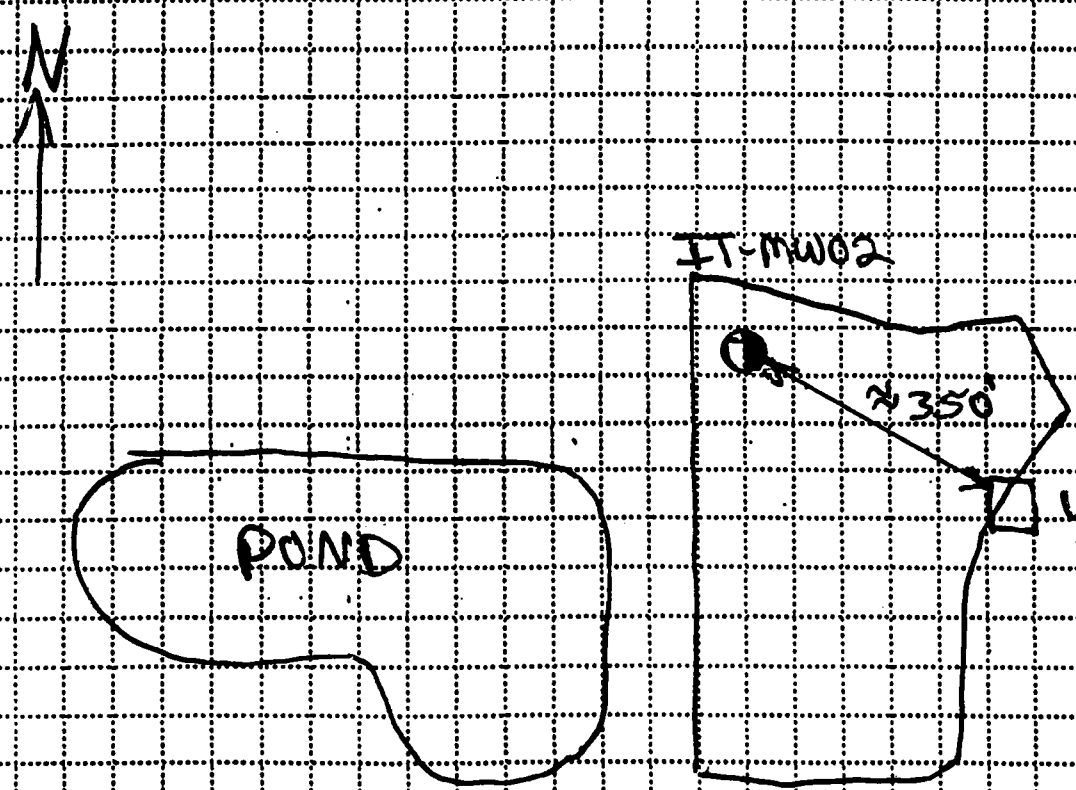
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Voogd

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP20	622,518.16	1,910,681.29	636.78

SCALE: Not to Scale



PROJECT: PBOW - WARP

HOLE NO. WARP-DP20

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP20

PROJECT SCS PBOW-WARP | INSPECTOR John Voegding | SHEET 2 OF 3 SHEETS

~~AREA~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Time Start 0950 End 1010
Sm	1 2 3'	0.5'-3' Loose, Light-dark brown, Fine, Silty Sand, moist 3'	NA		PBOW-98-SO-WARP-DP20-8860-(0002) 2'	Push 1 3.5' Recovery	
ml/Cl	3 4 5 6 7 8 9 10	3'-4' Soft-m. Firm, Light-dark brown and grey, low plasticity v. fine, Sandy Silt, moist 4'-8' Same as Above, grading to clayey Silt, Dry-Slightly moist 8'-10' Same as Above.	4' NA 8' NA	NA	4' PBOW-98-SO-WARP-DP20-8870-(0406) 6' 8' PBOW-98-SO-WARP-DP20-8880-(0806) 10'	4' Push 2 4' Recovery 8' Push 3 (8'-12') 4' Recovery	Hnu Meter Readings erratic Due to High Ambient and headspace moisture.

PROJECT PBOW-WARP | HOLE NO. WARP-DP20

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP20

PROJECT SCS PBOW-WARP

INSPECTOR John Voeding

SHEET 3 OF 3 SHEETS

SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
SC	11	10'-12' Loose, M. brown, Fine-med, Clayey Sand, wet	Headspace HNU Readings 12'		NA	Push 3 (8'-12') 12'	Start Time 0950 End 1010
	12	12'-13' Same as Above, moist 13'		NA		Push 4 4' Recovery	
Cl	13	13'-16' Soft, brown grading to grey, med plasticity, Clay, moist	NA		NA		
	14						
	15						
	16	16'	16'			16'	
		Bottom of Boring at 16.0 Ft.					

PROJECT PBOW-WARP

HOLE NO. WARP-DP20

(Proponent: CECW-EG)

ENG FORM 5056A-R, AUG 94

HTRW DRILLING LOG

DISTRICT: Nashville - TN		HOLE NUMBER: WARP DP21
1. COMPANY NAME: IT Corp.	2. DRILL SUBCONTRACTOR: Geo-Environmental Drilling Co.	SHEET 1 OF 3 SHEETS
3. PROJECT: PBOW - WARP	4. LOCATION: PBOW - WARP	
5. NAME OF DRILLER: Scott [redacted] Beal	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe Rig	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners	8. HOLE LOCATION: WARP-DP21	
	9. SURFACE ELEVATION: ~~NA~~ See below	
	10. DATE STARTED: 6-23-98	11. DATE COMPLETED: 6-23-98
12. OVERBURDEN THICKNESS: NA	13. DEPTH GROUNDWATER ENCOUNTERED: NA Ft. BGS	
13. DEPTH DRILLED INTO ROCK: NA	14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 12.0 Ft. BGS	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
	(3)		

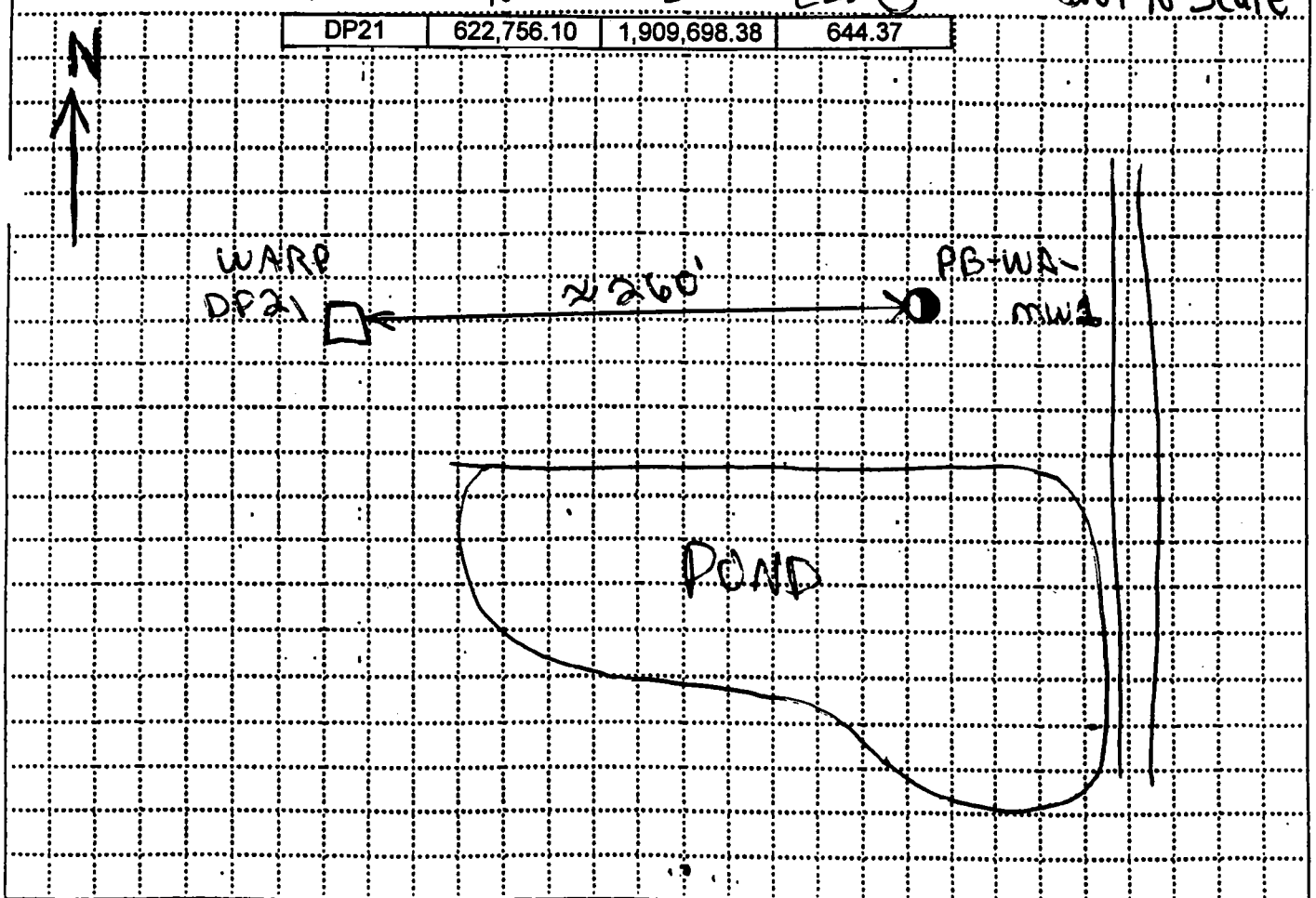
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogelsi

LOCATION SKETCH/COMMENTS

	N	E	EL.
DP21	622,756.10	1,909,698.38	644.37

SCALE: Not to Scale



PROJECT: PBOW - WARP

HOLE NO.: WARP-DP21

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP21

PROJECT: USCS, PBOW - WARP

INSPECTOR: John Voeding

SHEET 2 OF 3 SHEETS

SYMBOL (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' grass and Topsoil	Headspace Hnu Readings				Start 1000 End 1020
ml	1	0.5'-4' Soft, greyish brown, low Plasticity, v. Fine Sandy Silt, dry-Slightly moist	NA	PBOW-98-WARP-DP21-GEOT-0204 2'	NA 2'	Push 1 3' Recovery	
	3				NA		
	4	4'	4'	4'	4'	4'	
Sm	5	4'-6' Loose-M. Dense, brown and grey, v. Fine Silty Sand, moist	NA	6'	NA 6'	Push 2 4' Recovery	
	6	6'					
ml	7	6'-8' Soft-M. Firm, brown and grey, v. Fine, Sand, Silt and Clayey Silt, moist		PBOW-98-[redacted]WARP-DP21-GEOT-0608	NA		
	8		8'	8'	8'	8'	
	9	8'-12' Same as Above, grey, with Fine Sand stringers throughout, moist-Slightly wet	NA		NA	Push 3 (8'-12') 4' Recovery	
	10			10'	10'		

PROJECT: PBOW - WARP

HOLE NO. WARP - DP21

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER: DP21

PROJECT: SCS PBOW - WARP

INSPECTOR: John Vogeding

SHEET 3 OF 3

~~LOG~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~EQUIPMENT~~ Sampling Intervals (g)	REMARKS (h)
ML	11	10'-12' See page 2	Headspace Hnu Readings NA	PBOW-98-WARP-DP21-GE01-1012	NA	Push 3 (8'-12')	Start 1000 End 1020
	12	12'		12'		12'	
		Bottom of Boring at 12.0 Ft.					

PROJECT: PBOW - WARP

HOLE NO. WARP - DP21

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP22
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott [redacted] Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP22
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-25-98
11. DATE COMPLETED	6-25-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
14. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	18. TOTAL NUMBER OF CORE BOXES
	(3)		

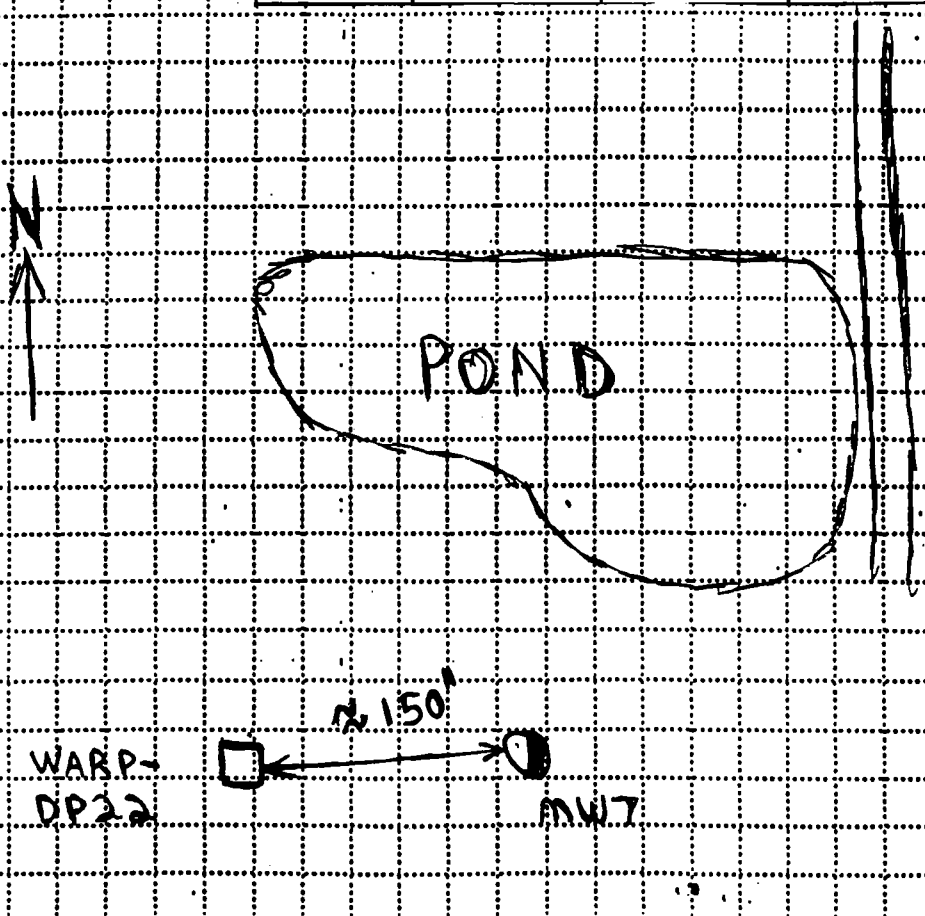
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogelin

LOCATION SKETCH/COMMENTS

N	E	EL.
622,056.95	1,909,921.72	632.41

SCALE Not to Scale



PROJECT PBOW - WARP

HOLE NO. WARP-DP22

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP22

PROJECT PBOW - WARP | INSPECTOR John Voegeding | SHEET 2 OF 3

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sn		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Start 1645 End 1700
Sm	1	0.5'-4' Loose, Light-Med. brown, Fm Silty sand grading to Clayey Sand, moist				Push 1 3' Recovery	
2'	2		NA	2' PBOW-98-WARP-DP22-GEOT-0604 4'			
SC	3						
	4	4-8' Clayey Fm Sand (As Above) grading to clayey Silt and Clay, moist			NA	4' Push 2 4' Recovery	
6'	6		NA	6' PBOW-98-WARP-DP22-GEOT-0608 8'			
Ml/Cl	7					8'	
	8	8'-11' M. Firm, grey, Med. Plasticity Clayey Silt and clay, moist				Push 3 (8-12') 4' Recovery	
	9		NA	10'			
	10						

PROJECT PBOW - WARP | HOLE NO. WARP-DP22

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP22

PROJECT ISCS PBOW - WARP

INSPECTOR John Vogeding

SHEET 3 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
M.L / Cl 11'	11	10'-11' See pg. 2 11'	Headspace Hnu Readings	PBOW-98-WARP-DP22-GEOT-1012	NA	Push 3 (8'-12')	Start 1645 End 1700
NA	12	11'-12' Hard, grey, weathered clayey shale, moist 12'	NA				
		Bottom of Boring at 12.0 Ft.					

PROJECT PBOW - WARP

HOLE NO. WARP - DP22

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

WARP

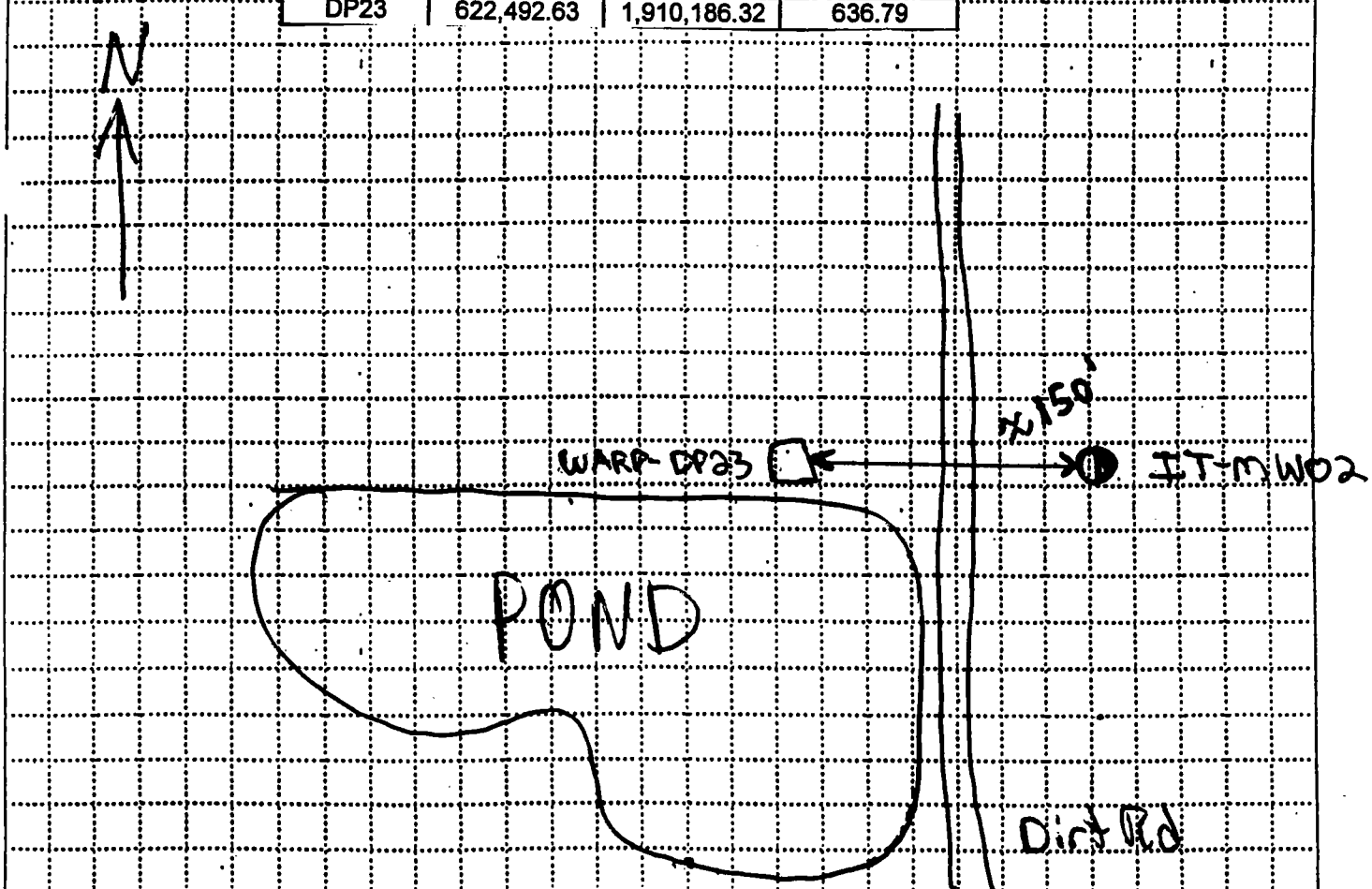
HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP23
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET / SHEETS	1 of 3
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Jack Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP23
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-16-98
11. DATE COMPLETED	6-16-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH DRILLED INTO ROCK	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
15. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	(3) DISTURBED; UNDISTURBED
19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC: [redacted]; TAL METALS: [redacted]; OTHER (SPECIFY): [redacted]; OTHER (SPECIFY): [redacted]; OTHER (SPECIFY): [redacted]
21. TOTAL CORE RECOVERY	NA
22. DISPOSITION OF HOLE	BACKFILLED: Grouted; MONITORING WELL: — ; OTHER (SPECIFY): —
23. SIGNATURE OF INSPECTOR	John Vogel

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale

	N	E	EL.
DP23	622,492.63	1,910,186.32	636.79



PROJECT PBOW - WARP

HOLE NO. WARP-DP23

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP23

PROJECT PBOW-WARP | INSPECTOR John Voeding | SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5 grass and Topsoil	Headspace Hnu Readings				Start Time 1330 End 1350
SC	1	0.5'-4' Soft, dark brown, Fine Clayey Sand, moist grading to Silty Clay.		2' PBOW-98-WARP-DP23-GEOT-0204		Push 1 3.5' Recovery	
	3						
ml/Cl	4	4'-6' Soft, whitish, grey-brown, med. plasticity, Clayey Silt and clay, moist	NA	4'	NA	4' Push 2 4' Recovery	
Pt	6	6-7' Soft, Black, Clayey Peat.		6' PBOW-98-WARP-DP23-GEOT-0608			
ml/Cl	8	7'-8' Soft, dark brown-grey, low-med. plasticity, Clayey Silt and Clay, moist-Slightly wet		8'		8' Push 3 4' Recovery (8'-12')	
	9	8'-12' Same as Above					
	10			10'			

PROJECT PBOW-WARP | HOLE NO. WARP-DP23

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP23

SHEET 3 OF 3 SHEETS

PROJECT PBOW - WARP

INSPECTOR John Voeding

SCS ~~USCS~~ (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	~~Recovery~~ Sampling Intervals (g)	REMARKS (h)
Ml / Cl	11	10'-12' See Pg 2	Headspace, HNU Readings NA	PBOW-98-WARD-DP23-GEOT-1012 12'	NA	Push 3 (8'-12') 12'	Start 1330 End 1350
	12	Bottom of Boring at 12.0 Ft.					

PROJECT PBOW - WARP

HOLE NO. WARP - DP23

(Proponent: CECW-EG)

ENG FORM 5056A-R, AUG 94

WARP

HTRW DRILLING LOG

DISTRICT	Nashville - TN
HOLE NUMBER	DP24
1. COMPANY NAME	IT Corp.
2. DRILL SUBCONTRACTOR	Geo-Environmental Drilling Co.
SHEET	1 OF 3 SHEETS
3. PROJECT	PBOW - WARP
4. LOCATION	PBOW - WARP
5. NAME OF DRILLER	Scott ~~[illegible]~~ Beal
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe Rig
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	4 Ft Long x 1.5 Inch Diameter Geoprobe Sample Rods w/ Acetate Liners
8. HOLE LOCATION	WARP-DP24
9. SURFACE ELEVATION	~~NA~~ See below
10. DATE STARTED	6-24-98
11. DATE COMPLETED	6-24-98
12. OVERBURDEN THICKNESS	NA
13. DEPTH GROUNDWATER ENCOUNTERED	NA Ft. BGS
13. DEPTH DRILLED INTO ROCK	NA
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	NA
14. TOTAL DEPTH OF HOLE	12.0 Ft. BGS
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	NA
18. GEOTECHNICAL SAMPLES	NA
DISTURBED	
UNDISTURBED	
19. TOTAL NUMBER OF CORE BOXES	

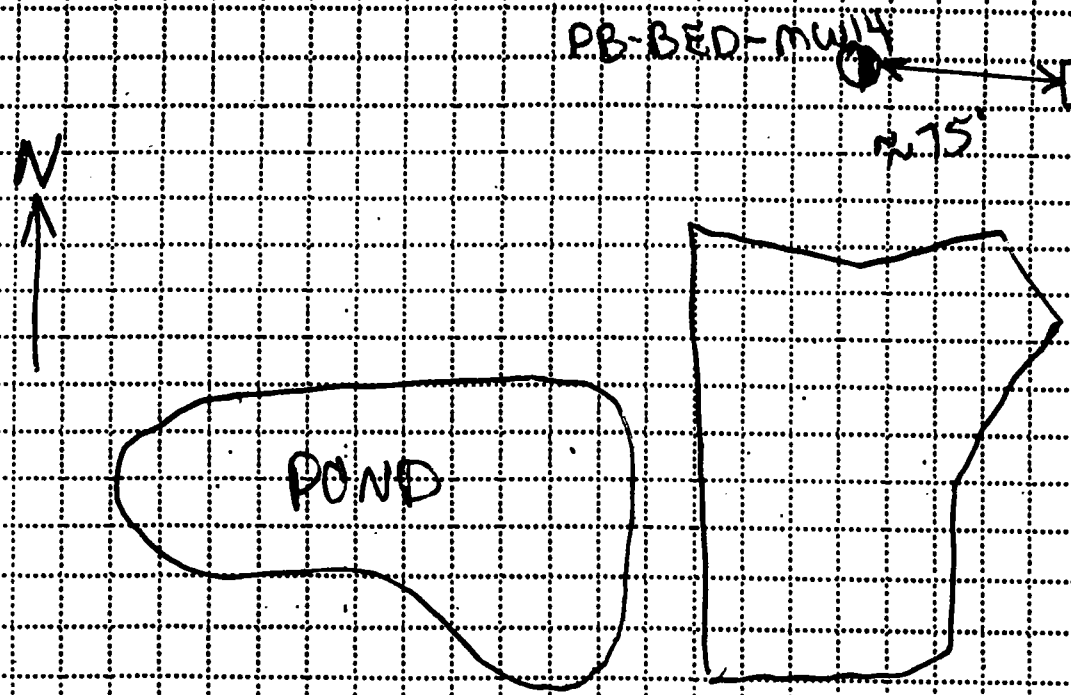
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	TAL METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Nitroaromatics	SVOCs	PCBs	NA

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Grouted	—	—	John Vogedin

LOCATION SKETCH/COMMENTS

SCALE Not to Scale

N	E	EL.
DP24	622,692.52	1,910,510.14	641.54



PROJECT PBOW - WARP

HOLE NO. WARP-DP24

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WARP

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER DP24

PROJECT PBOW - WARP

INSPECTOR John Vogeding

SHEET 2 OF 3 SHEETS

USCS (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO (e)	ANALYTICAL SAMPLE NO. (f)	Sampling Intervals (g)	REMARKS (h)
Pt/Sm		0-0.5' weeds and Topsoil	Headspace Hnu Readings				Start 0830 End 0845
Sm	1	0.5'-4' Loose, med-dark brown, v. Fine, Silty Sand, moist.				Push 1	
	2		NA	2' PBOW-98-WARP-DP24-GE07-0204		3.5' Recovery	
	3						
4'	4	4'	4'	4'		4'	
Ml	5	4'-8' Soft, med. brown, low Plasticity, v. fine, Sandy Silt, moist			NA	Push 2	
	6		NA	6' PBOW-98-WARP-DP24-GE07-0608		4' Recovery	
	7		8'	8'		8'	
	8	8'-12' Same as Above, grading to clayey Silt and Clay, moist				Push 3 (8'-12')	
	9		NA			4' Recovery	
10'	10	10'	10'	10'			

PROJECT PBOW - WARP

HOLE NO. WARP - DP24

ENG FORM 5056A-R, AUG 94

(Proponent: CECW-EG)

GROUNDWATER SAMPLIN FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: Red Water Pentaire
RFA/COC Number:

Collection Date: 6-12-98
Collection Time: 1100
Sample Filtered (Yes / No): YES
Weather/Temp: 81°F

Form Completed By: E. Kanevsky
Sampler(s): E. Kanevsky
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 0 1 – 7 2 3 0 – – –

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: PRRP-DP01
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: NA
Screen Height:
Casing Type:

Outside Casing Dia. (in): NA
Depth to Product (ft):
Total Well Depth (ft):
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NO
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm): Red Water
Remarks: ↓

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1115		4.61	7.63		16.4	>1000	8.57	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	[illegible]	[illegible]	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN(FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-PRRP
RFA/COC Number:

Collection Date:
Collection Time:
Sample Filtered (Yes / No):
Weather/Temp:

Form Completed By:
Sampler(s):
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 0 2 – 7 2 7 0 – ___ - ___

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: PRRP-DP02
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition:
Screen Height: NA
Casing Type: \

Outside Casing Dia. (in): NA
Depth to Product (ft): NA
Total Well Depth (ft): 12.0 Ft.
Depth to Water (ft): ≈ 8 Ft.
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N:
- Reading (ppm): NA
Remarks: \

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((NA)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE		NA	1.78 mS/cm	7.17	NA	15.0	24	13.20	NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PRRP
RFA/COC Number:

Collection Date: 6-8-98
Collection Time: 1600
Sample Filtered (Yes / No): yes
Weather/Temp: Sunny, 75°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Steinman
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP03-7310-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: PRRP-DP03
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: NA
Screen Height:
Casing Type:

Outside Casing Dia. (in): NA
Depth to Product (ft): NA
Boring ~~Total Well~~ Depth (ft): 10 ft.
Depth to Water (ft): ≈ 4.0 ft.
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor:
Vapor Monitor Type:
- Vapor Monitor S/N: NA
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

NA

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1600	NA	21.3 mS/cm	7.28	NA	15.1	675	8.38	NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW - PRRP
RFA/COC Number:

Collection Date: 6-9-98
Collection Time: 1505
Sample Filtered (Yes / No): YES
Weather/Temp: Cloudy, light Rain, 70 °F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Stineman
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 0 4 – 7 3 5 0 – – –

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

~~Well~~ Boring Number: PRRP - DP04
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: NA
Screen Height:
Casing Type:

Outside Casing Dia. (in): NA
Depth to Product (ft):
Total Well Depth (ft): Boring Depth = 12 Ft.
Depth to Water (ft): ≈ 8 Ft.
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm): NA
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-PRRP
RFA/COC Number:

Collection Date: 6-14-98
Collection Time: 1100
Sample Filtered (Yes / No): No
Weather/Temp: Cool, Cloudy, 60°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Stracenhn
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 0 5 – 7 3 9 0 – – –

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

~~Well~~ Boring Number: PRRP-DP05
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition: NA
Screen Height: \
Casing Type: \

Outside Casing Dia. (in): NA
Depth to Product (ft): NA
Total Well Depth (ft): 16.0 Ft.
Depth to Water (ft): ≈ 9 Ft.
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: \
- Reading (ppm): NA
Remarks: \

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

NA

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5	1100								
SAMPLE	~~1230~~	NA	1.74 mS/cm	7.71	NA	15	48	11.31	NA

SAMPLE ANALYTICAL INFORMATION

BTN

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW - PRRP
RFA/COC Number:

Collection Date: 6-9-98
Collection Time: 1415
Sample Filtered (Yes / No): No
Weather/Temp: Cloudy, 70 °F

Form Completed By: John Vogeding
Sampler(s): Ed Karavsky
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 0 6 – 7 4 3 0 – -

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: PRRP-DP06
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition: NA
Screen Height: \
Casing Type:

Outside Casing Dia. (in): NA
Depth to Product (ft):
Total Well Depth (ft): Boring depth = 12.0 Ft.
Depth to Water (ft): ≈ 8 Ft.
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: \
- Reading (ppm): NA
Remarks: \

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((NA)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4					NA				
Purge Vol 5									
SAMPLE									

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-PRRP
RFA/COC Number:

Collection Date: 6-10-98
Collection Time: 0815
Sample Filtered (Yes / No): yes
Weather/Temp: Cool, Cloudy, 55°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Stinemond
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP07-7470-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: PRRP-DP07
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition:
Screen Height: NA
Casing Type: \

Outside Casing Dia. (in):
Depth to Product (ft): NA
Total Well Depth (ft): 12.0 Ft.
Depth to Water (ft): ≈ 8 Ft.
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: \
- Reading (ppm): NA
Remarks: \

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	0815	≈ 8 Ft.	0.423 mS/cm	7.68	NA	14.8	667	9.50	NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN(FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-PRRP
RFA/COC Number:

Collection Date: 6-10-98
Collection Time: 1400
Sample Filtered (Yes / No): yes
Weather/Temp: Mild, Cloudy, 60°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding
Dave Stineman - Ed Ranavsky
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 0 8 – 7 5 1 0 – – –

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: PRRP-DP08
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition: NA
Screen Height: \
Casing Type: \

Outside Casing Dia. (in): \
Depth to Product (ft): \
Total Well Depth (ft):
Depth to Water (ft): 16 ft. NA
Water Column (ft): \
Elev. Ref. for Water Level: Ground Surface.

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: \
- Reading (ppm): NA
Remarks: \

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701 03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-PRRP
RFA/COC Number:

Collection Date: 6-14-98
Collection Time: 1600
Sample Filtered (Yes / No): Yes
Weather/Temp: Mild, Cloudy, 70°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Steinman
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP09-7550-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

~~Well~~ Boring Number: PRRP-DP09
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition: NA
Screen Height: \
Casing Type: \

Outside Casing Dia. (in): NA
Depth to Product (ft): NA
Total Well Depth (ft): 12.0 Ft.
Depth to Water (ft): ≈ 3 Ft.
Water Column (ft): NA
Elev. Ref. for Water Level: ground Surface

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: NA
- Reading (ppm): \
Remarks: Water reddish brown

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1600	NA	3.32 mS/cm	7.54	NA	15.5	331	10.20	NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PRRP
RFA/COC Number:

Collection Date: 6-10-98
Collection Time: 1415
Sample Filtered (Yes / No): yes
Weather/Temp: P. Cloudy, 65°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Stinemon
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP10-7590-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: PRRP-DP10
Well Secure (Yes / No):
Well Labeled (Yes / No): NA
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in): NA
Depth to Product (ft): 16.0 Ft.
Total Well Depth (ft): ≈ 13.0 Ft.
Depth to Water (ft): NA
Water Column (ft):
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm): NA
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1415	≈ 13 Ft	28.2	7.17	NA	17.0	> 999	5.47	NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: Pentonite RD
RFA/COC Number:

Collection Date: 6-14-98
Collection Time: 1700
Sample Filtered (Yes / No): Yes
Weather/Temp: 72°F

Form Completed By: EK
Sampler(s): EK
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP11-7630-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number:
Well Secure (Yes / No):
Well Labeled (Yes / No): NA
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft):
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: ND
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm):
Remarks: Red water

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE			12.4	7.92		17.8		10.12	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701 03000000
Project Name: PBOW Red Water
Investigation Site: Red water ponds
RFA/COC Number:

Collection Date: 6-11-98
Collection Time: 0930
Sample Filtered (Yes / No): yes
Weather/Temp: 78°F

Form Completed By: Ed Kanouse
Sampler(s): E.K.
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP12-7670-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: PRRP-DP12
Well Secure (Yes / No): NA
Well Labeled (Yes / No): NA
Well Condition: NA
Screen Height: NA
Casing Type: NA

Outside Casing Dia. (in): NA
Depth to Product (ft): ~~4~~ NA
Total Well Depth (ft): 16'
Depth to Water (ft): 4'
Water Column (ft): NA
Elev. Ref. for Water Level: Ground surface

Odor: NO
Vapor Monitor Type: HNU
- Vapor Monitor S/N: ~~0 ppm~~
- Reading (ppm): 0 ppm
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1			0.537	7.96		15°C	<1000	7.65	
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: Red Water Ponds
RFA/COC Number:

Collection Date: 6-12-98
Collection Time: 1430
Sample Filtered (Yes / No):
Weather/Temp:

Form Completed By: E.R.
Sampler(s): E.R.
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP13-7710-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: PRRP-DP13
Well Secure (Yes / No):
Well Labeled (Yes / No): NA
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft): NA
Total Well Depth (ft):
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NO
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1			1.01	7.94		15.3	38.2	7.17	
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-PRRP
RFA/COC Number:

Collection Date: 6-12-98
Collection Time: 1000
Sample Filtered (Yes / No): yes
Weather/Temp: Hot, Humid, 75°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding & Dave Stineman - Ed Ranavsky
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 1 4 – 7 7 5 0 – [redacted] - [ ] [ ]

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

~~Well~~ Boring Number: PRRP - DP14
Well Secure (Yes / No): —
Well Labeled (Yes / No): —
Well Condition: NA
Screen Height: —
Casing Type: —

Outside Casing Dia. (in): NA
Depth to Product (ft):
Total Well Depth (ft): 16 ft.
Depth to Water (ft): ≈ 4-5' and 8-9'
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type: —
- Vapor Monitor S/N: —
- Reading (ppm): NA
Remarks: —

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: Pentowith RD
RFA/COC Number:

Collection Date: 6-12-98
Collection Time: 1700
Sample Filtered (Yes / No):
Weather/Temp:

Form Completed By: EK
Sampler(s): EK
Reviewed By:

Sample Number: P B O W – 9 8 – G W – P R R P – D P 1 5 – 7 7 9 0 – – –

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: PRRP-DP15
Well Secure (Yes / No):
Well Labeled (Yes / No): NA
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft): NA
Total Well Depth (ft):
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor:
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm):
Remarks: Red water

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE			10.2	8.23		14.5	<1000	10.7	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: Bentonite Road
RFA/COC Number:

Collection Date: 6-13-98
Collection Time: 1100
Sample Filtered (Yes / No): yes
Weather/Temp: 78°

Form Completed By: EK
Sampler(s): EK
Reviewed By:

Sample Number: PBOW-98-GW-PRRP-DP16-7850-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number:
Well Secure (Yes / No): NA
Well Labeled (Yes / No):
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft): NA
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NO
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm):
Remarks: Red water

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE			5.73	8.22		16.5	>1000	10.67	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE 0.5	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE 0.5	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW Pentonite
RFA/COC Number:

Collection Date: 6-11-98
Collection Time: 1200
Sample Filtered (Yes / No): yes
Weather/Temp: 78°F

Form Completed By: E. Kanusky
Sampler(s):
Reviewed By:

Sample Number: PBOW-98-[ ][ ]-DRRP-DP17-7870 (787) (7872)-[ ][ ]-[ ][ ]

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: PRRP-DP17
Well Secure (Yes / No): NA
Well Labeled (Yes / No): NA
Well Condition: NA
Screen Height: NA
Casing Type: NA

Outside Casing Dia. (in): NA
Depth to Product (ft): NA
Total Well Depth (ft): NA
Depth to Water (ft): 4'
Water Column (ft): NA
Elev. Ref. for Water Level:

Odor: NO
Vapor Monitor Type: 0ppm
- Vapor Monitor S/N:
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1	1200	4	0.269	8.26		18.6	0	10.85	
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site:
RFA/COC Number:

Collection Date: 6-12-98
Collection Time: 0800
Sample Filtered (Yes / No): Yes
Weather/Temp: 78°F

Form Completed By: E. Kanensky
Sampler(s): E. Kanensky
Reviewed By:

Sample Number: PBOW-98-GW-PRRW-BP18-7910-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: PRRW-DP-18
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft): NA
Total Well Depth (ft):
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NO
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2		NA							
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site:
RFA/COC Number:

Collection Date: 6-13-98
Collection Time: 1000
Sample Filtered (Yes / No):
Weather/Temp: 78°F

Form Completed By: EK
Sampler(s): EK
Reviewed By:

Sample Number: PBOW - 98 - GW - PRRP - DP19 - 7950 - -

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number:
Well Secure (Yes / No):
Well Labeled (Yes / No): NA
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft): NA
Total Well Depth (ft):
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NO
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE			0.440	8.32		14.9	>1000	11.84	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE 0.5	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE 0.5	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: Pentaerite RD
RFA/COC Number:

Collection Date: 6-14-98
Collection Time: 1600
Sample Filtered (Yes / No): Ye
Weather/Temp: 72°F

Form Completed By: EK
Sampler(s): EK
Reviewed By:

Sample Number: P B O W – 9 8 – 6 w – P R R P – D P 2 0 – 7 9 9 0 – – –

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number:
Well Secure (Yes / No):
Well Labeled (Yes / No): NA
Well Condition:
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft): NA
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: ND
Vapor Monitor Type:
- Vapor Monitor S/N: NA
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE			0.292	7.29		14.5	21000	9.50	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

DP 02 / 6-23-98

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701 03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-WARP
RFA/COC Number:

Collection Date: 6-23-98
Collection Time: 1300
Sample Filtered (Yes / No): No
Weather/Temp:

Form Completed By: T. HENSLEY
Sampler(s): TOM HENSLEY
Reviewed By:

Sample Number: PBOW-98-GW-WARP-DP02-81700-00-00

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: WARP-DP02
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: N/A
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft): N/A
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NONE
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm): N/A
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	0835		2.56	7.33		13.8	999+	13.51	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

i -04 / 6-24-98

GROUNDWATER SAMPLING ORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-WARP
RFA/COC Number:

Collection Date: 6/24/98
Collection Time: 1500
Sample Filtered (Yes / No): YES
Weather/Temp:

Form Completed By:
Sampler(s): T. HEWACEY
Reviewed By:

Sample Number: PBOW-98-GW-WARP-AP04-8250-00-00

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: WARP-AP04
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: N/A
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft): N/A
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NONE
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm): N/A
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1725		38.03	7.27		16.7	999+	8.94	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

L-06 / 6-23-98

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: WARP-AP06
RFA/COC Number:

Collection Date: 6/23/98
Collection Time: 1600
Sample Filtered (Yes / No): NO
Weather/Temp:

Form Completed By:
Sampler(s): T. HEWALET
Reviewed By:

Sample Number: PBOW-98-6W-WARP-AP06-8330-00-00

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: WARP-AP06
Well Secure (Yes / No): N/A
Well Labeled (Yes / No): N/A
Well Condition: N/A
Screen Height: N/A
Casing Type: N/A

Outside Casing Dia. (in): N/A
Depth to Product (ft): N/A
Total Well Depth (ft): N/A
Depth to Water (ft): N/A
Water Column (ft): N/A
Elev. Ref. for Water Level: N/A

Odor: NON
Vapor Monitor Type: N/A
- Vapor Monitor S/N: N/A
- Reading (ppm): N/A
Remarks: N/A

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	0850		1.05	7.47		14.6	972	12.96	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701 03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-WARP
RFA/COC Number:

Collection Date: 6-16-98
Collection Time: 0730
Sample Filtered (Yes / No): No
Weather/Temp: Cool, Cloudy, 60°F

Form Completed By: John Vegeding
Sampler(s): John Vegeding, Dave Stinetman
Reviewed By:

Sample Number: PBOW-98-GW-WARP-DP08-8410-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

~~Well~~ Boring Number: WARP-DP08
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition: NA
Screen Height: \
Casing Type: \

Outside Casing Dia. (in): \
Depth to Product (ft): \
Total Well Depth (ft): NA
Depth to Water (ft): \
Water Column (ft): \
Elev. Ref. for Water Level: \

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: NA
- Reading (ppm): \
Remarks: No Water Quality Readings due to limited gw Present.

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLIN FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-WARP
RFA/COC Number:

Collection Date: 6-15-98
Collection Time: 1030
Sample Filtered (Yes / No): No
Weather/Temp: Mild, Cloudy, 60°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Stinemon
Reviewed By:

Sample Number: PBOW-98-GW-WARP-DP12-8576-

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: WARP-DP12
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: NA
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft):
Depth to Water (ft): NA
Water Column (ft):
Elev. Ref. for Water Level:

Odor: None
Vapor Monitor Type:
- Vapor Monitor S/N: NA
- Reading (ppm):
Remarks: No Water Quality Readings due to limited GW presence.

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x NA gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE									

NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW - WARP
RFA/COC Number:

Collection Date: 6-15-98
Collection Time: 1300
Sample Filtered (Yes / No): yes
Weather/Temp: Mild, Cloudy, 60°F

Form Completed By: John Vogeding
Sampler(s): John Vogeding, Dave Stineman
Reviewed By:

Sample Number: PBOW - 98 - GW - WARP - DP13 - 8610 - ___ - ___

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Boring ~~Well~~ Number: WARP - DP13
Well Secure (Yes / No): \
Well Labeled (Yes / No): \
Well Condition:
Screen Height: NA
Casing Type: \

Outside Casing Dia. (in): NA
Depth to Product (ft): NA
Total Well Depth (ft): 16.0 Ft
Depth to Water (ft): NA
Water Column (ft): NA
Elev. Ref. for Water Level: Ground Surface

Odor: None
Vapor Monitor Type: \
- Vapor Monitor S/N: NA
- Reading (ppm):
Remarks: Water is yellowish brown

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft
Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

NA

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft
Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

NA

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

NA

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1300	NA	1.42	7.32	NA	15.0°C	186	9.57	NA

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310 1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

D 16 / 6-25-98

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: WARP - AP16
RFA/COC Number:

Collection Date: 6/25/98
Collection Time: 1400
Sample Filtered (Yes / No): YES
Weather/Temp:

Form Completed By:
Sampler(s): T. HENNICKET
Reviewed By:

Sample Number: PBOW-98-GW-WARP-AP16-8730-00-00

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: WARP-AP16
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: N/A
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft): N/A
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor:
Vapor Monitor Type:
- Vapor Monitor S/N: N/A
- Reading (ppm):
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE			5.42	7.42		15.9	999+	12.96	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

D-17 / 6-25-98

GROUNDWATER SAMPLING FORM

INTERNATIONAL TECHNOLOGY CORPORATION

Project Number: 773701.03000000
Project Name: PBOW Red Water
Investigation Site: PBOW-WARP
RFA/COC Number:

Collection Date: 6/25/98
Collection Time: 1300
Sample Filtered (Yes / No): YES
Weather/Temp:

Form Completed By:
Sampler(s): T. HENSLEY
Reviewed By:

Sample Number: PBOW-98-GW-WARP-AP17-8770-00-00

MONITORING WELL INFORMATION [use top of casing (TOC) for all measurements]

Well Number: WARP-AP17
Well Secure (Yes / No):
Well Labeled (Yes / No):
Well Condition: N/A
Screen Height:
Casing Type:

Outside Casing Dia. (in):
Depth to Product (ft):
Total Well Depth (ft): N/A
Depth to Water (ft):
Water Column (ft):
Elev. Ref. for Water Level:

Odor: NONE
Vapor Monitor Type:
- Vapor Monitor S/N:
- Reading (ppm): N/A
Remarks:

MONITORING WELL PURGE CALCULATIONS AND PURGE RECORD

Volume of Water in Casing: Gallons/foot = 0.041 x d^2, where d is casing diameter in inches = (0.041 x (_____)^2) = _____ gal/ft

Well Volume (gallons) = Water Column (ft) x Gal/ft = _____ ft x _____ Gal/ft = _____ gallons

Volume of Water in Filter Pack: Gallons/foot = 0.041 x (D^2 - d^2), where D is total borehole dia. in inches & d is casing dia. in inches = 0.041 x ((_____)^2 - (_____)^2) = _____ gal/ft

Filter Pack Volume (gal) = ((Screen Height + lesser of 2 ft or water column) x gal/ft) x porosity (0.3) = ((Screen Height _____ ft + _____ ft) x _____ gal/ft) x 0.3 = _____ gallons

Purge Well Volume: Purge Well Volume = Filter Pack Volume + Well Volume = _____ gal + _____ gal = _____ gal

1 x Purge Well Volume (gal.)	2 x Purge Well Volume (gal.)	3 x Purge Well Volume (gal.)	4 x Purge Well Volume (gal.)	5 x Purge Well Volume (gal.)

Purge Cycle	Time (24 hr)	Depth to Water	Conductivity	pH	Eh	Temperature	Turbidity	Diss. O_2	Purge Volume
Units:		Feet	umhos/cm	Standard Units	ppm	°C	NTU	ppm	gallons
Purge Vol 1									
Purge Vol 2									
Purge Vol 3									
Purge Vol 4									
Purge Vol 5									
SAMPLE	1020		5.19	7.50		15.4	680	13.42	

SAMPLE ANALYTICAL INFORMATION

Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)	Requested Analysis	Method	Sample Container(s)
Nitroaromatics	Mod. 8330	2 - 1 Liter Amber Glass	PCBs	3520B/8081	2 - 1 Liter Amber Glass	Chloride	325.3	1 - 1 Liter HDPE
TCL Volatile Organics	8260A	3 - 40 mL Glass Vials	Cyanide (total)	9010A/9012	1 - 1 Liter HDPE	Nitrate	353.2	
TCL SVOCs	3520B/8270B	2 - 1 Liter Amber Glass	Alkalinity	310.1	1 - 1 Liter HDPE	Sulfate	375.4	
Total TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Total Organic Carbon	9060	1 - 1 Liter HDPE	Tot. Suspended Solids	160.2	1 - 1 Liter HDPE
Dissolved TAL Metals	3005A/6010A	1 - 1 Liter HDPE	Hardness	130.2	1 - 1 Liter HDPE	Total Dissolved Solids	160.1	1 - 1 Liter HDPE

APPENDIX B

LAND SURVEY DATA

Land Survey Results for the Acid Areas and the Red Water Ponds Areas at the Plum Brook Ordnance Works

Point ID	Y	X	Elevation	Remarks
Pentolite Road Red Water Ponds Direct Push Locations				
DP01	624,939.62	1,918,740.53	630.39	
DP02	625,232.21	1,918,802.48	630.37	
DP03	625,038.03	1,919,102.57	631.56	
DP04	624,727.92	1,918,917.68	633.01	
DP05	625,299.16	1,919,033.56	631.47	
DP06	624,951.14	1,918,911.07	632.75	
DP07	624,698.09	1,919,117.91	634.71	
DP08	624,514.99	1,919,063.91	635.88	
DP09	625,348.26	1,919,218.20	631.85	
DP10	625,028.13	1,919,381.06	634.90	
SB11	624,840.68	1,919,354.54	631.77	As marked in field - DP11
DP12	624,592.96	1,919,301.87	631.10	
DP13	625,442.21	1,919,550.70	633.36	
DP14	625,286.03	1,919,485.76	630.96	
DP15	625,066.49	1,919,559.32	631.05	
DP16	624,825.74	1,919,459.48	632.35	
DP17	624,590.95	1,919,594.96	636.57	
DP18	625,300.98	1,919,638.32	631.78	
DP19	625,047.57	1,919,757.82	632.86	
DP20	624,747.62	1,919,619.92	632.82	
Pentolite Road Red Water Ponds Geotechnical Locations				
DP21	625,221.36	1,918,941.85	632.89	
DP22	624,593.46	1,919,004.88	634.80	
DP23	624,953.28	1,919,383.04	634.36	
DP24	625,170.69	1,919,685.68	630.80	
SB25	624,687.56	1,919,500.10	632.48	As marked in field - DP25
Pentolite Road Red Water Ponds Surface Water and Sediment Locations				
SW01	624458.10	1919253.13	626.47	
SD01	624458.46	1919252.71	626.19	
SW02	624942.11	1919717.83	624.45	
SD02	624941.69	1919718.45	624.27	
SW03	625772.62	1919871.34	623.44	
SD03	625772.14	1919872.13	622.17	
SW04	625779.27	1919148.97	623.26	
SD04	625778.19	1919149.05	622.97	

Land Survey Results for the Acid Areas and the Red Water Ponds Areas at the Plum Brook Ordnance Works

Point ID	Y	X	Elevation	Remarks
West Area Red Water Ponds Direct Push Locations				
DP01	622,613.31	1,909,566.67	644.09	
DP02	622,379.43	1,909,598.56	636.50	
DP03	622,158.78	1,909,480.12	633.72	
DP04	621,917.58	1,909,501.45	634.11	
DP05	622,820.86	1,909,789.37	643.60	
DP06	622,610.42	1,909,780.55	643.32	
DP07	621,982.93	1,909,758.95	632.28	
DP08	622,727.47	1,909,986.13	642.69	
DP09	622,546.61	1,909,995.23	639.02	
DP10	622,147.23	1,910,023.31	633.34	
DP11	622,016.75	1,909,999.70	632.04	
DP12	622,764.13	1,910,219.74	642.78	
DP13	622,543.21	1,910,216.51	637.75	
DP14	622,049.80	1,910,188.23	632.04	
DB15	622,601.84	1,910,385.32	637.86	
DP16	622,425.11	1,910,395.07	632.83	
DP17	622,214.66	1,910,389.32	633.63	
DP18	622,051.37	1,910,366.62	633.15	
DP19	622,689.12	1,910,553.60	638.96	
DP20	622,518.16	1,910,681.29	636.78	
West Area Red Water Ponds Geotechnical Locations				
DP21	622,756.10	1,909,698.38	644.37	
DP22	622,056.95	1,909,921.72	632.41	
DP23	622,492.63	1,910,186.32	636.79	
DP24	622,692.52	1,910,510.14	641.54	
DP25	622,049.80	1,910,188.23	632.04	Also DP14
West Area Red Water Ponds Surface Water and Sediment Locations				
SW01	621762.51	1909434.98	625.09	
SD01	621760.93	1909434.49	624.65	
SW02	621937.76	1909811.87	624.98	
SD02	621936.88	1909811.94	624.73	
SW03	622012.13	1910446.96	624.44	
SD03	622012.58	1910446.14	624.29	
SW04	622490.42	1910795.65	623.10	
SD04	622490.63	1910796.51	626.64	
SW05	622498.50	1909841.06	634.49	
SD05	622496.86	1909841.32	634.27	
SW06	622468.69	1910162.64	634.50	
SD06	622468.10	1910162.48	634.12	

NOTICE:

Values were scaled to the Ohio State Plane Coordinate System (North Zone).
A combined factor of 0.999927 (0.999927034 for SW/SD) was used in this determination.
These coordinates are NAD 1983 Datum expressed in feet.
Vertical datum is NGVD 1929.

APPENDIX C

DATA QUALITY EVALUATION

Appendix C

Data Quality Evaluation
Investigation of Red Water Ponds Areas
Plum Brook Ordnance Works

C1.0 Introduction

This appendix of the Plum Brook Site Investigation Report presents the results of the Quality Assurance/Quality Control (QA/QC) protocols implemented during the sampling and analysis portion of the investigations of the Pentolite Road Red Water Ponds (PRRP) and the West Area Red Water Ponds (WARP). The quality indicators from every aspect of the data collection process have been reviewed, and an assessment of the data with regard to the project specific objectives is presented. The reliability of the sampling and analytical procedures used during the investigations was demonstrated by implementing the project specific quality assurance procedures specified in the site-wide Sampling and Analysis Plan and Quality Assurance Project Plan (IT, 1996a) and its site-specific attachments (SSAP, IT 1998). Successful execution of these procedures provides strong supporting evidence for the acceptance of the data as representative of the area under investigation. A complete evaluation of the procedures implemented in the investigations is summarized in this Data Quality Evaluation (DQE).

The DQE for the Plum Brook site investigations is divided into two phases. The first phase includes the discussion of the overall field sampling effort and the field quality control (QC) activities employed. The resulting QC data are presented and compared to the procedures and goals established in the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP), as well as the verification of the completeness, accuracy and representativeness of the field sampling. The second phase deals with the analytical program and the results of the QC activities employed. An overall comparison to data quality objectives (DQOs) was performed as well as a complete data review. All elements of data evaluation were compiled and used to determine the usability and overall applicability of the resulting data.

C2.0 Field Sampling Program

To ensure the reliability of the field sampling procedures and analytical data, field QA/QC samples were collected or prepared for each medium sampled, each sample shipment, and/or

each sampling event. The QA/QC samples are used to address sample variability and uncertainty in procedures.

C2.1 Field Duplicates

The purpose of the field duplicate is to evaluate the precision of the sample collection, handling and analysis procedures. Field duplicate samples were collected from the following locations: PRRP-DP01, PRRP-DP09, PRRP-DP17, PRRP-DP18, WARP-DP03, WARP-DP04, WARP-DP09, AND WARP-DP18.

It can be difficult to collect true duplicate samples, especially for solid matrices that are inherently more heterogeneous than liquid matrices. Greater variations are seen in the precision data which are measured by calculating the relative percent difference (RPD) between the original sample results and its duplicate results. Higher RPDs are thought to reflect difficulties encountered during the collection of duplicate samples or sample handling. Wide variations in soil results may be attributed to actual variations in concentrations rather than problems with precision or sampling effectiveness.

All positive concentrations and the calculated RPD for the original sample and/or its duplicate are presented in Tables C-1 to C-7. The RPD results were calculated as follows:

$$RPD = \frac{A-B}{[(A+B)/2]} 100$$

where:

RPD = Relative percent difference
A = Original sample result
B = Duplicate sample result.

When concentrations are detected in only one of the two samples, "NC" is used to represent the RPD which is then "not calculable" for the parameter. There is no quantifiable result available from the "non-detect" sample to be used in the RPD calculation. When "estimated" (J qualified) concentrations are reported, there is a greater potential for increased variability between the primary and duplicate results as reflected in the RPD calculation. Sample results with "B" qualification were not used for the RPD calculation.

Results from PRRP-DP01 demonstrated good precision for metals, but less for organics. bis(2-Ethylhexyl)phthalate, 2,4-dinitrotoluene, and 1,3,5-trinitrobenzene were detected in the duplicate, but not in the original. The values for the three compounds were qualified "J". The RPD values could not be calculated. The results from PRRP-DP09 showed a great degree of variability. RPDs were calculated for fifteen compounds. Only four RPD values were below 50. The results from the PRRP-DP17 water sample and duplicate were highly variable. Seven compounds were detected in the original, but not in the duplicate. Of those detected in both, the RPD values ranged from 2.5 for dissolved calcium to 184 for total manganese. The least variability was in the dissolved metals. The RPDs were from 2.5 to 35.5. RPD values for arsenic, calcium, copper, and nickel exceeded 50 in the sample pair from PRRP-DP18. Eleven other compounds had RPD values ranging from 7.9 to 37.1. bis(2-Ethylhexyl)phthalate was detected below the reporting limit in the duplicate, but not in the original. The RPD could not be calculated.

The data from WARP-DP03 demonstrated good precision. All compounds detected in the samples had RPD values less than 50. The values ranged from 0 for zinc to 40.5 for cadmium. Thirteen of seventeen RPDs were below 20. The precision data from the sample pair from WARP-DP09 was variable. The RPD values for inorganics ranged from 8.5 to 36.7. Nine semivolatile compounds were detected below the reporting limit in the duplicate. They were not detected in the original sample. Fluoranthene and pyrene were detected in both with high RPD values of 122 and 123, respectively. The sample pair from WARP-DP18 showed good precision. All RPD values were below 50. Twelve of the sixteen RPD values were below 10.

C2.2 Trip Blanks

Trip blanks are used to ensure that samples requiring volatile analysis are not exposed to contamination during storage and transport to the laboratory. They consist of a pair of VOA vials filled with ASTM Type II water. They are analyzed for volatile organics only. Acetone, chloroform, trichloroethene, toluene, and xylenes were detected in the trip blanks at estimated concentrations below the laboratory's reporting limits. The trip blank data were used in the validation process by applying the "5X/10X Rule" and associated results were qualified accordingly.

C2.3 Equipment Rinse Blanks

Equipment rinsates (ER) are used to assess the effectiveness of the equipment decontamination procedures employed and the potential of cross-contamination of environmental samples between sampling locations. The rinsates are collected by passing clean, analyte-free water through and over the sampling equipment after the decontamination procedures have been

executed. One ER was collected for each of the two areas. The blanks were analyzed for the same analytical parameters as the associated project samples.

The analyses detected low level concentrations of volatile organics. Acetone, chloroform, toluene, and xylenes were reported in the rinsates at estimated concentrations below the laboratory's reporting limits. Careful review of sample data suggested that the concentrations reported are not indicative of deficiencies in the decon process but laboratory process contamination or constituents detected or inherent in the water used in the final rinse. The ER data were used in the validation process by applying the "5X/10X Rule" and associated results were qualified accordingly.

C2.4 Field Blanks

Field blanks were prepared from clean water used in the decontamination procedures employed. Analysis of the blanks ensures that all water sources used during decon are free of parameters of interest. A field blank was collected from the final decontamination rinse water. Only one lot number of the deionized final rinse water was used; therefore, one (1) field blank was submitted for analysis and tested for the parameters analyzed in this investigation.

The non-potable, analyte-free water used in the final rinse of the sampling equipment exhibited low level concentrations of volatile organics. The volatiles detected were acetone at 1.6 μg/L, chloroform at 0.18 μg/L, and toluene at 0.17 μg/L. All concentrations are below reporting limits and qualified as estimated. Review of the associated field sample data suggest that these concentrations are a result of laboratory process contamination and should not be considered to be native to the water source being evaluated.

C3.0 Analytical Program

The analytical program determined, with documented precision and accuracy, if specific compounds were present in the samples collected from the areas investigated. Chemical analyses for the investigation were performed in accordance with the guidelines prescribed by the U.S. Environmental Protection Agency (EPA) Test Methods for Evaluating Solid Waste (SW-846), Physical/Chemical Methods, Third Edition, September 1986 and subsequent revisions and Methods for the Chemical Analysis of Water and Wastes (MCAWW), EPA-600/4-79-020, March 1983 and subsequent revisions. The samples and associated QA/QC samples were

analyzed for volatile organics, semivolatile organics, PCBs, metals, nitroaromatics, and several water quality analytes using the methods presented in Table C-8.

All analytical samples collected for the generation of definitive data were reported in EPA Level IV CLP-like data packages and a Level III data validation was performed using EPA validation guidelines as stated in EPA Contract Laboratory Functional Guidelines for organic and inorganic data review dated February 1994. To clarify the extent of blank contamination, blank evaluations were based on the criteria outlined in *Region III Modifications to National Functional Guidelines for Organic Data Review* (September 1994) and *Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (April 1993). The regulatory compound/analyte list reported was the Target Compound List (TCL) for organics and the Target Analyte List (TAL) for inorganics. These data packages have also been reviewed for completeness and compliance to the approved final work plan (IT, 1996). All samples were submitted to the laboratory accompanied by an analysis request/ chain of custody (AR/COC) form. The AR portion of the form provides project specific analytical specifications and quality control instruction to the laboratories. A formal chain-of-custody (COC) traceability record was included as part of the document ensuring documentation of custody for sample transportation, storage and eventual disposal by the laboratory. Copies of all custody documentation are included in the data packages submitted. All samples were received at the laboratory with intact custody seals. Several samples were received in the laboratory at greater temperatures than allowed by the SAP and QAPP. The samples were recollected. Several samples collected for metal analyses were received with pHs greater than two. Additional nitric acid was added to the samples by the laboratory to lower the pH. No data were qualified.

C3.1 QA/QC Procedures

The project QA/QC program described in the SAP and QAPP was followed for the sample collection and laboratory analysis of samples. The elements of this program are discussed in the sections that follow. The laboratory analytical program consisted of EPA SW-846 and MCAWW methods with Level IV CLP-like deliverables for the generation of definitive data for the investigation. Deliverables included sample preparation information, calibration records, QC data such as method blanks, spikes, duplicates, surrogate recoveries, internal standards, and copies of the AR and COC records. Chemical analyses for this project were performed following standardized protocols, which include specific requirements for how compounds are analyzed, identified and reported.

Each of the methods employed included specific QA/QC protocols that are used to support the validity of the sampling event and the resulting data. These QA/QC protocols are a critical part of the analytical method and were followed explicitly during sample analysis. Specific measures included detailed record keeping procedures, analysis of duplicate samples, instrument calibrations, and the analyses of blanks, surrogate and internal standards.

C3.1.1 Reporting Limits

Practical Quantitation Limits (PQLs), the laboratory's statistically determined reporting limits, were presented in the QAPP section of the Final Work Plan for the investigation for the Quanterra-Knoxville, TN laboratory. The analytical program executed required the use of SW-846 methods which specify the procedures for calculating the PQLs presented. Each laboratory is required to demonstrate method performance through method detection limit (MDL) studies for every analysis, media, and instrument. These studies are required to be laboratory specific so that individual laboratory variables such as equipment brands, reagent suppliers, chemist technique, etc., are all factored into the performance study. The PQL is statistically supported by the MDL established. The PQL calculation is designed to use the MDL, established using controlled matrices (i.e., distilled water), and adjusts the limit by a predetermined mathematical factor for the analysis of actual environmental sample matrices (i.e., soil, groundwater, etc.). For purposes of clarity and consistency with respect to definition and terminology, the term "reporting limit" has been substituted for PQL when referencing the limit of detection the laboratory reported for each sample and analytical parameter. This value has been corrected for all necessary dilution and interference factors based on the analytical data for each sample.

All laboratory results were reviewed with respect to the actual reporting limits achieved as compared to the limits presented in the SAP. Dilutions resulted in high reporting limits for several organics and metals. Samples 7550, 7590, 7630, 7790, and 7830 were diluted before VOA analysis because of foaming noticed during the screening process. Samples 7290, 7310, 7590, 8450, and 8610 were reported with elevated reporting limits for PCBs because of sample matrix difficulties. Samples 7200, 7290, 7310, 7550, 7590, 7630, 7790, 8610, 8730, and 8770 were reported with elevated reporting limits for semivolatiles because of matrix difficulties. Samples 7210, 7270, 7390, 7550, 7580, 7870, 7750, 7780, 7790, 7830, 8130, 8170, 8250, 8251, 8370, 8690, and 8850 were reported with elevated reporting limits for explosives because of sample matrix. Samples 7550, 7630, 8450, and 8610 were reported with elevated reporting limits for chloride. Data were reported on a dry-weight basis.

C3.1.2 Holding Times

All laboratory results submitted for the Plum Brook site investigations were reviewed with respect to laboratory adherence to analysis holding times. Maximum analytical holding times, as presented in Table 5-1 of the QAPP, were usually met by the laboratory. The laboratory exceeded the holding time for volatile analyses. Upon analysis it was determined the pHs of several samples were greater than two. The holding time for unpreserved samples is seven days. Benzene, chlorobenzene, ethylbenzene, styrene, toluene, and xylenes were qualified as estimated, "J" for detects and "UJ" for non-detects. Samples 7270, 7310, 7350, 7550, 7990, and 8610 were analyzed by method E300.0 instead of E353.2 to meet holding times. They were analyzed by 353.2 after the holding time was exceeded. The results of the two methods are compared in Table C-9. The values for E353.2 are estimated because they were analyzed past the holding time. No nitrate was detected in samples 7270, 7350, and 7990. Samples 7550 and 8610 had RPD values of 3 and 6, respectively. Sample 7310 had an RPD value of 113.

C3.1.3 Method Blanks

Method blanks were analyzed with each analytical "batch" processed. The blanks were carried through the analytical procedure, step-by-step, including the addition of all solvents and other reagents required in the analytical process. The purpose of the blank is to ensure that no contaminants are being introduced to the sample as a result of the analytical process, helping to eliminate the element of doubt as to the origin of reported concentrations.

The method blank results reported with the direct push investigation data were evaluated for high readings characteristic of background or process contamination. There were no significant concentrations detected in the designated blank samples that deem any analytical process out of control or require further corrective action. Methylene chloride and bis(2-ethylhexyl)phthalate concentrations reported for the method blanks submitted should be attributed to laboratory process contamination. Methylene chloride is a solvent used in the preparation and extraction of samples for many analyses. Phthalate esters are thought to originate from the extraction portion of the semivolatiles analysis either through the safety gloves worn by the extraction technician or other theorized origins. Lead and copper were detected in one method blank. Associated results were qualified accordingly. The method blank data were used in the validation process by applying the "5X/10X Rule" and associated samples were qualified accordingly.

C3.1.4 Laboratory Control Samples

Laboratory control samples (LCSs) were used in the analytical program as a measure of accuracy without the influence of matrix on the analysis. The laboratory control sample is best described as a spiked laboratory blank measured and reported by calculating the percent recovery of the known spiked concentrations. An LCS was analyzed with every batch of samples processed and analyzed. The control limits applied were statistically derived by the laboratory as required by the method. The review of the LCS data associated with these site investigation data sets showed the data to be within the specified control limits demonstrating accuracy for the analytical processes employed, except for a few compounds. RDX was outside control limits in the LCS associated with sample delivery group PB029. 2,4,6-Trinitotoluene was outside control limits in PB033, PB035, and PB036. No data were qualified.

C3.1.5 Matrix Spike\Matrix Spike Duplicates

Matrix spikes are used to provide an indication of bias due to matrix effects and a measure of accuracy of associated results. Duplicate analyses, sometimes performed using a matrix spike duplicate in the case of organics analyses, provide a measure of precision in the analytical process. Six matrix spike/matrix spike duplicate (MS/MSD) pairs were analyzed for the Red Water Area Ponds investigation. Samples 7200, 7530R, 7880, 7990, 8100, 8170, 8180, 8430, and 8780 were collected and submitted for an MS/MSD analysis. The observed percent recoveries of the spikes were used to determine accuracy for the analyses. Control limits used to evaluate these recoveries were determined statistically by the laboratory for organics as required by the methods employed. Relative percent difference (RPD) calculations are used to evaluate precision between matrix spike and matrix spike duplicate results. The acceptance criteria for the precision data were statistically determined by the laboratory. Metals data exhibited variability in accuracy for several elements in all of the MS/MSD pairs except 8430. Antimony percent recoveries were low in the MS/MSDs for 7200, 7880, 8180, and 8780. Detects were qualified "J" and non-detects were qualified "UJ". Percent recoveries for several metals fell below the acceptable project range of 80-120 percent in the MS/MSDs of 7200. They were arsenic, silver, and thallium. Thallium was low in 7880 also. Detects were qualified "J" and non-detects were qualified "UJ". Chromium recovery was high in 8780, but low in 8180. Magnesium recovery was high in the MS/MSDs of 7990 and 8780. Detects were qualified "J". Potassium recovery was high in 8180 and 8780. Vanadium recovery was high in 8180. Detects were qualified "J".

Overall, percent recovery for organic MS/MSD compounds was good. For explosive compounds, six compounds in the MSD for 7200 were high. 2,4-Dinitrotoluene and

1,3,5- trinitrobenzene were qualified "J". They were the only compounds detected in the associated samples. HMX recovery was low in 7880. The RPD for pentachlorophenol and pyrene exceeded the acceptable range in the sample pair of 7990. No data were qualified. Only one VOA compound RPD was unacceptable. 1,1-Dichloroethene RPD exceeded the range in the MS/MSD of 7880. No data were qualified.

C3.1.6 Surrogate Standards

Surrogate standards were used in the analytical program to monitor the percent recovery efficiencies of the sample preparation and analytical procedure on a sample-by-sample basis for organic constituents. The surrogate standards used were those required by the analytical methods employed and were compliant with the requirements of the methods. Control limits for the surrogate recoveries were determined statistically by the laboratory as required by the methodology. Evaluation of the surrogate standard data exhibited acceptable results for most analyses. Surrogate recovery for the PCB analysis of 7320 was low. The sample was reanalyzed outside the holding time. The reanalysis was rejected and all compounds in the original were qualified "UJ" as estimated. Surrogate recoveries for the explosives analyses of 7780, 7880, and 8230 were high. No qualifications were necessary. Surrogate recoveries for the semivolatile analyses of 8730 and 8770 were out of control. Both samples were dilutions. 8730 was not reanalyzed. 8770 was reanalyzed after the holding time. The reanalysis was rejected. No qualifications were applied to the original samples. No other problems were encountered in the surrogate standard data reported. All data were found to be acceptable as reported and qualified.

C4.0 Data Quality Objectives

DQOs are qualitative and quantitative criteria used to guide sample collection and analysis activities. The DQOs for the project were developed at the outset of the investigation to ensure that the data generated during the execution of the analytical program were of appropriate quality to support the anticipated end use of the data. DQOs describe the level of uncertainty that a decision-maker is willing to accept in results derived from the environmental data. This uncertainty is used to the quality of the measurement data, usually in terms of objectives, bias, representativeness, comparability and completeness. DQOs seek to ensure that the right type, amount and quality of data are collected to accomplish the objectives of the project. The DQOs for this project are to produce scientifically valid data of known accuracy and precision, which

are complete with respect to identified critical samples, comparable with similar data types and representative of the media sampled so as to be useful for the cited purposes.

In order to achieve these DQOs, criteria were established in the SAP by which these goals could be achieved. The Site Investigation required that all laboratory analyses be performed and resulting data reported as definitive data. A non-CLP, (SW-846) method was employed and Level IV (CLP-like) data packages were provided for evaluation for these samples. Definitive data criteria were chosen because compliance with the criteria specified within its guidelines provides quantified concentrations with acceptable reliability for the purposes of the investigation.

C5.0 Data Useability

The data review process as presented in this report, compares sample results to preestablished criteria to confirm that the data are of acceptable technical quality. Specific criteria were reviewed which verifies the achievement of all precision, accuracy, completeness, comparability and representativeness goals established to meet the project DQOs. To verify that these objectives were met, field measurements, sampling and handling procedures, laboratory analysis and reporting and all nonconformances and discrepancies in the data were examined to determine compliance with the appropriate and applicable procedures. The results of this review were presented in previous sections with all outliers or nonconformances were discussed where they occurred.

Precision data was obtained through the analysis and evaluation of duplicate QA samples. Accuracy was determined through the analysis and evaluation of method blanks, laboratory control samples, trip blanks and matrix spike samples. These QA samples were collected and/or analyzed at the frequency established in the SAP, verifying the completeness element of the goals along with the evaluation of holding times, and reporting limits.

Completeness is a measure of the amount of valid data that are obtained during a sampling event. Although most analyses were acceptable, some data points were rejected in the evaluation process. Acetone, 2-butanone, and 2-hexanone were rejected in several samples due to low RRF values in the initial and continuing calibrations. Only non-detects were rejected. Detects were qualified "J".

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability ensures that results for the sampling event can be compared with data from other past and/or future sampling programs. Comparability for this sampling event was achieved through the use of established and recognized techniques and accepted standard EPA methods. All samples collected and analyzed were subjected to the same sampling, handling, preparation, analysis, reporting and validation criteria for the purpose of achieving comparability goals within the data set.

To verify sample representativeness, field data such as field activity daily logs (FADL), sample collection logs, COC/RFA forms, field instrument calibrations and variances were reviewed. The overall results of the analyses as discussed in this evaluation suggest that representative samples were collected and analyzed with results being indicative of the media analyzed with the exception of the few anomalies noted. Organic chemicals were omitted from consideration if they were common laboratory contaminants or could be traced to some other source within the analytical investigation process.

All analytical results for chemicals are reported using validation qualifiers. Chemicals flagged with a "U" qualifier are considered to be not detected, or detected at a concentration below the normal, random "noise" of the analytical instrument. The "J" qualifier describes an estimated value when a compound is qualitatively identified (spectral identification criteria are met), but at values less that the project-required reporting limit. The "UJ" qualifier is applied to analytes that are not detected above the reporting limit. The reporting limit, however, is approximate. The "R" qualifier is used to denote data that are rejected because of deficiencies in the ability to analyze the sample and meet QC criteria. The absence or presence of an analyte cannot be verified.

C6.0 Conclusions

The purpose of the direct-push sampling effort at the Red Water Ponds Areas was to determine the nature and extent of source areas. Specifically, the objectives of the investigation were as follows: to delineate the vertical and lateral extent of overburden contamination in the Red Water Ponds Area in anticipation of future remedial action and to collect data for use in fate and transport modeling. To accomplish this goal, samples were collected and definitive data were generated for the contaminants of potential concern. Evaluation of the data using the specific DQOs established for the project and the data validation process resulted in the determination

that the data set is valid and of sufficient quality to meet the objectives of the investigation. There were no significant problems observed that would adversely affect the application of the data or the success of the overall investigation.

Table C-1

Field Duplicate Results
Pentolite Road Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-PRRP-DP01-7200 (0-1.0)

Parameter	7200 Original (mg/kg)	7201 Duplicate (mg/kg)	RPD %
bis(2-Ethylhexyl)phthalate	4.1 U	0.047 J	NC
Aluminum	9370	10100	7.5
Arsenic	4.5 J	6.3 J	33.3
Barium	84.3	80.1	5.1
Beryllium	0.69	0.73	5.6
Calcium	5740	5080	12.2
Chromium	14.7	16.1	9.1
Cobalt	11.1	10.4	6.5
Copper	22.6	24.0	6.0
Iron	18000	21400	17.3
Lead	8.6	9.0	4.5
Magnesium	2480	2620	5.5
Manganese	321	275	15.4
Nickel	27.2	32.7	18.4
Potassium	777	1060	30.8
Selenium	0.84	0.68	21.1
Sodium	1240	985	22.9
Vanadium	19.1	22.0	14.1
Zinc	78.5	78.6	0.1
2,4-Dinitrotoluene	0.25 U	0.28 J	NC
1,3,5-Trinitrobenzene	0.25 U	0.34 J	NC

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-2

Field Duplicate Results
Pentolite Road Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-PRRP-DP09-7530 (4.0-5.0)

Parameter	7530R Original (mg/kg)	7531R Duplicate (mg/kg)	RPD %
2,4-Dinitrotoluene	0.056 J	0.083 J	38.8
Toluene	0.0017 J	0.0018 J	5.7
Aluminum	4410	9820	76.0
Arsenic	2.6	6.6	198
Barium	24.9 U	81.4	NC
Calcium	63200	47900	27.5
Chromium	9.2	15.4	50.4
Cobalt	6.2 U	10.4	NC
Copper	11.2	18.9	51.2
Iron	9480	18700	65.4
Lead	4.9	7.5	41.9
Magnesium	16800	17200	2.4
Manganese	184 J	727 J	119
Nickel	8.4	27.6	107
Potassium	1050	1870	56.2
Vanadium	20.9 J	27.2 J	26.2
Zinc	24.8	54.1	74.3

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-3

Field Duplicate Results
Pentolite Road Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-GW-PRRP-DP17-7870

Parameter	7870 Original (ug/L)	7871 Duplicate (ug/L)	RPD %
2,4-Dinitrotoluene (by 8270)	1.5 J	2.4 J	46.2
1,3-Dinitrobenzene	6.4	1.7	116
2,4-Dinitrotoluene (by 8330)	8.9	3.7	82.5
2,6-Dinitrotoluene	1.7	0.51	108
Aluminum (Total)	38600	1930	181
Barium (Total)	218	200 U	NC
Calcium (Dissolved)	55000	56400	2.5
Calcium (Total)	1270000	86100	175
Chromium (Total)	65.8	10 U	NC
Copper (Total)	106	25 U	NC
Iron (Total)	87000	4250	181
Magnesium (Dissolved)	13200	13600	3.0
Magnesium (Total)	286000	21200	172
Manganese (Dissolved)	22.4	25.4	12.6
Manganese (Total)	3280	141	184
Nickel (Total)	113	40 U	NC
Potassium (Total)	6430	5000 U	NC
Sodium (Total)	6010	5000 U	NC
Vanadium (Total)	163	50 U	NC
Zinc (Dissolved)	28.7	41.1	35.5
Zinc (Total)	341	44.7	154

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-4

Field Duplicate Results
Pentolite Road Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-PRRP-DP18-7880 (0-1.0)

Parameter	7880 Original (mg/kg)	7881 Duplicate (mg/kg)	RPD %
bis(2-Ethylhexyl)phthalate	0.38 U	0.047 J	NC
Aluminum	10700	8940	22.9
Arsenic	4.0 J	7.3 J	58.4
Barium	32.3	41.0	23.7
Calcium	1040	2360	77.6
Chromium	14.6	15.8	7.9
Cobalt	6.2	7.3	16.3
Copper	7.5	13.7	58.5
Iron	17800	19900	11.1
Lead	5.6	6.1	8.5
Magnesium	1120	1630	37.1
Manganese	158	216	31.0
Nickel	9.8	17.7	57.5
Vanadium	30.3	27.5	9.7
Zinc	27.9	39.5	34.4

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-5

Field Duplicate Results
West Area Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-WARP-DP03-8180 (0-1.0)

Parameter	8180 Original (mg/kg)	8181 Duplicate (mg/kg)	RPD %
bis(2-Ethylhexyl)phthalate	0.390 U	0.068 J	NC
Aluminum	16500	14700	11.5
Arsenic	8.1	6.5	21.9
Barium	112	158	34.1
Beryllium	0.76 J	0.81 J	6.4
Cadmium	0.59	0.89	40.5
Calcium	2710	2560	5.7
Chromium	19.9 J	17.4 J	13.4
Cobalt	17.9	20.9	15.5
Copper	21.4	22.5	5.0
Iron	30200	26300	13.8
Lead	11.7	10.3	12.7
Magnesium	3760	3630	3.5
Manganese	1340	1270	5.4
Nickel	44.3	45.6	2.9
Potassium	2970 J	2350 J	23.3
Vanadium	32.5 J	26.7 J	19.6
Zinc	111	111	0

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-6

Field Duplicate Results
West Area Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-WARP-DP09-8430 (4.0-5.0)

Parameter	8430 Original (ug/kg)	8431 Duplicate (ug/kg)	RPD %
Anthracene	390 U	36 J	NC
Benzo(a)anthracene	390 U	110 J	NC
Benzo(a)pyrene	390 U	84 J	NC
Benzo(b)fluoranthene	390 U	74 J	NC
Benzo(ghi)perylene	390 U	46 J	NC
Benzo(k)fluoranthene	390 U	87 J	NC
Chrysene	390 U	100 J	NC
Fluoranthene	58 J	240 J	122
Indeno(1,2,3-cd)pyrene	390 U	47 J	NC
Phenanthrene	390 U	140 J	NC
Pyrene	43 J	180 J	123

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-6

Field Duplicate Results
West Area Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-WARP-DP09-8430 (4.0-5.0)

Parameter	8430 Original (mg/kg)	8431 Duplicate (mg/kg)	RPD %
Aluminum	6470	5370	18.6
Arsenic	2.2	2.4	8.7
Barium	41.3	37.2	10.4
Calcium	1220	1100	10.3
Chromium	8.2	6.7	20.1
Copper	4.9	7.1	36.7
Iron	8490	7110	17.7
Lead	5.8	4.1	34.3
Magnesium	2010	1660	19.1
Manganese	83.4	91.2	8.9
Nickel	7.4	6.8	8.5
Vanadium	14.2 J	10.9 J	26.3
Zinc	30.6	27.3	11.4

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-7

Field Duplicate Results
West Area Red Water Ponds
Former Plum Brook Ordnance Works, Sandusky, Ohio
PBOW-98-SO-WARP-DP18-8780 (0.0-1.0)

Parameter	8780 Original (mg/kg)	8781 Duplicate (mg/kg)	RPD %
Aluminum	10700	9480	12.1
Arsenic	5.3	5.5	3.7
Barium	61.9	60.3	2.6
Beryllium	0.59	0.61	3.3
Calcium	7330	11400	43.5
Chromium	15.3 J	14.3 J	6.8
Cobalt	11.1	10.7	3.7
Copper	17.3	18.0	4.0
Iron	18400	18400	0
Lead	9.6	11.9	21.4
Magnesium	4680 J	5000 J	6.6
Manganese	453	350	26.6
Nickel	23.5	22.7	3.5
Potassium	1270 J	1180 J	7.4
Vanadium	23.0	21.2	8.1
Zinc	60.3	64.6	6.9

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

Table C-8

Summary of Chemical Analyses and Methodologies
Direct Push Investigation of Red Water Ponds Areas
Former Plum Brook Ordnance Works, Sandusky, Ohio

Matrix	Analytical Parameters	Analytical Method
Soil	TCL Volatile Organic Compounds	SW-846 8260A[a]
	TCL Semivolatile Organic Compounds	SW-846 3520B/3541/8270B[a]
	TAL Metals	SW-846 3050A/6010A[b] for Ag, Al, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sb, Tl, V, Zn 7471A[a] for Hg 7060A[b] for As 7740[b] for Se
	PCBs	SW-846 3520B/8081[a]
	Nitroaromatic Compounds	SW-846/8330[c] (as modified)
Water	TCL Volatile Organic Compounds	SW-846 8260A[a]
	TCL Semivolatile Organic Compounds	SW-846 3520B/3541/8270B[a]
	TAL Metals	SW-846 3050A/6010A[b] for Ag, Al, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sb, Tl, V, Zn 7470A[a] for Hg 7060A[b] for As 7740[b] for Se
	PCBs	SW-846 3520B/8081[a]
	Nitroaromatic Compounds	SW-846/8330[c] (as modified)
	TOC, Total Cyanide Alkalinity, Chloride, TDS, TSS, Nitrate Sulfate	SW-846 9060, 9010A MCAWW[d] 310.1, 325.2 160.1, 160.2, 353.2 375.4

[a]U.S. Environmental Protection Agency (EPA), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Third Edition, Update II, September 1994.
[b]U.S. Environmental Protection Agency (EPA), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Third Edition, Update I, July 1992.
[c]U.S. Environmental Protection Agency (EPA), *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Third Edition, Revision 1, December 1990
[d]U.S. Environmental Protection Agency (EPA), *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, March 1983 and subsequent revisions

TCL - Target compound list
TAL - Target analyte list
TDS - Total dissolved solids
TOC - Total organic carbon
TSS - Total suspended solids

Table C-9

Nitrate Analysis Results
Methods E300 and E353.2
Former Plum Brook Ordnance Works
Sandusky, Ohio

Sample	E300 (ug/L)	E353.2 (ug/L)	RPD %
7270	500 U	1000 U	NC
7310	465000	130000 J	113
7350	500 U	100 U	NC
7550	16900	16400 J	3.0
7990	500 U	100 U	NC
8610	1600	1700 J	6.0

U = Compound analyzed for but not detected; value given is quantitation limit.
J = Compound detected but value is estimated.
NC = Not calculable.

APPENDIX D

DATA VALIDATION SUMMARY

E & E Technologies, Inc.

Plum Brook Ordnance Works
Data Validation Summary Report

August, 1998

Analytical results from soil and water samples, collected in June, 1998, were 100% validated at Level III according to the EPA National Functional Guidelines for Data Review. Volatiles, Semi-volatiles, PCBs, Explosives, Metals, and miscellaneous analyses were reviewed from 10 SDGs including PB027, PB028, PB029, PB030, PB031, PB032, PB033, PB034, PB035, and PB036.

Volatiles. Sixteen samples from SDGs -027, -031, and -034 were not correctly preserved and consequently the aromatic fraction was analyzed outside of the acceptable QC holding times. These compounds were qualified as "UJ/J" in the samples. Additionally, 36 samples from the same SDGs required an "R" or "J" qualifier for acetone, 2-butanone, and 2-hexanone due to low RRFs(<0.05) for both the initial and continuing calibration standards analyses. Low Internal Standard (IS) counts for 13 samples in SDGs -028, -029, -032, -033, and -036 resulted in the compounds associated with the IS being qualified as "UJ/J". Due to the trip blank and equipment rinsate blank contamination, acetone was qualified as "U" and raised to the reporting limit in 35 samples, toluene in 23, TCE in 3 three, and chloroform in one. Contamination in the method blank resulted in methylene chloride being qualified as "U" and raised to the reporting limit in 18 samples across all of the SDGs.

Semi-volatiles. Five samples from -028 had a low perylene IS area count and the associated compounds were qualified as "UJ". Bis- (2 ethyl hexyl) phthalate was qualified as "U" in one sample in -034.

Pesticides/PCBs. One sample from -028 had low surrogate recoveries and was qualified as "UJ".

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Explosives. The soil samples from -028, -029, -030, -032, -033, -035, and -036 did not have the detected results corrected for the percent moisture content of the sample. All results were corrected and changed on their respective Form I. Twenty samples were changed in the effected SDGs. One sample in -027 had tetryl reported on the primary column, an inspection of the confirmation analysis did not show tetryl detected. The original value was lowered to the reporting limit and qualified as "U". In -029, one sample had results for 2,4-DNT and 1,3,5-TNB that were qualified as "J" since it appeared that they could have been effected by residual contamination from the previous sample.

Metals. High or low recoveries in the matrix spike resulted in a number of elements being qualified as "UJ/J" in 85 samples across all SDGs. The effected elements were antimony, thallium, lead, arsenic, selenium, silver, potassium, magnesium, chromium, vanadium, and manganese. Additionally, high percent difference in the serial dilution analysis had vanadium, lead, chromium, and beryllium qualified as "J" in a total of 53 samples from -027, -032, -035, and -036.

Wet Chemistry. No qualifiers were required.

APPENDIX E

ANALYTICAL DATA DUMP

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1,2,2-Tetrachloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1,2-Trichloroethane	mg/kg										
1,1-Dichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloropropane	mg/kg	.0005		.0005		.0005		.0005		.0005	
2-Butanone	mg/kg	.011		.0115		.011		.0115		.011	
2-Hexanone	mg/kg	.0055		.0055		.0055		.006		.0055	
4-Methyl-2-pentanone	mg/kg	.0055		.0055		.0055		.006		.0055	
Acetone	mg/kg	.011		.0115		.011		.0115		.011	
Benzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromodichloromethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromoform	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromomethane	mg/kg	.001		.001		.001		.001		.001	
Carbon disulfide	mg/kg	.011		.0115		.011		.0115		.011	
Carbon tetrachloride	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chlorobenzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chloroethane	mg/kg	.001		.001		.001		.001		.001	
Chloroform	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chloromethane	mg/kg	.001		.001		.001		.001		.001	
Dibromochloromethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
Ethylbenzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Methylene chloride	mg/kg	.0005		.0005		.0005		.0005		.0005	
Styrene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Tetrachloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Toluene	mg/kg	.0005		.0022		.0005		.0013		.0017	
Total xylenes	mg/kg	.0005		.0005		.0012		.0005		.0005	
Trichloroethene	mg/kg	.0014		.0005		.0005		.0045		.0005	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1,2,2-Tetrachloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1,2-Trichloroethane	mg/kg										
1,1-Dichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloropropane	mg/kg	.0005		.0005		.0005		.0005		.0005	
2-Butanone	mg/kg	.011		.012		.011		.012		.0115	
2-Hexanone	mg/kg	.0055		.006		.0055		.006		.0055	
4-Methyl-2-pentanone	mg/kg	.0055		.006		.0055		.006		.0055	
Acetone	mg/kg	.011		.012		.011		.012		.0115	
Benzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromodichloromethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromoform	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromomethane	mg/kg	.001		.001		.001		.001		.001	
Carbon disulfide	mg/kg	.011		.012		.011		.012		.0115	
Carbon tetrachloride	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chlorobenzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chloroethane	mg/kg	.001		.001		.001		.001		.001	
Chloroform	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chloromethane	mg/kg	.001		.001		.001		.001		.001	
Dibromochloromethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
Ethylbenzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Methylene chloride	mg/kg	.0005		.0005		.0005		.0005		.0005	
Styrene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Tetrachloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Toluene	mg/kg	.0019		.0035		.0005		.0005		.0005	
Total xylenes	mg/kg	.0005		.0035		.0005		.0005		.0005	
Trichloroethe	mg/kg	.0005		0005		.0012		.0005		05	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1,2,2-Tetrachloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1,2-Trichloroethane	mg/kg										
1,1-Dichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,1-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloroethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
1,2-Dichloropropane	mg/kg	.0005		.0005		.0005		.0005		.0005	
2-Butanone	mg/kg	.0115		.0115		.012		.011		.012	
2-Hexanone	mg/kg	.0055		.0055		.006		.0055		.006	
4-Methyl-2-pentanone	mg/kg	.0055		.0055		.006		.0055		.006	
Acetone	mg/kg	.0115		.0115		.012		.011		.012	
Benzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromodichloromethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromoform	mg/kg	.0005		.0005		.0005		.0005		.0005	
Bromomethane	mg/kg	.001		.001		.001		.001		.001	
Carbon disulfide	mg/kg	.0115		.0115		.012		.011		.012	
Carbon tetrachloride	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chlorobenzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chloroethane	mg/kg	.001		.001		.001		.001		.001	
Chloroform	mg/kg	.0005		.0005		.0005		.0005		.0005	
Chloromethane	mg/kg	.001		.001		.001		.001		.001	
Dibromochloromethane	mg/kg	.0005		.0005		.0005		.0005		.0005	
Ethylbenzene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Methylene chloride	mg/kg	.0005		.0005		.0005		.0005		.0005	
Styrene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Tetrachloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Toluene	mg/kg	.0005		.0005		.0005		.0005		.0005	
Total xylenes	mg/kg	.0005		.0005		.0005		.0005		.0005	
Trichloroethene	mg/kg	.0005		.0005		.0046		.0005		.0022	

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Sample Location:		WARP-DP01		WARP-DP02		WARP-DP03		WARP-DP04		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8180		8240		8270	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		16-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		8 - 10		4 - 6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
1,1,2,2-Tetrachloroethane	mg/kg	.00315	U	.003	UJ	.00295	U	.0032	U	.00305	U
1,1,2-Trichloroethane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
1,1-Dichloroethane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
1,1-Dichloroethene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
1,2-Dichloroethane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
1,2-Dichloroethene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
1,2-Dichloropropane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
2-Butanone	mg/kg	.0125	U	.012	U	.012	U	.0125	U	.012	U
2-Hexanone	mg/kg	.0125	U	.012	U	.012	U	.0125	U	.012	U
4-Methyl-2-pentanone	mg/kg	.0125	U	.012	U	.012	U	.0125	U	.012	U
Acetone	mg/kg	.0125	U	.012	U	.012	U	.0125	U	.012	U
Benzene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Bromodichloromethane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Bromoform	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Bromomethane	mg/kg	.0065	U	.006	U	.006	U	.0065	U	.006	U
Carbon disulfide	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Carbon tetrachloride	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Chlorobenzene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Chloroethane	mg/kg	.0065	U	.006	U	.006	U	.0065	U	.006	U
Chloroform	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Chloromethane	mg/kg	.0065	U	.006	U	.006	U	.0065	U	.006	U
Dibromochloromethane	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Ethylbenzene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Methylene chloride	mg/kg	.0032	B	.0023	B	.0039	B	.0027	B	.00305	U
Styrene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Tetrachloroethene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Toluene	mg/kg	.0022	J	.0018	J	.00295	U	.0025	J	.00305	U
Total xylenes	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
Trichloroethe	mg/kg	.00315	U	003	U	.00295	U	.0032	U	305	U

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Sample Location:		WARP-DP06		WARP-DP07		WARP-DP08		WARP-DP09		WARP-DP10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8350		8380		8430		8460	
Sample Date:		23-JUN-98		25-JUN-98		15-JUN-98		16-JUN-98		26-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0028	U	.0029	U	.0029	U	.003	U	.0029	U
1,1,2,2-Tetrachloroethane	mg/kg	.0028	U	.0029	UJ	.0029	U	.003	U	.0029	UJ
1,1,2-Trichloroethane	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
1,1-Dichloroethane	mg/kg	.0028	U	.0029	U	.0029	U	.003	U	.0029	U
1,1-Dichloroethene	mg/kg	.0028	U	.0029	U	.0029	U	.003	U	.0029	U
1,2-Dichloroethane	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
1,2-Dichloroethene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
1,2-Dichloropropane	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
2-Butanone	mg/kg	.011	U	.0115	U	.0115	U	.012	U	.0115	U
2-Hexanone	mg/kg	.011	U	.0115	U	.0115	U	.012	UJ	.0115	U
4-Methyl-2-pentanone	mg/kg	.011	U	.0115	U	.0115	U	.012	UJ	.0115	U
Acetone	mg/kg	.011	U	.0115	U	.035		.012	U	.0115	U
Benzene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Bromodichloromethane	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Bromoform	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Bromomethane	mg/kg	.0055	U	.006	U	.006	U	.006	U	.006	U
Carbon disulfide	mg/kg	.0028	U	.0029	U	.0029	U	.003	U	.0029	U
Carbon tetrachloride	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Chlorobenzene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Chloroethane	mg/kg	.0055	U	.006	U	.006	U	.006	U	.006	U
Chloroform	mg/kg	.0028	U	.0029	U	.0029	U	.003	U	.0029	U
Chloromethane	mg/kg	.0055	U	.006	U	.006	U	.006	U	.006	U
Dibromochloromethane	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Ethylbenzene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Methylene chloride	mg/kg	.0018	B	.0032	B	.002	J	.003	U	.0027	B
Styrene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Tetrachloroethene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Toluene	mg/kg	.0023	J	.0029	U	.0029	U	.003	UJ	.0029	U
Total xylenes	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
Trichloroethene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U

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Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8700	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
1,1,2,2-Tetrachloroethane	mg/kg	.003	UJ	.0031	U	.00285	U	.00295	U	.003	U
1,1,2-Trichloroethane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
1,1-Dichloroethane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
1,1-Dichloroethene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
1,2-Dichloroethane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
1,2-Dichloroethene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
1,2-Dichloropropane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
2-Butanone	mg/kg	.012	U	.0125	U	.0115	U	.012	U	.012	U
2-Hexanone	mg/kg	.012	U	.0125	U	.0115	U	.012	U	.012	U
4-Methyl-2-pentanone	mg/kg	.012	U	.0125	U	.0115	U	.012	U	.012	U
Acetone	mg/kg	.012	U	.0125	U	.0115	U	.012	U	.012	U
Benzene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Bromodichloromethane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Bromoform	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Bromomethane	mg/kg	.006	U	.006	U	.0055	U	.006	U	.006	U
Carbon disulfide	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Carbon tetrachloride	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Chlorobenzene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Chloroethane	mg/kg	.006	U	.006	U	.0055	U	.006	U	.006	U
Chloroform	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Chloromethane	mg/kg	.006	U	.006	U	.0055	U	.006	U	.006	U
Dibromochloromethane	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Ethylbenzene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Methylene chloride	mg/kg	.0037	B	.002	J	.0023	J	.0025	B	.0026	B
Styrene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Tetrachloroethene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Toluene	mg/kg	.0032	J	.0031	U	.00285	U	.0021	J	.003	U
Total xylenes	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
Trichloroeth	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	3	U

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Sample Location:		WARP-DP17		WARP-DP18		WARP-DP19		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8750		8780		8820		8870	
Sample Date:		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		4 - 6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
1,1,2,2-Tetrachloroethane	mg/kg	.00305	U	.00285	UJ	.0028	U	.00285	U
1,1,2-Trichloroethane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
1,1-Dichloroethane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
1,1-Dichloroethene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
1,2-Dichloroethane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
1,2-Dichloroethene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
1,2-Dichloropropane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
2-Butanone	mg/kg	.012	U	.0115	U	.011	U	.0115	U
2-Hexanone	mg/kg	.012	U	.0115	U	.011	U	.0115	U
4-Methyl-2-pentanone	mg/kg	.012	U	.0115	U	.011	U	.0115	U
Acetone	mg/kg	.012	U	.0115	U	.011	U	.0115	U
Benzene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Bromodichloromethane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Bromoform	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Bromomethane	mg/kg	.006	U	.0055	U	.0055	U	.0055	U
Carbon disulfide	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Carbon tetrachloride	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Chlorobenzene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Chloroethane	mg/kg	.006	U	.0055	U	.0055	U	.0055	U
Chloroform	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Chloromethane	mg/kg	.006	U	.0055	U	.0055	U	.0055	U
Dibromochloromethane	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Ethylbenzene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Methylene chloride	mg/kg	.00305	U	.0019	B	.0024	B	.0024	B
Styrene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Tetrachloroethene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Toluene	mg/kg	.0022	J	.00285	U	.0028	U	.0015	J
Total xylenes	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
Trichloroethene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U

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Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg	.0055		.0055		.0055		.006		.0055	
Vinyl chloride	mg/kg	.0002		.00025		.0002		.00025		.0002	
cis-1,2-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
cis-1,3-Dichloropropene	mg/kg	.0005		.0005		.0005		.0005		.0005	
trans-1,3-Dichloropropene	mg/kg	.0005		.0005		.0005		.0005		.0005	

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Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg	.0055		.006		.0055		.006		.0055	
Vinyl chloride	mg/kg	.0002		.00025		.0002		.00025		.00025	
cis-1,2-Dichloroethene	mg/kg	.0005		.0005		.0005		.0005		.0005	
cis-1,3-Dichloropropene	mg/kg	.0005		.0005		.0005		.0005		.0005	
trans-1,3-Dichloropropene	mg/kg	.0005		.0005		.0005		.0005		.0005	

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Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg	.0055		.0055		.006		.0055		.006	
Vinyl chloride	mg/kg	.0002		.00025		.00025		.0002		.00025	
cis-1,2-Dichloroethene	mg/kg	.0005		.0005		.0013		.0005		.0005	
cis-1,3-Dichloropropene	mg/kg	.0005		.0005		.0005		.0005		.0005	
trans-1,3-Dichloropropene	mg/kg	.0005		.0005		.0005		.0005		.0005	

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Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP01		WARP-DP02		WARP-DP03		WARP-DP04		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8180		8240		8270	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		16-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		8 - 10		4 - 6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg										
Vinyl chloride	mg/kg	.0065	U	.006	U	.006	U	.0065	U	.006	U
cis-1,2-Dichloroethene	mg/kg										
cis-1,3-Dichloropropene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U
trans-1,3-Dichloropropene	mg/kg	.00315	U	.003	U	.00295	U	.0032	U	.00305	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP06		WARP-DP07		WARP-DP08		WARP-DP09		WARP-DP10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8350		8380		8430		8460	
Sample Date:		23-JUN-98		25-JUN-98		15-JUN-98		16-JUN-98		26-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg										
Vinyl chloride	mg/kg	.0055	U	.006	U	.006	U	.006	U	.006	U
cis-1,2-Dichloroethene	mg/kg										
cis-1,3-Dichloropropene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U
trans-1,3-Dichloropropene	mg/kg	.0028	U	.0029	U	.0029	U	.003	UJ	.0029	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8700	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg										
Vinyl chloride	mg/kg	.006	U	.006	U	.0055	U	.006	U	.006	U
cis-1,2-Dichloroethene	mg/kg										
cis-1,3-Dichloropropene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U
trans-1,3-Dichloropropene	mg/kg	.003	U	.0031	U	.00285	U	.00295	U	.003	U

Report Date: 09/19/00

Sample Location:		WARP-DP17		WARP-DP18		WARP-DP19		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8750		8780		8820		8870	
Sample Date:		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		4 - 6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl acetate	mg/kg								
Vinyl chloride	mg/kg	.006	U	.0055	U	.0055	U	.0055	U
cis-1,2-Dichloroethene	mg/kg								
cis-1,3-Dichloropropene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U
trans-1,3-Dichloropropene	mg/kg	.00305	U	.00285	U	.0028	U	.00285	U

Report Date: 09/19/00

Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.18		.19		.185		.19		.18	
1,2-Dichlorobenzene	mg/kg	.18		.19		.185		.19		.18	
1,3-Dichlorobenzene	mg/kg	.18		.19		.185		.19		.18	
1,4-Dichlorobenzene	mg/kg	.18		.19		.185		.19		.18	
2,4,5-Trichlorophenol	mg/kg	.18		.19		.185		.19		.18	
2,4,6-Trichlorophenol	mg/kg	.18		.19		.185		.19		.18	
2,4-Dichlorophenol	mg/kg	.18		.19		.185		.19		.18	
2,4-Dimethylphenol	mg/kg	.18		.19		.185		.19		.18	
2,4-Dinitrophenol	mg/kg	.895		.94		.915		.96		.895	
2,4-Dinitrotoluene	mg/kg	.18		.19		.185		.19		.18	
2,6-Dinitrotoluene	mg/kg	.18		.19		.185		.19		.18	
2-Chloronaphthalene	mg/kg	.18		.19		.185		.19		.18	
2-Chlorophenol	mg/kg	.18		.19		.185		.19		.18	
2-Methylnaphthalene	mg/kg	.18		.19		.185		.19		.18	
2-Methylphenol	mg/kg	.18		.19		.185		.19		.18	
2-Nitroaniline	mg/kg	.895		.94		.915		.96		.895	
2-Nitrophenol	mg/kg	.18		.19		.185		.19		.18	
3,3'-Dichlorobenzidine	mg/kg	.36		.375		.365		.385		.36	
3-Nitroaniline	mg/kg	.895		.94		.915		.96		.895	
4,6-Dinitro-2-methylphenol	mg/kg	.895		.94		.915		.96		.895	
4-Bromophenyl phenyl ether	mg/kg	.18		.19		.185		.19		.18	
4-Chloro-3-methylphenol	mg/kg	.36		.375		.365		.385		.36	
4-Chloroaniline	mg/kg	.36		.375		.365		.385		.36	
4-Chlorophenyl phenyl ether	mg/kg	.18		.19		.185		.19		.18	
4-Methylphenol	mg/kg	.18		.19		.185		.19		.18	
4-Nitroaniline	mg/kg	.36		.375		.365		.385		.36	
4-Nitrophenol	mg/kg	.895		.94		.915		.96		.895	
Acenaphthene	mg/kg	.18		.19		.185		.19		.18	
Acenaphthylene	mg/kg	.18		.19		.185		.19		.18	
Anthracene	mg/kg	.18		.19		.185		.19		.18	

Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.18		.2		.185		.195		.19	
1,2-Dichlorobenzene	mg/kg	.18		.2		.185		.195		.19	
1,3-Dichlorobenzene	mg/kg	.18		.2		.185		.195		.19	
1,4-Dichlorobenzene	mg/kg	.18		.2		.185		.195		.19	
2,4,5-Trichlorophenol	mg/kg	.18		.2		.185		.195		.19	
2,4,6-Trichlorophenol	mg/kg	.18		.2		.185		.195		.19	
2,4-Dichlorophenol	mg/kg	.18		.2		.185		.195		.19	
2,4-Dimethylphenol	mg/kg	.18		.2		.185		.195		.19	
2,4-Dinitrophenol	mg/kg	.905		.995		.915		.97		.95	
2,4-Dinitrotoluene	mg/kg	.18		.2		.185		.195		.19	
2,6-Dinitrotoluene	mg/kg	.18		.2		.185		.195		.19	
2-Chloronaphthalene	mg/kg	.18		.2		.185		.195		.19	
2-Chlorophenol	mg/kg	.18		.2		.185		.195		.19	
2-Methylnaphthalene	mg/kg	.18		.2		.185		.195		.19	
2-Methylphenol	mg/kg	.18		.2		.185		.195		.19	
2-Nitroaniline	mg/kg	.905		.995		.915		.97		.95	
2-Nitrophenol	mg/kg	.18		.2		.185		.195		.19	
3,3'-Dichlorobenzidine	mg/kg	.365		.4		.365		.39		.38	
3-Nitroaniline	mg/kg	.905		.995		.915		.97		.95	
4,6-Dinitro-2-methylphenol	mg/kg	.905		.995		.915		.97		.95	
4-Bromophenyl phenyl ether	mg/kg	.18		.2		.185		.195		.19	
4-Chloro-3-methylphenol	mg/kg	.365		.4		.365		.39		.38	
4-Chloroaniline	mg/kg	.365		.4		.365		.39		.38	
4-Chlorophenyl phenyl ether	mg/kg	.18		.2		.185		.195		.19	
4-Methylphenol	mg/kg	.18		.2		.185		.195		.19	
4-Nitroaniline	mg/kg	.365		.4		.365		.39		.38	
4-Nitrophenol	mg/kg	.905		.995		.915		.97		.95	
Acenaphthene	mg/kg	.18		.2		.185		.195		.19	
Acenaphthylene	mg/kg	.18		.2		.185		.195		.19	
Anthracene	mg/kg	.18		2		.185		.195			

Report Date: 09/19/00

Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.19		.19		.195		.185		.2	
1,2-Dichlorobenzene	mg/kg	.19		.19		.195		.185		.2	
1,3-Dichlorobenzene	mg/kg	.19		.19		.195		.185		.2	
1,4-Dichlorobenzene	mg/kg	.19		.19		.195		.185		.2	
2,4,5-Trichlorophenol	mg/kg	.19		.19		.195		.185		.2	
2,4,6-Trichlorophenol	mg/kg	.19		.19		.195		.185		.2	
2,4-Dichlorophenol	mg/kg	.19		.19		.195		.185		.2	
2,4-Dimethylphenol	mg/kg	.19		.19		.195		.185		.2	
2,4-Dinitrophenol	mg/kg	.95		.94		.98		.915		1.005	
2,4-Dinitrotoluene	mg/kg	.19		.19		.195		.185		.2	
2,6-Dinitrotoluene	mg/kg	.19		.19		.195		.185		.2	
2-Chloronaphthalene	mg/kg	.19		.19		.195		.185		.2	
2-Chlorophenol	mg/kg	.19		.19		.195		.185		.2	
2-Methylnaphthalene	mg/kg	.19		.19		.195		.185		.2	
2-Methylphenol	mg/kg	.19		.19		.195		.185		.2	
2-Nitroaniline	mg/kg	.95		.94		.98		.915		1.005	
2-Nitrophenol	mg/kg	.19		.19		.195		.185		.2	
3,3'-Dichlorobenzidine	mg/kg	.38		.375		.395		.365		.405	
3-Nitroaniline	mg/kg	.95		.94		.98		.915		1.005	
4,6-Dinitro-2-methylphenol	mg/kg	.95		.94		.98		.915		1.005	
4-Bromophenyl phenyl ether	mg/kg	.19		.19		.195		.185		.2	
4-Chloro-3-methylphenol	mg/kg	.38		.375		.395		.365		.405	
4-Chloroaniline	mg/kg	.38		.375		.395		.365		.405	
4-Chlorophenyl phenyl ether	mg/kg	.19		.19		.195		.185		.2	
4-Methylphenol	mg/kg	.19		.19		.195		.185		.2	
4-Nitroaniline	mg/kg	.38		.375		.395		.365		.405	
4-Nitrophenol	mg/kg	.95		.94		.98		.915		1.005	
Acenaphthene	mg/kg	.19		.19		.195		.185		.2	
Acenaphthylene	mg/kg	.19		.19		.195		.185		.2	
Anthracene	mg/kg	.19		.19		.195		.185		.2	

Report Date: 09/19/00

Sample Location:		WARP-DP01		WARP-DP02		WARP-DP03		WARP-DP04		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8180		8240		8270	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		16-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		8 - 10		4 - 6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
1,2-Dichlorobenzene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
1,3-Dichlorobenzene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
1,4-Dichlorobenzene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2,4,5-Trichlorophenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2,4,6-Trichlorophenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2,4-Dichlorophenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2,4-Dimethylphenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2,4-Dinitrophenol	mg/kg	1	U	.95	U	.95	U	1	U	1	U
2,4-Dinitrotoluene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2,6-Dinitrotoluene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2-Chloronaphthalene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2-Chlorophenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2-Methylnaphthalene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2-Methylphenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
2-Nitroaniline	mg/kg	1	U	.95	U	.95	U	1	U	1	U
2-Nitrophenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
3,3'-Dichlorobenzidine	mg/kg	1	U	.95	U	.95	U	1	U	1	U
3-Nitroaniline	mg/kg	1	U	.95	U	.95	U	1	U	1	U
4,6-Dinitro-2-methylphenol	mg/kg	1	U	.95	U	.95	U	1	U	1	U
4-Bromophenyl phenyl ether	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
4-Chloro-3-methylphenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
4-Chloroaniline	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
4-Chlorophenyl phenyl ether	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
4-Methylphenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
4-Nitroaniline	mg/kg	1	U	.95	U	.95	U	1	U	1	U
4-Nitrophenol	mg/kg	1	U	.95	U	.95	U	1	U	1	U
Acenaphthene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Acenaphthylene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Anthracene	mg/kg	.205	U	.2	U	.195	U	.21	U		U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP06		WARP-DP07		WARP-DP08		WARP-DP09		WARP-DP10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8350		8380		8430		8460	
Sample Date:		23-JUN-98		25-JUN-98		15-JUN-98		16-JUN-98		26-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
1,2-Dichlorobenzene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
1,3-Dichlorobenzene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
1,4-Dichlorobenzene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2,4,5-Trichlorophenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2,4,6-Trichlorophenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2,4-Dichlorophenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2,4-Dimethylphenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2,4-Dinitrophenol	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
2,4-Dinitrotoluene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2,6-Dinitrotoluene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2-Chloronaphthalene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2-Chlorophenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2-Methylnaphthalene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2-Methylphenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
2-Nitroaniline	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
2-Nitrophenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
3,3'-Dichlorobenzidine	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
3-Nitroaniline	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
4,6-Dinitro-2-methylphenol	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
4-Bromophenyl phenyl ether	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
4-Chloro-3-methylphenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
4-Chloroaniline	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
4-Chlorophenyl phenyl ether	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
4-Methylphenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
4-Nitroaniline	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
4-Nitrophenol	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
Acenaphthene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Acenaphthylene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Anthracene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U

Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8700	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
1,2-Dichlorobenzene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
1,3-Dichlorobenzene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
1,4-Dichlorobenzene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2,4,5-Trichlorophenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2,4,6-Trichlorophenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2,4-Dichlorophenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2,4-Dimethylphenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2,4-Dinitrophenol	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
2,4-Dinitrotoluene	mg/kg	.043	J	.205	U	.19	U	.195	U	.2	U
2,6-Dinitrotoluene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2-Chloronaphthalene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2-Chlorophenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2-Methylnaphthalene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2-Methylphenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
2-Nitroaniline	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
2-Nitrophenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
3,3'-Dichlorobenzidine	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
3-Nitroaniline	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
4,6-Dinitro-2-methylphenol	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
4-Bromophenyl phenyl ether	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
4-Chloro-3-methylphenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
4-Chloroaniline	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
4-Chlorophenyl phenyl ether	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
4-Methylphenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
4-Nitroaniline	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
4-Nitrophenol	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
Acenaphthene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Acenaphthylene	mg/kg	.195	U	.205	U	.041	J	.195	U	.2	U
Anthracene	mg/kg	.195	U	.205	U	.23	J	.195	U		U

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Sample Location:		WARP-DP17		WARP-DP18		WARP-DP19		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8750		8780		8820		8870	
Sample Date:		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		4 - 6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.2	U	.185	U	.185	U	.19	U
1,2-Dichlorobenzene	mg/kg	.2	U	.185	U	.185	U	.19	U
1,3-Dichlorobenzene	mg/kg	.2	U	.185	U	.185	U	.19	U
1,4-Dichlorobenzene	mg/kg	.2	U	.185	U	.185	U	.19	U
2,4,5-Trichlorophenol	mg/kg	.2	U	.185	U	.185	U	.19	U
2,4,6-Trichlorophenol	mg/kg	.2	U	.185	U	.185	U	.19	U
2,4-Dichlorophenol	mg/kg	.2	U	.185	U	.185	U	.19	U
2,4-Dimethylphenol	mg/kg	.2	U	.185	U	.185	U	.19	U
2,4-Dinitrophenol	mg/kg	.95	U	.9	U	.9	U	.9	U
2,4-Dinitrotoluene	mg/kg	.2	U	.185	U	.185	U	.19	U
2,6-Dinitrotoluene	mg/kg	.2	U	.185	U	.185	U	.19	U
2-Chloronaphthalene	mg/kg	.2	U	.185	U	.185	U	.19	U
2-Chlorophenol	mg/kg	.2	U	.185	U	.185	U	.19	U
2-Methylnaphthalene	mg/kg	.2	U	.185	U	.185	U	.19	U
2-Methylphenol	mg/kg	.2	U	.185	U	.185	U	.19	U
2-Nitroaniline	mg/kg	.95	U	.9	U	.9	U	.9	U
2-Nitrophenol	mg/kg	.2	U	.185	U	.185	U	.19	U
3,3'-Dichlorobenzidine	mg/kg	.95	U	.9	U	.9	U	.9	U
3-Nitroaniline	mg/kg	.95	U	.9	U	.9	U	.9	U
4,6-Dinitro-2-methylphenol	mg/kg	.95	U	.9	U	.9	U	.9	U
4-Bromophenyl phenyl ether	mg/kg	.2	U	.185	U	.185	U	.19	U
4-Chloro-3-methylphenol	mg/kg	.2	U	.185	U	.185	U	.19	U
4-Chloroaniline	mg/kg	.2	U	.185	U	.185	U	.19	U
4-Chlorophenyl phenyl ether	mg/kg	.2	U	.185	U	.185	U	.19	U
4-Methylphenol	mg/kg	.2	U	.185	U	.185	U	.19	U
4-Nitroaniline	mg/kg	.95	U	.9	U	.9	U	.9	U
4-Nitrophenol	mg/kg	.95	U	.9	U	.9	U	.9	U
Acenaphthene	mg/kg	.2	U	.185	U	.185	U	.19	U
Acenaphthylene	mg/kg	.2	U	.185	U	.185	U	.04	J
Anthracene	mg/kg	.2	U	.185	U	.185	U	.12	J

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.18		.19		.185		.19		.18	
Benzo(a)pyrene	mg/kg	.18		.19		.185		.19		.18	
Benzo(b)fluoranthene	mg/kg	.18		.19		.185		.19		.18	
Benzo(ghi)perylene	mg/kg	.18		.19		.185		.19		.18	
Benzo(k)fluoranthene	mg/kg	.18		.19		.185		.19		.18	
Benzoic acid	mg/kg	.895		.94		.915		.96		.895	
Benzyl alcohol	mg/kg	.36		.375		.365		.385		.36	
Butyl benzyl phthalate	mg/kg	.18		.19		.185		.19		.18	
Carbazole	mg/kg										
Chrysene	mg/kg	.18		.19		.185		.19		.18	
Dibenz(a,h)anthracene	mg/kg	.18		.19		.185		.19		.18	
Dibenzofuran	mg/kg	.18		.19		.185		.19		.18	
Diethyl phthalate	mg/kg	.18		.19		.185		.19		.18	
Dimethyl phthalate	mg/kg	.18		.19		.185		.19		.18	
Fluoranthene	mg/kg	.18		.19		.185		.19		.18	
Fluorene	mg/kg	.18		.19		.185		.19		.18	
Hexachlorobenzene	mg/kg	.18		.19		.185		.19		.18	
Hexachlorobutadiene	mg/kg	.18		.19		.185		.19		.18	
Hexachlorocyclopentadiene	mg/kg	.18		.19		.185		.19		.18	
Hexachloroethane	mg/kg	.18		.19		.185		.19		.18	
Indeno(1,2,3-cd)pyrene	mg/kg	.18		.19		.185		.19		.18	
Isophorone	mg/kg	.18		.19		.185		.19		.18	
Naphthalene	mg/kg	.18		.19		.185		.19		.18	
Nitrobenzene	mg/kg	.18		.19		.185		.19		.18	
Pentachlorophenol	mg/kg	.895		.94		.915		.96		.895	
Phenanthrene	mg/kg	.18		.19		.185		.19		.18	
Phenol	mg/kg	.18		.19		.185		.19		.18	
Pyrene	mg/kg	.18		.19		.185		.19		.18	
bis(2-Chloroethoxy)methane	mg/kg	.18		.19		.185		.19		.18	
bis(2-Chloroe her	mg/kg	.18		19		.185		.19			

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Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.18		.2		.185		.195		.19	
Benzo(a)pyrene	mg/kg	.18		.2		.185		.195		.19	
Benzo(b)fluoranthene	mg/kg	.18		.2		.915		.195		.19	
Benzo(ghi)perylene	mg/kg	.18		.2		.185		.195		.19	
Benzo(k)fluoranthene	mg/kg	.18		.2		.185		.195		.19	
Benzoic acid	mg/kg	.905		.995		.915		.97		.95	
Benzyl alcohol	mg/kg	.365		.4		.365		.39		.38	
Butyl benzyl phthalate	mg/kg	.18		.2		.185		.195		.19	
Carbazole	mg/kg										
Chrysene	mg/kg	.18		.2		.185		.195		.19	
Dibenz(a,h)anthracene	mg/kg	.18		.2		.185		.195		.19	
Dibenzofuran	mg/kg	.18		.2		.185		.195		.19	
Diethyl phthalate	mg/kg	.18		.2		.185		.195		.19	
Dimethyl phthalate	mg/kg	.18		.2		.185		.195		.19	
Fluoranthene	mg/kg	.18		.2		.185		.195		.19	
Fluorene	mg/kg	.18		.2		.185		.195		.19	
Hexachlorobenzene	mg/kg	.18		.2		.185		.195		.19	
Hexachlorobutadiene	mg/kg	.18		.2		.185		.195		.19	
Hexachlorocyclopentadiene	mg/kg	.18		.2		.185		.195		.19	
Hexachloroethane	mg/kg	.18		.2		.185		.195		.19	
Indeno(1,2,3-cd)pyrene	mg/kg	.18		.2		.915		.195		.19	
Isophorone	mg/kg	.18		.2		.185		.195		.19	
Naphthalene	mg/kg	.18		.2		.185		.195		.19	
Nitrobenzene	mg/kg	.18		.2		.185		.195		.19	
Pentachlorophenol	mg/kg	.905		.995		.915		.97		.95	
Phenanthrene	mg/kg	.18		.2		.185		.195		.19	
Phenol	mg/kg	.18		.2		.185		.195		.19	
Pyrene	mg/kg	.18		.2		.185		.195		.19	
bis(2-Chloroethoxy)methane	mg/kg	.18		.2		.185		.195		.19	
bis(2-Chloroethyl)ether	mg/kg	.18		.2		.185		.195		.19	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.19		.19		.195		.185		.2	
Benzo(a)pyrene	mg/kg	.19		.19		.195		.185		.2	
Benzo(b)fluoranthene	mg/kg	.19		.19		.195		.185		.2	
Benzo(ghi)perylene	mg/kg	.19		.19		.195		.185		.2	
Benzo(k)fluoranthene	mg/kg	.19		.19		.195		.185		.2	
Benzoic acid	mg/kg	.95		.94		.98		.915		1.005	
Benzyl alcohol	mg/kg	.38		.375		.395		.365		.405	
Butyl benzyl phthalate	mg/kg	.19		.19		.195		.185		.2	
Carbazole	mg/kg										
Chrysene	mg/kg	.19		.19		.195		.185		.2	
Dibenz(a,h)anthracene	mg/kg	.19		.19		.195		.185		.2	
Dibenzofuran	mg/kg	.19		.19		.195		.185		.2	
Diethyl phthalate	mg/kg	.19		.19		.195		.185		.2	
Dimethyl phthalate	mg/kg	.19		.19		.195		.185		.2	
Fluoranthene	mg/kg	.19		.19		.195		.185		.2	
Fluorene	mg/kg	.19		.19		.195		.185		.2	
Hexachlorobenzene	mg/kg	.19		.19		.195		.185		.2	
Hexachlorobutadiene	mg/kg	.19		.19		.195		.185		.2	
Hexachlorocyclopentadiene	mg/kg	.19		.19		.195		.185		.2	
Hexachloroethane	mg/kg	.19		.19		.195		.185		.2	
Indeno(1,2,3-cd)pyrene	mg/kg	.19		.19		.98		.185		.2	
Isophorone	mg/kg	.19		.19		.195		.185		.2	
Naphthalene	mg/kg	.19		.19		.195		.185		.2	
Nitrobenzene	mg/kg	.19		.19		.195		.185		.2	
Pentachlorophenol	mg/kg	.95		.94		.98		.915		1.005	
Phenanthrene	mg/kg	.19		.19		.195		.185		.2	
Phenol	mg/kg	.19		.19		.195		.185		.2	
Pyrene	mg/kg	.19		.19		.195		.185		.2	
bis(2-Chloroethoxy)methane	mg/kg	.19		.19		.195		.185		.2	
bis(2-Chloro her	mg/kg	.19		19		.195		.185			

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Sample Location:		WARP-DP01		WARP-DP02		WARP-DP03		WARP-DP04		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8180		8240		8270	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		16-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		8 - 10		4 - 6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Benzo(a)pyrene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Benzo(b)fluoranthene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Benzo(ghi)perylene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Benzo(k)fluoranthene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Benzoic acid	mg/kg										
Benzyl alcohol	mg/kg										
Butyl benzyl phthalate	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Carbazole	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Chrysene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Dibenz(a,h)anthracene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Dibenzofuran	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Diethyl phthalate	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Dimethyl phthalate	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Fluoranthene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Fluorene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Hexachlorobenzene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Hexachlorobutadiene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Hexachlorocyclopentadiene	mg/kg	1	U	.95	U	.95	U	1	U	1	U
Hexachloroethane	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Indeno(1,2,3-cd)pyrene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Isophorone	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Naphthalene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Nitrobenzene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Pentachlorophenol	mg/kg	1	U	.95	U	.95	U	1	U	1	U
Phenanthrene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Phenol	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
Pyrene	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
bis(2-Chloroethoxy)methane	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
bis(2-Chloroethyl)ether	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U

Sample Location:		WARP-DP06		WARP-DP07		WARP-DP08		WARP-DP09		WARP-DP10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8350		8380		8430		8460	
Sample Date:		23-JUN-98		25-JUN-98		15-JUN-98		16-JUN-98		26-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Benzo(a)pyrene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Benzo(b)fluoranthene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Benzo(ghi)perylene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Benzo(k)fluoranthene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Benzoic acid	mg/kg										
Benzyl alcohol	mg/kg										
Butyl benzyl phthalate	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Carbazole	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Chrysene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Dibenz(a,h)anthracene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Dibenzofuran	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Diethyl phthalate	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Dimethyl phthalate	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Fluoranthene	mg/kg	.185	U	.195	U	.19	U	.058	J	.19	U
Fluorene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Hexachlorobenzene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Hexachlorobutadiene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Hexachlorocyclopentadiene	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
Hexachloroethane	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Indeno(1,2,3-cd)pyrene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Isophorone	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Naphthalene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Nitrobenzene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Pentachlorophenol	mg/kg	.9	U	.95	U	.95	U	.95	U	.95	U
Phenanthrene	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Phenol	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
Pyrene	mg/kg	.185	U	.195	U	.19	U	.043	J	.19	U
bis(2-Chloroethoxy)methane	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
bis(2-Chloro[illegible]her	mg/kg	.185	U	195	U	.19	U	.195	U		U

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Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8700	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.195	U	.205	U	.4		.195	U	.2	U
Benzo(a)pyrene	mg/kg	.195	U	.205	U	.39		.195	U	.2	U
Benzo(b)fluoranthene	mg/kg	.195	U	.205	U	.3	J	.195	U	.2	U
Benzo(ghi)perylene	mg/kg	.195	U	.205	U	.22	J	.195	U	.2	U
Benzo(k)fluoranthene	mg/kg	.195	U	.205	U	.35	J	.195	U	.2	U
Benzoic acid	mg/kg										
Benzyl alcohol	mg/kg										
Butyl benzyl phthalate	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Carbazole	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Chrysene	mg/kg	.195	U	.205	U	.42		.195	U	.2	U
Dibenz(a,h)anthracene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Dibenzofuran	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Diethyl phthalate	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Dimethyl phthalate	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Fluoranthene	mg/kg	.195	U	.205	U	.76		.195	U	.2	U
Fluorene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Hexachlorobenzene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Hexachlorobutadiene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Hexachlorocyclopentadiene	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
Hexachloroethane	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Indeno(1,2,3-cd)pyrene	mg/kg	.195	U	.205	U	.23	J	.195	U	.2	U
Isophorone	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Naphthalene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Nitrobenzene	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Pentachlorophenol	mg/kg	.95	U	1	U	.9	U	.95	U	.95	U
Phenanthrene	mg/kg	.195	U	.205	U	.36	J	.195	U	.2	U
Phenol	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
Pyrene	mg/kg	.195	U	.205	U	.55		.195	U	.2	U
bis(2-Chloroethoxy)methane	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
bis(2-Chloroethyl)ether	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U

Sample Location:		WARP-DP17		WARP-DP18		WARP-DP19		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8750		8780		8820		8870	
Sample Date:		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		4 - 6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.2	U	.185	U	.185	U	.17	J
Benzo(a)pyrene	mg/kg	.2	U	.185	U	.185	U	.14	J
Benzo(b)fluoranthene	mg/kg	.2	U	.185	U	.185	U	.14	J
Benzo(ghi)perylene	mg/kg	.2	U	.185	U	.185	U	.076	J
Benzo(k)fluoranthene	mg/kg	.2	U	.185	U	.185	U	.11	J
Benzoic acid	mg/kg								
Benzyl alcohol	mg/kg								
Butyl benzyl phthalate	mg/kg	.2	U	.185	U	.185	U	.19	U
Carbazole	mg/kg	.2	U	.185	U	.185	U	.19	U
Chrysene	mg/kg	.2	U	.185	U	.185	U	.17	J
Dibenz(a,h)anthracene	mg/kg	.2	U	.185	U	.185	U	.19	U
Dibenzofuran	mg/kg	.2	U	.185	U	.185	U	.19	U
Diethyl phthalate	mg/kg	.2	U	.185	U	.185	U	.19	U
Dimethyl phthalate	mg/kg	.2	U	.185	U	.185	U	.19	U
Fluoranthene	mg/kg	.2	U	.185	U	.185	U	.38	
Fluorene	mg/kg	.2	U	.185	U	.185	U	.19	U
Hexachlorobenzene	mg/kg	.2	U	.185	U	.185	U	.19	U
Hexachlorobutadiene	mg/kg	.2	U	.185	U	.185	U	.19	U
Hexachlorocyclopentadiene	mg/kg	.95	U	.9	U	.9	U	.9	U
Hexachloroethane	mg/kg	.2	U	.185	U	.185	U	.19	U
Indeno(1,2,3-cd)pyrene	mg/kg	.2	U	.185	U	.185	U	.076	J
Isophorone	mg/kg	.2	U	.185	U	.185	U	.19	U
Naphthalene	mg/kg	.2	U	.185	U	.185	U	.19	U
Nitrobenzene	mg/kg	.2	U	.185	U	.185	U	.19	U
Pentachlorophenol	mg/kg	.95	U	.9	U	.9	U	.9	U
Phenanthrene	mg/kg	.2	U	.185	U	.185	U	.25	J
Phenol	mg/kg	.2	U	.185	U	.185	U	.19	U
Pyrene	mg/kg	.2	U	.185	U	.185	U	.28	J
bis(2-Chloroethoxy)methane	mg/kg	.2	U	.185	U	.185	U	.19	U
bis(2-Chloroe her	mg/kg	.2	U	185	U	.185	U	.19	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.18		.19		.185		.19		.18	
bis(2-Ethylhexyl)phthalate	mg/kg	.18		.41		.185		.19		.18	
di-n-Butyl phthalate	mg/kg	.18		.19		.185		.19		.18	
di-n-Octyl phthalate	mg/kg	.18		.19		.185		.19		.18	
n-Nitroso-di-n-propylamine	mg/kg	.18		.19		.185		.19		.18	
n-Nitrosodiphenylamine	mg/kg										

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Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.18		.2		.185		.195		.19	
bis(2-Ethylhexyl)phthalate	mg/kg	.18		1.07		.98		.195		.19	
di-n-Butyl phthalate	mg/kg	.18		.2		.185		.195		.19	
di-n-Octyl phthalate	mg/kg	.18		.2		.185		.195		.19	
n-Nitroso-di-n-propylamine	mg/kg	.18		.2		.185		.195		.19	
n-Nitrosodiphenylamine	mg/kg										

Report Date: 09/19/00

Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.19		.19		.195		.185		.2	
bis(2-Ethylhexyl)phthalate	mg/kg	.19		.19		.195		.185		.2	
di-n-Butyl phthalate	mg/kg	.19		.19		.195		.185		.2	
di-n-Octyl phthalate	mg/kg	.19		.19		.195		.185		.2	
n-Nitroso-di-n-propylamine	mg/kg	.19		.19		.195		.185		.2	
n-Nitrosodiphenylamine	mg/kg										

Report Date: 09/19/00

Sample Location:		WARP-DP01		WARP-DP02		WARP-DP03		WARP-DP04		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8180		8240		8270	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		16-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		8 - 10		4 - 6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
bis(2-Ethylhexyl)phthalate	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
di-n-Butyl phthalate	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
di-n-Octyl phthalate	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
n-Nitroso-di-n-propylamine	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U
n-Nitrosodiphenylamine	mg/kg	.205	U	.2	U	.195	U	.21	U	.2	U

Sample Location:		WARP-DP06		WARP-DP07		WARP-DP08		WARP-DP09		WARP-DP10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8350		8380		8430		8460	
Sample Date:		23-JUN-98		25-JUN-98		15-JUN-98		16-JUN-98		26-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
bis(2-Ethylhexyl)phthalate	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
di-n-Butyl phthalate	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
di-n-Octyl phthalate	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
n-Nitroso-di-n-propylamine	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U
n-Nitrosodiphenylamine	mg/kg	.185	U	.195	U	.19	U	.195	U	.19	U

Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8700	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
bis(2-Ethylhexyl)phthalate	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
di-n-Butyl phthalate	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
di-n-Octyl phthalate	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
n-Nitroso-di-n-propylamine	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U
n-Nitrosodiphenylamine	mg/kg	.195	U	.205	U	.19	U	.195	U	.2	U

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Sample Location:		WARP-DP17		WARP-DP18		WARP-DP19		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8750		8780		8820		8870	
Sample Date:		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		4 - 6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether	mg/kg	.2	U	.185	U	.185	U	.19	U
bis(2-Ethylhexyl)phthalate	mg/kg	.2	U	.185	U	.185	U	.19	U
di-n-Butyl phthalate	mg/kg	.2	U	.185	U	.185	U	.19	U
di-n-Octyl phthalate	mg/kg	.2	U	.185	U	.185	U	.19	U
n-Nitroso-di-n-propylamine	mg/kg	.2	U	.185	U	.185	U	.19	U
n-Nitrosodiphenylamine	mg/kg	.2	U	.185	U	.185	U	.19	U

Sample Location:		WARP-DP01		WARP-DP02		WARP-DP03		WARP-DP04		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8180		8240		8270	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		16-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		8 - 10		4 - 6	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U
Aroclor 1221	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U
Aroclor 1232	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U
Aroclor 1242	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U
Aroclor 1248	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U
Aroclor 1254	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U
Aroclor 1260	mg/kg	.0205	U	.02	U	.0195	U	.021	U	.02	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP06		WARP-DP07		WARP-DP08		WARP-DP09		WARP-DP10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8350		8380		8430		8460	
Sample Date:		23-JUN-98		25-JUN-98		15-JUN-98		16-JUN-98		26-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U
Aroclor 1221	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U
Aroclor 1232	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U
Aroclor 1242	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U
Aroclor 1248	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U
Aroclor 1254	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U
Aroclor 1260	mg/kg	.0185	U	.0195	U	.019	U	.0195	U	.019	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8700	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		0 - 2	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U
Aroclor 1221	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U
Aroclor 1232	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U
Aroclor 1242	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U
Aroclor 1248	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U
Aroclor 1254	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U
Aroclor 1260	mg/kg	.0195	U	.0205	U	.019	U	.0195	U	.02	U

Report Date: 09/19/00

Sample Location:		WARP-DP17		WARP-DP18		WARP-DP19		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8750		8780		8820		8870	
Sample Date:		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		0 - 2		0 - 2		4 - 6	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.02	U	.0185	U	.0185	U	.019	U
Aroclor 1221	mg/kg	.02	U	.0185	U	.0185	U	.019	U
Aroclor 1232	mg/kg	.02	U	.0185	U	.0185	U	.019	U
Aroclor 1242	mg/kg	.02	U	.0185	U	.0185	U	.019	U
Aroclor 1248	mg/kg	.02	U	.0185	U	.0185	U	.019	U
Aroclor 1254	mg/kg	.02	U	.0185	U	.0185	U	.019	U
Aroclor 1260	mg/kg	.02	U	.0185	U	.0185	U	.019	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.7		2.85		6.3		2.9		2.7	
Arsenic	mg/kg	6.8		10		8.4		12		3.5	
Barium	mg/kg										
Beryllium	mg/kg	.55		.55		.55		.6		.55	
Cadmium	mg/kg	.55		.55		.55		.6		.55	
Calcium	mg/kg										
Chromium	mg/kg	11		14		17		17		6.2	
Cobalt	mg/kg										
Copper	mg/kg	3.6		5.2		2.3		4		1.1	
Iron	mg/kg										
Lead	mg/kg	8.5		9.5		11		9.9		5.3	
Magnesium	mg/kg										
Manganese	mg/kg	270		400		340		314		152	
Mercury	mg/kg	.135		.14		.14		.145		.135	
Nickel	mg/kg	13		16		16		17		9	
Potassium	mg/kg										
Selenium	mg/kg	2.15		2.25		2.2		2.35		2.15	
Silver	mg/kg	.55		.55		.55		.6		.55	
Sodium	mg/kg										
Thallium	mg/kg	2.7		2.85		2.8		2.9		2.7	
Vanadium	mg/kg										
Zinc	mg/kg	41		39		51		45		43	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.75		7.6		6.7		5.9		6.4	
Arsenic	mg/kg	15		17		17		6.1		23	
Barium	mg/kg										
Beryllium	mg/kg	.55		.6	UJ	.55	UJ	.6	UJ	.55	
Cadmium	mg/kg	.55		.6		.55		.6		.55	
Calcium	mg/kg										
Chromium	mg/kg	13		13		17		29		6	
Cobalt	mg/kg										
Copper	mg/kg	35		34		10		6.7		14	
Iron	mg/kg										
Lead	mg/kg	24		27		11		13		15	
Magnesium	mg/kg										
Manganese	mg/kg	154		24		220		330		78	
Mercury	mg/kg	.135		.15		.14		.145		.145	
Nickel	mg/kg	33		11		28		33		15	
Potassium	mg/kg										
Selenium	mg/kg	2.2		2.4		2.2		2.35		2.3	
Silver	mg/kg	.55		.6		.55		.6		.55	
Sodium	mg/kg										
Thallium	mg/kg	2.75		3		2.8		2.95		2.85	
Vanadium	mg/kg										
Zinc	mg/kg	187		13		54		64		56	

Report Date: 09/19/00

Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.85		7.5		6.4		2.8		3.05	
Arsenic	mg/kg	8.3		14		19		1.65		1.85	
Barium	mg/kg										
Beryllium	mg/kg	.55		.55		.6	UJ	.55		.6	
Cadmium	mg/kg	.55		.55		.6		.55		.6	
Calcium	mg/kg										
Chromium	mg/kg	9.1		14		10		9.2		15	
Cobalt	mg/kg										
Copper	mg/kg	7.5		34		27		1.1		17	
Iron	mg/kg										
Lead	mg/kg	11		22		23		6.6		15	
Magnesium	mg/kg										
Manganese	mg/kg	21		63		8.7		133		695	
Mercury	mg/kg	.145		.14		.15		.14		.15	
Nickel	mg/kg	20		24		9.4		7.6		30	
Potassium	mg/kg										
Selenium	mg/kg	2.3		2.25		2.4		2.2		2.45	
Silver	mg/kg	.55		.55		.6		.55		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.85		2.85		3		2.8		3.05	
Vanadium	mg/kg										
Zinc	mg/kg	34		32		10		24		61	

Plum Brook Ordnance Works
West Area Red Water Ponds
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Report Date: 09/19/00

Sample Location:		PB-PR-S1		PB-PR-S1		PB-PR-S10		PB-PR-S10		PB-PR-S10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S1-0.0-2.0		PB-PR-S1-2.0-5.0		PB-PR-S10-0.0-3.0		PB-PR-S10-3.0-5.0		PB-PR-S10-5.0-10.0	
Sample Date:		31-OCT-94		31-OCT-94		29-OCT-94		29-OCT-94		29-OCT-94	
Depth:		0 - 2		2 - 5		0 - 3		3 - 5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.65		2.85		2.95		3		3.15	
Arsenic	mg/kg	1.6		4.1		22		9.6		12	
Barium	mg/kg										
Beryllium	mg/kg	.55		.55		.6		.6		.65	
Cadmium	mg/kg	.55		.55		.6		.6		.65	
Calcium	mg/kg										
Chromium	mg/kg	8.7		11		15		17		18	
Cobalt	mg/kg										
Copper	mg/kg	1.05		3.3		1.2		14		9.4	
Iron	mg/kg										
Lead	mg/kg	5.9		8.4		12		18		11	
Magnesium	mg/kg										
Manganese	mg/kg	150		260		820		1040		490	
Mercury	mg/kg	.135		.14		.145		.15		.16	
Nickel	mg/kg	6.7		10		15		35		25	
Potassium	mg/kg										
Selenium	mg/kg	2.15		2.25		2.35		2.4		2.55	
Silver	mg/kg	.55		.55		.6		.6		.65	
Sodium	mg/kg										
Thallium	mg/kg	2.65		2.85		2.95		3		3.15	
Vanadium	mg/kg										
Zinc	mg/kg	23		31		38		65		56	

Plum Brook Ordnance Works
West Area Red Water Ponds
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Report Date: 09/19/00

Sample Location:		PB-PR-S11		PB-PR-S11		PB-PR-S11		PB-PR-S12		PB-PR-S12	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S11-0.0-3.0		PB-PR-S11-3.0-5.0		PB-PR-S11-5.0-10.0		PB-PR-S12-0.0-3.0		PB-PR-S12-3.0-5.0	
Sample Date:		29-OCT-94		29-OCT-94		29-OCT-94		30-OCT-94		30-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 3		3 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.75		7.3		3.1		3		3.05	
Arsenic	mg/kg	1.65		8		1.85		6.7		11	
Barium	mg/kg										
Beryllium	mg/kg	.55		.6		.6		.6		.6	
Cadmium	mg/kg	.55		.6		.6		.6		.6	
Calcium	mg/kg										
Chromium	mg/kg	11		15		15		8.7		16	
Cobalt	mg/kg										
Copper	mg/kg	1.1		13		16		12		12	
Iron	mg/kg										
Lead	mg/kg	5.9		8.9		11		18		8.9	
Magnesium	mg/kg										
Manganese	mg/kg	150		800		720		810		520	
Mercury	mg/kg	.135		.15		.155		.15		.15	
Nickel	mg/kg	6.4		24		30		8.3		23	
Potassium	mg/kg										
Selenium	mg/kg	2.2		2.45		2.45		2.4		2.45	
Silver	mg/kg	.55		.6		.6		.6		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.75		3.05		3.1		3		3.05	
Vanadium	mg/kg										
Zinc	mg/kg	24		52		58		28		49	

Plum Brook Ordnance Works
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Report Date: 09/19/00

Sample Location:		PB-PR-S12		PB-PR-S13		PB-PR-S13		PB-PR-S13		PB-PR-S13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S12-5.0-10.0		PB-PR-S13-0.0-3.0		PB-PR-S13-3.0-10.0		PB-PR-S13-3.0-5.0		PB-PR-S13-5.0-10.0	
Sample Date:		30-OCT-94		31-OCT-94		31-OCT-94		31-OCT-94		31-OCT-94	
Depth:		5 - 10		0 - 3		3 - 10		3 - 5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3		2.85				2.8		3.1	
Arsenic	mg/kg	9.3		4.4				3.6		15	
Barium	mg/kg										
Beryllium	mg/kg	.6		.55				.55		.6	
Cadmium	mg/kg	.6		.55				.55		.6	
Calcium	mg/kg										
Chromium	mg/kg	14		13				17		17	
Cobalt	mg/kg										
Copper	mg/kg	14		3.8				11		12	
Iron	mg/kg										
Lead	mg/kg	9.2		9.8				13		15	
Magnesium	mg/kg										
Manganese	mg/kg	410		330				530		580	
Mercury	mg/kg	.15		.14				.14		.155	
Nickel	mg/kg	20		9.7				20		22	
Potassium	mg/kg					1500					
Selenium	mg/kg	2.4		2.25				2.25		2.45	
Silver	mg/kg	.6		.55				.55		.6	
Sodium	mg/kg										
Thallium	mg/kg	3		2.85				2.8		3.1	
Vanadium	mg/kg										
Zinc	mg/kg	47		33				53		58	

Plum Brook Ordnance Works
West Area Red Water Ponds
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Report Date: 09/19/00

Sample Location:		PB-PR-S13		PB-PR-S14		PB-PR-S14		PB-PR-S14		PB-PR-S14	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S13-0.0-0.5		PB-PR-S14-0.0-3.0		PB-PR-S14-3.0-5.0		PB-PR-S14-5.0-10.0		PB-PR-S14-0.0-0.5	
Sample Date:		11-DEC-94		07-NOV-94		07-NOV-94		07-NOV-94		11-DEC-94	
Depth:		0 - 0.5		0 - 3		3 - 5		5 - 10		0 - 0.5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.15		2.65		2.8		3.1		3	
Arsenic	mg/kg	10		3.4		6.6		4.3		1.8	
Barium	mg/kg										
Beryllium	mg/kg	.65		.55		.55		.6		.6	
Cadmium	mg/kg	.65		.55		.55		.6		.6	
Calcium	mg/kg										
Chromium	mg/kg	21		8.2		11		15		9.3	
Cobalt	mg/kg										
Copper	mg/kg	5.9		1.05		1.1		7		1.2	
Iron	mg/kg										
Lead	mg/kg	19		7.1		16		11		6.9	
Magnesium	mg/kg										
Manganese	mg/kg	390		170		225		260		190	
Mercury	mg/kg	.155		.13		.14		.155		.15	
Nickel	mg/kg	20		6.6		9.4		21		6.7	
Potassium	mg/kg										
Selenium	mg/kg	2.5		2.1		2.25		2.45		2.4	
Silver	mg/kg	.65		.55		.55		.6		.6	
Sodium	mg/kg										
Thallium	mg/kg	3.15		2.65		2.8		3.1		3	
Vanadium	mg/kg										
Zinc	mg/kg	64		33		47		85		24	

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West Area Red Water Ponds
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Report Date: 09/19/00

Sample Location:		PB-PR-S15		PB-PR-S15		PB-PR-S15		PB-PR-S16		PB-PR-S16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S15-0.0-3.0		PB-PR-S15-3.0-5.0		PB-PR-S15-5.0-10.0		PB-PR-S16-0.0-3.0		PB-PR-S16-3.0-5.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 3		3 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.75		2.75		3.1		2.7		5.6	
Arsenic	mg/kg	4.6		6.3		11		1.65		19	
Barium	mg/kg										
Beryllium	mg/kg	.55		.55		.6		.55		.55	
Cadmium	mg/kg	.55		.55		.6		.55		.55	
Calcium	mg/kg										
Chromium	mg/kg	9.9		12		21		10		16	
Cobalt	mg/kg										
Copper	mg/kg	4.1		3		3.2		1.1		1.1	
Iron	mg/kg										
Lead	mg/kg	7.8		6.9		11		4.6		8	
Magnesium	mg/kg										
Manganese	mg/kg	320		340		780		250		210	
Mercury	mg/kg	.135		.135		.155		.135		.14	
Nickel	mg/kg	9.3		11		20		7.2		9.6	
Potassium	mg/kg										
Selenium	mg/kg	2.2		2.2		2.45		2.15		2.25	
Silver	mg/kg	.55		.55		.6		.55		.55	
Sodium	mg/kg										
Thallium	mg/kg	2.75		2.75		3.1		2.7		2.8	
Vanadium	mg/kg										
Zinc	mg/kg	29		33		59		22		28	

Plum Brook Ordnance Works
West Area Red Water Ponds
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Report Date: 09/19/00

Sample Location:		PB-PR-S16		PB-PR-S17		PB-PR-S17		PB-PR-S17		PB-PR-S18	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S16-5.0-10.0		PB-PR-S17-0.0-2.0		PB-PR-S17-2.0-5.0		PB-PR-S17-0.0-0.5		PB-PR-S18-0.0-2.0	
Sample Date:		30-OCT-94		31-OCT-94		31-OCT-94		15-DEC-94		30-OCT-94	
Depth:		5 - 10		0 - 2		2 - 5		0 - 0.5		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.05		2.75		6.1		3.1		2.8	
Arsenic	mg/kg	9.5		3.3		7.1		5.8		3.6	
Barium	mg/kg										
Beryllium	mg/kg	.6		.55		.55		.6		.55	
Cadmium	mg/kg	.6		.55		.55		.6		.55	
Calcium	mg/kg										
Chromium	mg/kg	17		11		18		12		9.1	
Cobalt	mg/kg										
Copper	mg/kg	9.8		1.1		11		1.25		2.7	
Iron	mg/kg										
Lead	mg/kg	13		7		11		9		9	
Magnesium	mg/kg										
Manganese	mg/kg	480		165		1500		185		160	
Mercury	mg/kg	.15		.135		.145		.155		.14	
Nickel	mg/kg	23		7.8		28		9.1		8.6	
Potassium	mg/kg										
Selenium	mg/kg	2.45		2.2		2.3		2.45		2.2	
Silver	mg/kg	.6		.55		.55		.6		.55	
Sodium	mg/kg										
Thallium	mg/kg	3.05		2.75		2.85		3.1		2.8	
Vanadium	mg/kg										
Zinc	mg/kg	60		26		51		28		28	

Plum Brook Ordnance Works
West Area Red Water Ponds
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Report Date: 09/19/00

Sample Location:		PB-PR-S18		PB-PR-S19		PB-PR-S19		PB-PR-S19		PB-PR-S19	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S18-2.0-5.0		PB-PR-S19-0.0-3.0		PB-PR-S19-3.0-5.0		PB-PR-S19-5.0-10.0		PB-PR-S19-0.0-0.5	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		11-DEC-94	
Depth:		2 - 5		0 - 3		3 - 5		5 - 10		0 - 0.5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3		2.7		6		6.8		3.15	
Arsenic	mg/kg	6.4		4.6		14		7.9		6.1	
Barium	mg/kg										
Beryllium	mg/kg	.6		.55		.6		.6		.65	
Cadmium	mg/kg	.6		.55		.6		.6		.65	
Calcium	mg/kg										
Chromium	mg/kg	14		11		13		15		10	
Cobalt	mg/kg										
Copper	mg/kg	8.6		1.1		7.5		8.8		1.25	
Iron	mg/kg										
Lead	mg/kg	12		7.5		11		12		8	
Magnesium	mg/kg										
Manganese	mg/kg	390		370		380		570		300	
Mercury	mg/kg	.15		.135		.15		.15		.155	
Nickel	mg/kg	17		9.9		18		24		7.1	
Potassium	mg/kg										
Selenium	mg/kg	2.4		2.15		2.4		2.45		2.5	
Silver	mg/kg	.6		.55		.6		.6		.65	
Sodium	mg/kg										
Thallium	mg/kg	3		2.7		3		3.05		3.15	
Vanadium	mg/kg										
Zinc	mg/kg	43		37		43		48		24	

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Sample Location:		PB-PR-S2		PB-PR-S2		PB-PR-S2		PB-PR-S20		PB-PR-S20	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S2-0.0-3.0		PB-PR-S2-3.0-5.0		PB-PR-S2-5.0-10.0		PB-PR-S20-0.0-2.0		PB-PR-S20-2.0-5.0	
Sample Date:		28-OCT-94		28-OCT-94		28-OCT-94		30-OCT-94		30-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 2		2 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.8		6.8		3.1		2.75		5.7	
Arsenic	mg/kg	1.7		6.5		6		3.8		1.7	
Barium	mg/kg										
Beryllium	mg/kg	.55		.55		.6		.55		.55	
Cadmium	mg/kg	.55		.55		.6		.55		.55	
Calcium	mg/kg										
Chromium	mg/kg	11		14		19		11		16	
Cobalt	mg/kg										
Copper	mg/kg	2.5		7.4		8.4		4.4		1.15	
Iron	mg/kg										
Lead	mg/kg	6.9		8.5		9.5		12		10	
Magnesium	mg/kg										
Manganese	mg/kg	110		280		400		340		140	
Mercury	mg/kg	.14		.14		.155		.135		.145	
Nickel	mg/kg	6.7		13		19		13		14	
Potassium	mg/kg										
Selenium	mg/kg	2.25		2.25		2.45		2.2		2.3	
Silver	mg/kg	.55		.55		.6		.55		.55	
Sodium	mg/kg										
Thallium	mg/kg	2.8		2.85		3.1		2.75		2.85	
Vanadium	mg/kg										
Zinc	mg/kg	22		36		49		35		38	

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Sample Location:		PB-PR-S21		PB-PR-S22		PB-PR-S23		PB-PR-S24		PB-PR-S25	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S21-0.0-0.5		PB-PR-S22-0.0-0.5		PB-PR-S23-0.0-0.5		PB-PR-S24-0.0-0.5		PB-PR-S25-5.0-10.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		29-OCT-94	
Depth:		0 - 0.5		0 - 0.5		0 - 0.5		0 - 0.5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.7		2.8		2.85		2.8		3.05	
Arsenic	mg/kg	1.6		1.65		1.7		1.65		9.8	
Barium	mg/kg										
Beryllium	mg/kg	.55		.55		.55		.55		.6	
Cadmium	mg/kg	.55		.55		.55		.55		.6	
Calcium	mg/kg										
Chromium	mg/kg	10		7		7.1		5.6		15	
Cobalt	mg/kg										
Copper	mg/kg	1.1		1.1		1.15		1.1		13	
Iron	mg/kg										
Lead	mg/kg	9.8		7.2		8.7		14		13	
Magnesium	mg/kg										
Manganese	mg/kg	460		130		180		180		1100	
Mercury	mg/kg	.135		.14		.145		.14		.15	
Nickel	mg/kg	8.8		8.4		6		4.7		40	
Potassium	mg/kg										
Selenium	mg/kg	2.15		2.2		2.3		2.2		2.45	
Silver	mg/kg	.55		.55		.55		.55		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.7		2.8		2.85		2.8		3.05	
Vanadium	mg/kg										
Zinc	mg/kg	20		19		26		17		52	

Sample Location:		PB-PR-S26		PB-PR-S27		PB-PR-S28		PB-PR-S29		PB-PR-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S26-5.0-10.0		PB-PR-S27-5.0-10.0		PB-PR-S28-5.0-10.0		PB-PR-S29-2.0-5.0		PB-PR-S3-0.0-2.0	
Sample Date:		29-OCT-94		30-OCT-94		07-NOV-94		31-OCT-94		30-OCT-94	
Depth:		5 - 10		5 - 10		5 - 10		2 - 5		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	6.7		3.1		3		2.95		2.65	
Arsenic	mg/kg	13		12		5.6		6.2		1.6	
Barium	mg/kg										
Beryllium	mg/kg	.6		.6		.6		.6		.55	
Cadmium	mg/kg	.6		.6		.6		.6		.55	
Calcium	mg/kg										
Chromium	mg/kg	19		16		20		13		9	
Cobalt	mg/kg										
Copper	mg/kg	7.7		11		3.6		13		1.05	
Iron	mg/kg										
Lead	mg/kg	10		12		9.5		10		6.4	
Magnesium	mg/kg										
Manganese	mg/kg	420		530		570		380		88	
Mercury	mg/kg	.15		.155		.15		.145		.135	
Nickel	mg/kg	29		26		20		15		5.5	
Potassium	mg/kg										
Selenium	mg/kg	2.4		2.45		2.4		2.35		2.15	
Silver	mg/kg	.6		.6		.6		.6		.55	
Sodium	mg/kg										
Thallium	mg/kg	3		3.1		3		2.95		2.65	
Vanadium	mg/kg										
Zinc	mg/kg	62		59		54		44		23	

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Sample Location:		PB-PR-S3		PB-PR-S30		PB-PR-S4		PB-PR-S4		PB-PR-S4	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S3-2.0-5.0		PB-PR-S30-0.0-0.5		PB-PR-S4-0.0-3.0		PB-PR-S4-3.0-5.0		PB-PR-S4-5.0-10.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94	
Depth:		2 - 5		0 - 0.5		0 - 3		3 - 5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3		2.65		2.9		3.1		3.1	
Arsenic	mg/kg	3.9		1.6		1.75		8		1.85	
Barium	mg/kg										
Beryllium	mg/kg	.6		.55		.6		.6		.6	
Cadmium	mg/kg	.6		.55		.6		.6		.6	
Calcium	mg/kg										
Chromium	mg/kg	11		8.3		9.5		15		20	
Cobalt	mg/kg										
Copper	mg/kg	6.2		1.05		4.3		6.9		6.3	
Iron	mg/kg										
Lead	mg/kg	9		8.5		12		7.3		11	
Magnesium	mg/kg										
Manganese	mg/kg	310		150		210		560		470	
Mercury	mg/kg	.15		.135		.145		.155		.155	
Nickel	mg/kg	13		5.9		9.3		16		20	
Potassium	mg/kg										
Selenium	mg/kg	2.4		2.15		2.35		2.45		2.45	
Silver	mg/kg	.6		.55		.6		.6		.6	
Sodium	mg/kg										
Thallium	mg/kg	3		2.65		2.9		3.1		3.1	
Vanadium	mg/kg										
Zinc	mg/kg	38		24		34		46		51	

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Sample Location:		PB-PR-S5		PB-PR-S5		PB-PR-S5		PB-PR-S6		PB-PR-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S5-0.0-3.0		PB-PR-S5-3.0-5.0		PB-PR-S5-5.0-10.0		PB-PR-S6-0.0-3.0		PB-PR-S6-3.0-5.0	
Sample Date:		28-OCT-94		28-OCT-94		28-OCT-94		29-OCT-94		29-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 3		3 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.8		3.1		3.1		2.8		3.05	
Arsenic	mg/kg	15		9.3		4.8		3.9		6.3	
Barium	mg/kg										
Beryllium	mg/kg	.55		.6		.6		.55		.6	
Cadmium	mg/kg	.55		.6		.6		.55		.6	
Calcium	mg/kg										
Chromium	mg/kg	9.8		21		27		13		16	
Cobalt	mg/kg										
Copper	mg/kg	3.5		6.8		3.2		1.1		1.2	
Iron	mg/kg										
Lead	mg/kg	7.2		12		11		12		9.5	
Magnesium	mg/kg										
Manganese	mg/kg	200		270		490		150		280	
Mercury	mg/kg	.14		.155		.155		.14		.15	
Nickel	mg/kg	8.8		19		27		8.9		12	
Potassium	mg/kg										
Selenium	mg/kg	2.25		2.45		2.45		2.25		2.45	
Silver	mg/kg	.55		.6		.6		.55		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.8		3.1		3.1		2.8		3.05	
Vanadium	mg/kg										
Zinc	mg/kg	28		62		62		35		41	

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Sample Location:		PB-PR-S6		PB-PR-S7		PB-PR-S7		PB-PR-S7		PB-PR-S8	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S6-5.0-10.0		PB-PR-S7-0.0-3.0		PB-PR-S7-3.0-5.0		PB-PR-S7-5.0-10.0		PB-PR-S8-0.0-2.0	
Sample Date:		29-OCT-94		28-OCT-94		28-OCT-94		28-OCT-94		31-OCT-94	
Depth:		5 - 10		0 - 3		3 - 5		5 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.05		2.85		3.1		3.1		2.6	UJ
Arsenic	mg/kg	9.4		3.7		14		8.3		1.55	
Barium	mg/kg										
Beryllium	mg/kg	.6		.55		.6		.6		.5	
Cadmium	mg/kg	.6		.55		.6		.6		.5	
Calcium	mg/kg										
Chromium	mg/kg	15		11		15		19		8	
Cobalt	mg/kg										
Copper	mg/kg	7.9		1.15		7.8		4.2		1.05	
Iron	mg/kg										
Lead	mg/kg	12		6.4		11		10		3.9	
Magnesium	mg/kg										
Manganese	mg/kg	490		230		650		500		86	
Mercury	mg/kg	.15		.145		.155		.155		.13	
Nickel	mg/kg	16		8.6		20		20		5.4	
Potassium	mg/kg										
Selenium	mg/kg	2.45		2.3		2.45		2.45		2.05	
Silver	mg/kg	.6		.55		.6		.6		.5	UJ
Sodium	mg/kg										
Thallium	mg/kg	3.05		2.85		3.1		3.1		2.6	
Vanadium	mg/kg										
Zinc	mg/kg	45		25		48		54		33	

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Sample Location:		PB-PR-S8		PB-PR-S8		PB-PR-S9		PB-PR-S9		PB-PR-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S8-2.0-5.0		PB-PR-S8-0.0-0.5		PR-PR-S9-0.0-3.0		PB-PR-S9-3.0-5.0		PB-PR-S9-5.0-10.0	
Sample Date:		31-OCT-94		15-DEC-94		29-OCT-94		29-OCT-94		29-OCT-94	
Depth:		2 - 5		0 - 0.5		0 - 3		3 - 5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.6		2.9		2.8		3.1		6.7	
Arsenic	mg/kg	1.55		1.75		4.6		6		11	
Barium	mg/kg										
Beryllium	mg/kg	.5		.6		.55		.6		.6	
Cadmium	mg/kg	.5		.6		.55		.6		.6	
Calcium	mg/kg										
Chromium	mg/kg	8		7.9		10		16		15	
Cobalt	mg/kg										
Copper	mg/kg	1.05		1.15		1.1		6.5		7.3	
Iron	mg/kg										
Lead	mg/kg	3.9		8.6		7.8		11		10	
Magnesium	mg/kg										
Manganese	mg/kg	230		90		130		320		415	
Mercury	mg/kg	.13		.145		.14		.155		.15	
Nickel	mg/kg	6.4		6		7.3		17		18	
Potassium	mg/kg										
Selenium	mg/kg	2.1		2.35		2.2		2.45		2.45	
Silver	mg/kg	.5		.6		.55		.6		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.6		2.9		2.8		3.1		3.05	
Vanadium	mg/kg										
Zinc	mg/kg	23		31		28		47		48	

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Sample Location:		PB-WA-S1		PB-WA-S10		PB-WA-S10		PB-WA-S11		PB-WA-S11	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S1-0.0-0.5		PB-WA-S10-3.0-5.0		PB-WA-S10-5.0-10.0		PB-WA-S11-0.0-2.0		PB-WA-S11-2.0-5.0	
Sample Date:		27-OCT-94		27-OCT-94		27-OCT-94		25-OCT-94		25-OCT-94	
Depth:		0 - 0.5		3 - 5		5 - 10		0 - 2		2 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.05		3.25		3.15		2.85		2.8	
Arsenic	mg/kg	6		5.8		14		5.1		4.3	
Barium	mg/kg										
Beryllium	mg/kg	.6		.65		.65		.55		.55	
Cadmium	mg/kg	.6		.65		.65		.55		.55	
Calcium	mg/kg										
Chromium	mg/kg	23		26		25		16		10.6	
Cobalt	mg/kg										
Copper	mg/kg	1.2		3.4		1.25		6.8		6.4	
Iron	mg/kg										
Lead	mg/kg	16		10		10.9		18		13	
Magnesium	mg/kg										
Manganese	mg/kg	366		455		392		466		267	
Mercury	mg/kg	.15		.16		.16		.14		.14	
Nickel	mg/kg	23		23		25		27		19	
Potassium	mg/kg										
Selenium	mg/kg	2.45		2.6		2.55		2.25		2.2	
Silver	mg/kg	.6		.65		.65		.55		.55	
Sodium	mg/kg										
Thallium	mg/kg	3.05		3.25		3.15		2.85		2.8	
Vanadium	mg/kg										
Zinc	mg/kg	73		60		68		76		51	

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Sample Location:		PB-WA-S12		PB-WA-S12		PB-WA-S13		PB-WA-S13		PB-WA-S13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S12-0.0-2.0		PB-WA-S12-2.0-5.0		PB-WA-S13-0.0-3.0		PB-WA-S13-3.0-5.0		PB-WA-S13-5.0-10.0	
Sample Date:		25-OCT-94		25-OCT-94		18-OCT-94		18-OCT-94		18-OCT-94	
Depth:		0 - 2		2 - 5		0 - 3		3 - 5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.85		3		2.85		3.05		3	
Arsenic	mg/kg	4.8		7.2		1.7		1.85		1.8	
Barium	mg/kg										
Beryllium	mg/kg	.55		.6		.55		.6		.6	
Cadmium	mg/kg	.55		.6		.55		.6		.6	
Calcium	mg/kg										
Chromium	mg/kg	15		29		16		11		23	
Cobalt	mg/kg										
Copper	mg/kg	1.15		3.5		7.4		8.8		12	
Iron	mg/kg										
Lead	mg/kg	10.6		16		15		11.1		18	
Magnesium	mg/kg										
Manganese	mg/kg	216		373		184		220		434	
Mercury	mg/kg	.14		.15		.145		.15		.15	
Nickel	mg/kg	16		29		20		22		35	
Potassium	mg/kg										
Selenium	mg/kg	2.25		2.4		2.3		2.45		2.4	
Silver	mg/kg	.55		.6		.55		.6		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.85		3		2.85		3.05		3	
Vanadium	mg/kg										
Zinc	mg/kg	41		58		55		54		59	

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Sample Location:		PB-WA-S13		PB-WA-S14		PB-WA-S14		PB-WA-S15		PB-WA-S15	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S13-0.0-0.5		PB-WA-S14-0.0-2.0		PB-WA-S14-2.0-5.0		PB-WA-S15-0.0-2.0		PB-WA-S15-2.0-5.0	
Sample Date:		13-DEC-94		25-OCT-94		25-OCT-94		24-OCT-94		24-OCT-94	
Depth:		0 - 0.5		0 - 2		2 - 5		0 - 2		2 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.1		2.7		2.75		2.8		2.7	
Arsenic	mg/kg	6.4		5.6		5.5		6.1		4.8	
Barium	mg/kg										
Beryllium	mg/kg	.6		.55		.55		.55		.55	
Cadmium	mg/kg	.6		.55		.55		.55		.55	
Calcium	mg/kg										
Chromium	mg/kg	14		9.2		9.9		16		13	
Cobalt	mg/kg										
Copper	mg/kg	3.2		5.1		7.4		7.1		7.1	
Iron	mg/kg										
Lead	mg/kg	17		10.3		8.4		17		12	
Magnesium	mg/kg										
Manganese	mg/kg	200		398		198		433		413	
Mercury	mg/kg	.155		.135		.135		.14		.135	
Nickel	mg/kg	17		17		19		21		23	
Potassium	mg/kg										
Selenium	mg/kg	2.45		2.15		2.2		2.2		2.15	
Silver	mg/kg	.6		.55		.55		.55		.55	
Sodium	mg/kg										
Thallium	mg/kg	3.1		2.7		2.75		2.8		2.7	
Vanadium	mg/kg										
Zinc	mg/kg	57		45		46		64		62	

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Sample Location:		PB-WA-S16		PB-WA-S16		PB-WA-S17		PB-WA-S17		PB-WA-S17	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S16-0.0-2.0		PB-WA-S16-2.0-4.0		PB-WA-S17-0.0-3.0		PB-WA-S17-3.0-5.0		PB-WA-S17-5.0-10.0	
Sample Date:		18-OCT-94		18-OCT-94		19-OCT-94		19-OCT-94		19-OCT-94	
Depth:		0 - 2		2 - 4		0 - 3		3 - 5		5 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.95		3.1		2.9		2.85		3	
Arsenic	mg/kg	4.4		6.9		1.75		8.5		5.4	
Barium	mg/kg										
Beryllium	mg/kg	.6		.6		.6		.55		.6	
Cadmium	mg/kg	.6		.6		.6		.55		.6	
Calcium	mg/kg										
Chromium	mg/kg	21		19		17		16		11.2	
Cobalt	mg/kg										
Copper	mg/kg	2.8		5.3		8.5		8.2		11.3	
Iron	mg/kg										
Lead	mg/kg	8.4		8.9		23		16		11.4	
Magnesium	mg/kg										
Manganese	mg/kg	165		185		1023		398		274	
Mercury	mg/kg	.145		.155		.145		.14		.15	
Nickel	mg/kg	10.1		9.5		31		22		18	
Potassium	mg/kg										
Selenium	mg/kg	2.35		2.45		2.35		2.25		2.4	
Silver	mg/kg	.6		.6		.6		.55		.6	
Sodium	mg/kg										
Thallium	mg/kg	2.95		3.1		2.9		2.85		3	
Vanadium	mg/kg										
Zinc	mg/kg	32		33		80		64		50	

Plum Brook Ordnance Works
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Sample Location:		PB-WA-S17		PB-WA-S18		PB-WA-S18		PB-WA-S18		PB-WA-S19	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S17-0.0-0.5		PB-WA-S18-0.0-3.0		PB-WA-S18-3.0-5.0		PB-WA-S18-5.0-10.0		PB-WA-S19-0.0-2.0	
Sample Date:		13-DEC-94		18-OCT-94		18-OCT-94		18-OCT-94		24-OCT-94	
Depth:		0 - 0.5		0 - 3		3 - 5		5 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	7.4		3.15		3		3.35		2.9	
Arsenic	mg/kg	8.5		3.9		1.8		2		5.7	
Barium	mg/kg										
Beryllium	mg/kg	.65		.65		.6		.65		.6	
Cadmium	mg/kg	.65		.65		.6		.65		.6	
Calcium	mg/kg										
Chromium	mg/kg	19		20		11		19		22	
Cobalt	mg/kg										
Copper	mg/kg	3.7		16		9.3		5.9		6.2	
Iron	mg/kg										
Lead	mg/kg	22		19		12		15		20	
Magnesium	mg/kg										
Manganese	mg/kg	270		1000		325		333		442	
Mercury	mg/kg	.16		.16		.15		.165		.145	
Nickel	mg/kg	18		34		18		24		27	
Potassium	mg/kg										
Selenium	mg/kg	2.55		2.55		2.4		2.65		2.35	
Silver	mg/kg	.65		.65		.6		.65		.6	
Sodium	mg/kg										
Thallium	mg/kg	3.2		3.15		3		3.35		2.9	
Vanadium	mg/kg										
Zinc	mg/kg	69		87		54		57		79	

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Sample Location:		PB-WA-S19		PB-WA-S2		PB-WA-S20		PB-WA-S21		PB-WA-S22	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S19-2.0-5.0		PB-WA-S2-0.0-0.5		PB-WA-S20-0.0-0.5		PB-WA-S21-0.0-2.0		PB-WA-S22-2.0-5.0	
Sample Date:		24-OCT-94		27-OCT-94		29-OCT-94		17-OCT-94		18-OCT-94	
Depth:		2 - 5		0 - 0.5		0 - 0.5		0 - 2		2 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	2.85		3.15		3		3.05		2.65	
Arsenic	mg/kg	7.7		5.7		4.6		5.2		5	
Barium	mg/kg										
Beryllium	mg/kg	.55		.65		.6		.6		.55	
Cadmium	mg/kg	.55		.65		.6		.6		1.6	
Calcium	mg/kg										
Chromium	mg/kg	22		10.8		16		16		12	
Cobalt	mg/kg										
Copper	mg/kg	11		7.6		2.9		6		14	
Iron	mg/kg										
Lead	mg/kg	15		10		12		15		8.5	
Magnesium	mg/kg										
Manganese	mg/kg	494		329		190		695		3300	
Mercury	mg/kg	.145		.16		.15		.15		.135	
Nickel	mg/kg	31		20		16		29		52	
Potassium	mg/kg										
Selenium	mg/kg	2.3		2.55		2.4		2.45		2.15	
Silver	mg/kg	.55		.65		.6		.6		.55	
Sodium	mg/kg										
Thallium	mg/kg	2.85		3.15		3		3.05		2.65	
Vanadium	mg/kg										
Zinc	mg/kg	66		26		45		72		37	

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Sample Location:		PB-WA-S23		PB-WA-S24		PB-WA-S3		PB-WA-S4		PB-WA-S5	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S23-0.0-0.5		PB-WA-S24-5.0-10		PB-WA-S3-0.0-0.5		PB-WA-S4-0.0-0.5		PB-WA-S5-0.0-2.0	
Sample Date:		29-OCT-94		19-OCT-94		27-OCT-94		29-OCT-94		17-OCT-94	
Depth:		0 - 0.5		5 - 10		0 - 0.5		0 - 0.5		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3		2.9		3.6		3.05		3.1	
Arsenic	mg/kg	5		1.75		6.5		1.85		4.7	
Barium	mg/kg										
Beryllium	mg/kg	.6		.6		.7		.6		.6	
Cadmium	mg/kg	.6		.6		.7		.6		.6	
Calcium	mg/kg										
Chromium	mg/kg	18		11.2		16		12		35	
Cobalt	mg/kg										
Copper	mg/kg	3.1		5.3		11.3		2.4		1.25	
Iron	mg/kg										
Lead	mg/kg	13		11		16		12		19	
Magnesium	mg/kg										
Manganese	mg/kg	290		198		841		350		1012	
Mercury	mg/kg	.15		.145		.18		.15		.155	
Nickel	mg/kg	18		15		29		15		35	
Potassium	mg/kg										
Selenium	mg/kg	2.4		2.35		2.9		2.45		2.45	
Silver	mg/kg	.6		.6		.7		.6		.6	
Sodium	mg/kg										
Thallium	mg/kg	3		2.9		3.6		3.05		3.1	
Vanadium	mg/kg										
Zinc	mg/kg	51		43		78		49		91	

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Sample Location:		PB-WA-S5		PB-WA-S6		PB-WA-S6		PB-WA-S7		PB-WA-S7	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S5-2.0-5.0		PB-WA-S6-0.0-2.0		PB-WA-S6-2.0-5.0		PB-WA-S7-0.0-2.0		PB-WA-S7-2.0-5.0	
Sample Date:		17-OCT-94		17-OCT-94		17-OCT-94		18-OCT-94		18-OCT-94	
Depth:		2 - 5		0 - 2		2 - 5		0 - 2		2 - 5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.05		3.05		3.2		2.8		2.85	
Arsenic	mg/kg	4.8		1.85		5.6		4.4		5.1	
Barium	mg/kg										
Beryllium	mg/kg	.6		.6		.65		.55		.55	
Cadmium	mg/kg	.6		.6		.65		.55		.55	
Calcium	mg/kg										
Chromium	mg/kg	17		16		12.7		14		16	
Cobalt	mg/kg										
Copper	mg/kg	7.1		3.3		7.8		3.6		14	
Iron	mg/kg										
Lead	mg/kg	11.7		15		11.5		16		20	
Magnesium	mg/kg										
Manganese	mg/kg	305		268		282		300		1011	
Mercury	mg/kg	.15		.15		.16		.14		.145	
Nickel	mg/kg	26		21		22		16		31	
Potassium	mg/kg										
Selenium	mg/kg	2.45		2.45		2.55		2.2		2.3	
Silver	mg/kg	.6		.6		.65		.55		.55	
Sodium	mg/kg										
Thallium	mg/kg	3.05		3.05		3.2		2.8		2.85	
Vanadium	mg/kg										
Zinc	mg/kg	62		66		56		64		60	

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Sample Location:		PB-WA-S8		PB-WA-S8		PB-WA-S9		PB-WA-S9		WARP-DP01	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S8-0.0-2.0		PB-WA-S8-2.0-5.0		PB-WA-S9-0.0-2.0		PB-WA-S9-2.0-5.0		8100	
Sample Date:		18-OCT-94		18-OCT-94		18-OCT-94		18-OCT-94		23-JUN-98	
Depth:		0 - 2		2 - 5		0 - 2		2 - 5		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg									6880	
Antimony	mg/kg	3		2.65		2.9		3.25		3.4	UJ
Arsenic	mg/kg	4.5		5.3		6.2		3.9		2.8	
Barium	mg/kg									11.4	U
Beryllium	mg/kg	.6		.55		.6		.65		.285	U
Cadmium	mg/kg	.6		1.4		.6		.65		.285	U
Calcium	mg/kg									1490	
Chromium	mg/kg	14		13		30		23		9.9	J
Cobalt	mg/kg									2.85	U
Copper	mg/kg	1.2		2.4		2.6		1.3		4.0	
Iron	mg/kg									10300	
Lead	mg/kg	13		7.4		7.8		7.9		3.6	J
Magnesium	mg/kg									1090	
Manganese	mg/kg	702		621		163		156		89.6	
Mercury	mg/kg	.15		.13		.145		.16		.019	U
Nickel	mg/kg	17		16		10.3		9.4		7.6	
Potassium	mg/kg									284.5	U
Selenium	mg/kg	2.4		2.1		2.35		2.6		.285	U
Silver	mg/kg	.6		.55		.6		.65		.55	U
Sodium	mg/kg									284.5	U
Thallium	mg/kg	3		2.65		2.9		3.25		.55	UJ
Vanadium	mg/kg									18.9	
Zinc	mg/kg	57		34		33		34		21.7	

Sample Location:		WARP-DP01		WARP-DP01		WARP-DP02		WARP-DP02		WARP-DP02	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8120		8140		8150		8160	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9190		6010		17900		7540		14500	
Antimony	mg/kg	3.75	UJ	3.75	UJ	3.6	UJ	3.6	UJ	3.8	UJ
Arsenic	mg/kg	8.6		4.5		7.2		2.5		11.7	
Barium	mg/kg	40.3		27.9		124		32.1		75.3	
Beryllium	mg/kg	.315	U	.31	U	1.0		.3	U	0.70	
Cadmium	mg/kg	.315	U	.31	U	.3	U	.3	U	.315	U
Calcium	mg/kg	35700		67600		5930		3010		56600	
Chromium	mg/kg	16.1	J	10.9	J	20.8	J	12.1	J	22.2	J
Cobalt	mg/kg	8.5		6.2		16.2		3	U	10	
Copper	mg/kg	20.1		17.1		20.0		7.0		25.6	
Iron	mg/kg	19600		15000		26800		11500		26400	
Lead	mg/kg	8.1	J	7.1	J	13.5	J	4.8	J	10.8	J
Magnesium	mg/kg	14500		20700		4020		2110		15100	
Manganese	mg/kg	282		329		1190		92.5		423	
Mercury	mg/kg	.0205	U	.0205	U	0.061		.02	U	.021	U
Nickel	mg/kg	19.4		14.0		29.1		13.0		27.8	
Potassium	mg/kg	2010	J	1480	J	2490	J	1210	J	3370	J
Selenium	mg/kg	.315	U	.6	U	.3	U	.3	U	.65	U
Silver	mg/kg	.65	U	.6	U	.6	U	.6	U	.65	U
Sodium	mg/kg	314	U	310.5	U	300	U	301	U	317	U
Thallium	mg/kg	.65	UJ	1.25	UJ	.6	UJ	.6	UJ	1.25	UJ
Vanadium	mg/kg	28.0		20.5		37.7		17.8		34.6	
Zinc	mg/kg	51.2		40.0		87.4		33.9		68.1	

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Sample Location:		WARP-DP03		WARP-DP03		WARP-DP03		WARP-DP04		WARP-DP04	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8180		8190		8200		8220		8230	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	16500		7040		9400		17000		8640	
Antimony	mg/kg	3.55	UJ	3.55	UJ	3.75	UJ	3.5	UJ	3.35	UJ
Arsenic	mg/kg	8.1		6.8		5.8		6.1		4.5	
Barium	mg/kg	112		87.2		58.0		85.4		45.7	
Beryllium	mg/kg	0.76	J	.295	U	.315	U	0.78	J	.28	U
Cadmium	mg/kg	0.59		.295	U	.315	U	.29	U	.28	U
Calcium	mg/kg	2710		2200		40200		1900		1860	
Chromium	mg/kg	19.9	J	11.4	J	14.8	J	19.2	J	11.9	J
Cobalt	mg/kg	17.9		21.0		8.5		14.7		9.2	
Copper	mg/kg	21.4		15.1		20.3		21.9		12.7	
Iron	mg/kg	30200		19600		20100		23900		14500	
Lead	mg/kg	11.7		9.4		7.6		10.3		6.2	
Magnesium	mg/kg	3760		2020		10800		3220		1990	
Manganese	mg/kg	1340		495		372		915		267	
Mercury	mg/kg	.0195	U	.0195	U	.0205	U	.0195	U	.0185	U
Nickel	mg/kg	44.3		24.0		23.0		29.7		20.9	
Potassium	mg/kg	2970	J	941	J	2460	J	2510	J	1370	J
Selenium	mg/kg	.295	U	.295	U	.315	U	.29	U	.28	U
Silver	mg/kg	.6	U	.6	U	.65	U	.6	U	.55	U
Sodium	mg/kg	294.5	U	295	U	313	U	292.5	U	281	U
Thallium	mg/kg	.6	U	.6	U	.65	U	.6	U	.55	U
Vanadium	mg/kg	32.5	J	19.6	J	23.3	J	32.9	J	18.2	J
Zinc	mg/kg	111		64.1		54.7		88.1		53.8	

Sample Location:		WARP-DP04		WARP-DP05		WARP-DP05		WARP-DP05		WARP-DP06	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8240		8260		8270		8280		8300	
Sample Date:		23-JUN-98		16-JUN-98		16-JUN-98		16-JUN-98		23-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	13400		8120		8840		9510		5600	
Antimony	mg/kg	3.8	UJ	3.35	U	3.65	U	3.65	U	3.35	UJ
Arsenic	mg/kg	11.2		4.8		4.6		6.7		2.3	
Barium	mg/kg	35.3		51.2		62.4		54.3		11.2	U
Beryllium	mg/kg	.32	U	.28	U	.305	U	.305	U	.28	U
Cadmium	mg/kg	.32	U	.28	U	.305	U	.305	U	.28	U
Calcium	mg/kg	40300		2390		54500		50400		1620	
Chromium	mg/kg	20.0	J	13.1		15.3		17.4		8.9	J
Cobalt	mg/kg	11.6		8.5		9.6		9.2		2.8	U
Copper	mg/kg	34.7		11.7		19.3		19.0		4.5	
Iron	mg/kg	27800		17600		17000		18200		10200	
Lead	mg/kg	12.3		6.1		10.5		8.4		2.8	J
Magnesium	mg/kg	11000		2150		23400		14800		1060	
Manganese	mg/kg	363		468		527		362		143	
Mercury	mg/kg	.021	U	.0185	U	.02	U	.02	U	.0185	U
Nickel	mg/kg	36.0		17.0		23.2		21.7		7.1	
Potassium	mg/kg	3570	J	813		1740		1730		280	U
Selenium	mg/kg	.32	U	.28	U	.305	U	.305	U	.28	U
Silver	mg/kg	.65	U	.55	U	.6	U	.6	U	.55	U
Sodium	mg/kg	317.5	U	280.5	U	305.5	U	304	U	280	U
Thallium	mg/kg	.65	U	.55	U	.6	U	.6	U	.55	UJ
Vanadium	mg/kg	24.7	J	24.1	J	27.1	J	25.9	J	17.9	
Zinc	mg/kg	80.0		40.4		53.6		53.4		21.1	

Sample Location:		WARP-DP06		WARP-DP06		WARP-DP07		WARP-DP07		WARP-DP07	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8310		8320		8340		8350		8360	
Sample Date:		23-JUN-98		23-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8610		12100		11500		9160		10900	
Antimony	mg/kg	3.5	UJ	3.75	UJ	3.6	UJ	3.5	UJ	3.65	UJ
Arsenic	mg/kg	6.8		6.6		3.7		3.1		7.4	
Barium	mg/kg	31.3		82.3		69.7		43.3		55.4	
Beryllium	mg/kg	.29	U	.315	U	0.70		.29	U	0.65	
Cadmium	mg/kg	.29	U	.315	U	.3	U	.29	U	.305	U
Calcium	mg/kg	2530		55700		2700		2410		25000	
Chromium	mg/kg	15.5	J	17.9	J	15.8	J	14.1	J	17.1	J
Cobalt	mg/kg	7.9		12.8		9.0		7.3		13.8	
Copper	mg/kg	12.4		23.5		15.9		12.5		21.4	
Iron	mg/kg	17000		21500		16800		13900		20700	
Lead	mg/kg	7.1	J	11.6	J	10.1	J	6.9	J	11.6	J
Magnesium	mg/kg	1860		17700		2720		2340		5620	
Manganese	mg/kg	413		768		186		123		472	
Mercury	mg/kg	.0195	U	.0205	U	.0195	U	.0195	U	.02	U
Nickel	mg/kg	14.8		31.4		22.3		18.3		29.7	
Potassium	mg/kg	924	J	2860	J	1650	J	1650	J	2390	J
Selenium	mg/kg	.29	U	.65	U	.3	U	.29	U	.305	U
Silver	mg/kg	.6	U	.65	U	.6	U	.6	U	.6	U
Sodium	mg/kg	292.5	U	313.5	U	299	U	292	U	305.5	U
Thallium	mg/kg	.6	UJ	1.25	UJ	.6	UJ	.6	UJ	.6	UJ
Vanadium	mg/kg	25.4		30.8		21.1		20.4		24.2	
Zinc	mg/kg	39.3		62.2		70.5		57.5		75.6	

Sample Location:		WARP-DP08		WARP-DP08		WARP-DP08		WARP-DP09		WARP-DP09	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8380		8390		8400		8420		8430	
Sample Date:		15-JUN-98		15-JUN-98		15-JUN-98		16-JUN-98		16-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4880		8740		5570		7610		6470	
Antimony	mg/kg	3.5	U	3.55	U	3.45	U	4.15	U	3.6	U
Arsenic	mg/kg	2.2		6.9		4.0		6.8		2.2	
Barium	mg/kg	11.6	U	43.8		11.55	U	53.9		41.3	
Beryllium	mg/kg	.29	U	.295	U	.29	U	.345	U	.3	U
Cadmium	mg/kg	.29	U	.295	U	.29	U	.345	U	.3	U
Calcium	mg/kg	1480		1810		1460		58600		1220	
Chromium	mg/kg	6.8		17.4		7.5		22.2		8.2	
Cobalt	mg/kg	2.9	U	7.4		2.9	U	3.45	U	3	U
Copper	mg/kg	2.9		10.4		6.9		18.5		4.9	
Iron	mg/kg	8460		22000		10000		14200		8490	
Lead	mg/kg	2.2		5.4		4.4		11.7		5.8	
Magnesium	mg/kg	289.5	U	1810		832		4510		2010	
Manganese	mg/kg	107		231		215		213		83.4	
Mercury	mg/kg	.019	U	.0195	U	.019	U	0.10		.0195	U
Nickel	mg/kg	7.5		17.0		10.8		10.6		7.4	
Potassium	mg/kg	289.5	U	643		289	U	346.5	U	299	U
Selenium	mg/kg	.29	U	.295	U	.29	U	.345	U	.3	U
Silver	mg/kg	.6	U	.6	U	.6	U	.7	U	.6	U
Sodium	mg/kg	289.5	U	297.5	U	289	U	346.5	U	299	U
Thallium	mg/kg	.6	U	.6	U	.6	U	.7	U	.6	U
Vanadium	mg/kg	15.8		30.0		17.8		21.1	J	14.2	J
Zinc	mg/kg	15.9		37.8		26.5		36.9		30.6	

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Sample Location:		WARP-DP09		WARP-DP10		WARP-DP10		WARP-DP11		WARP-DP11	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8440		8460		8470		8500		8510	
Sample Date:		16-JUN-98		26-JUN-98		26-JUN-98		25-JUN-98		25-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	11100		12300		12000		11300		5980	
Antimony	mg/kg	7.7		3.5	UJ	3.6	UJ	3.6	UJ	3.5	UJ
Arsenic	mg/kg	14.0		5.2		7.9		3.7		6.5	
Barium	mg/kg	78.2		77.4		80.3		72.9		35.5	
Beryllium	mg/kg	0.65		0.73		0.86		0.64		.29	U
Cadmium	mg/kg	.32	U	.29	U	.3	U	.3	U	.29	U
Calcium	mg/kg	7860		3260		2130		2600		1570	
Chromium	mg/kg	20.9		15.7	J	17.9	J	15.8	J	9.4	J
Cobalt	mg/kg	11.9		15.7		11.2		11.5		6.9	
Copper	mg/kg	24.2		16.5		20.4		12.3		10.4	
Iron	mg/kg	29000		20000		27000		18700		16800	
Lead	mg/kg	10.6		11.0	J	11.5	J	9.1	J	6.2	J
Magnesium	mg/kg	4980		2930		2850		3030		1580	
Manganese	mg/kg	405		681		243		375		114	
Mercury	mg/kg	.021	U	0.045		.02	U	.0195	U	.0195	U
Nickel	mg/kg	36.6		29.0		33.5		22.6		16.6	
Potassium	mg/kg	1160		1600	J	1340	J	1660	J	903	J
Selenium	mg/kg	.32	U	.29	U	.3	U	.3	U	.29	U
Silver	mg/kg	.65	U	.6	U	.6	U	.6	U	.6	U
Sodium	mg/kg	319.5	U	291.5	U	1270		298.5	U	292	U
Thallium	mg/kg	.65	U	.6	UJ	.6	UJ	.6	UJ	.6	UJ
Vanadium	mg/kg	27.5	J	22.4		24.6		21.1		13.9	
Zinc	mg/kg	72.5		74.6		94.6		75.4		42.4	

Sample Location:		WARP-DP11		WARP-DP12		WARP-DP12		WARP-DP12		WARP-DP13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8520		8540		8550		8560		8580	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		15-JUN-98		15-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	11400		4720		5080		9320		11900	
Antimony	mg/kg	3.5	UJ	3.35	U	3.75	U	3.75	U	3.4	U
Arsenic	mg/kg	7.9		2.0		23.6		8.3		11.5	
Barium	mg/kg	51.5		24.8		39.3		54.5		82.0	
Beryllium	mg/kg	0.59		.28	U	.31	U	.31	U	0.67	
Cadmium	mg/kg	.29	U	.28	U	.31	U	.31	U	.285	U
Calcium	mg/kg	51000		757		18800		57200		16600	
Chromium	mg/kg	16.8	J	5.4		10.6		16.2		20.3	
Cobalt	mg/kg	10.1		2.8	U	8.2		8.9		11.1	
Copper	mg/kg	24.3		3.5		19.3		22.6		26.8	
Iron	mg/kg	22500		7190		23200		19500		27400	
Lead	mg/kg	8.2	J	2.9		6.4		9.8		11.3	
Magnesium	mg/kg	11300		684		6810		17400		8890	
Manganese	mg/kg	392		172		551		433		391	
Mercury	mg/kg	.019	U	.0185	U	.0205	U	.0205	U	.019	U
Nickel	mg/kg	30.2		8.6		24.9		23.9		29.1	
Potassium	mg/kg	3140	J	279.5	U	803		1860		1830	
Selenium	mg/kg	.29	U	.28	U	.31	U	.31	U	.285	U
Silver	mg/kg	.6	U	.55	U	.6	U	.6	U	.55	U
Sodium	mg/kg	290.5	U	279.5	U	311.5	U	311.5	U	284.5	U
Thallium	mg/kg	.6	UJ	.55	U	.6	U	.6	U	.55	U
Vanadium	mg/kg	24.2		10.1		22.3		25.9		31.0	
Zinc	mg/kg	58.9		22.9		55.0		60.6		69.9	

Plum Brook Ordnance Works
West Area Red Water Ponds
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Sample Location:		WARP-DP13		WARP-DP13		WARP-DP15		WARP-DP15		WARP-DP15	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8590		8600		8660		8670		8680	
Sample Date:		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	5910		13700		14300		11100		13800	
Antimony	mg/kg	3.5	U	3.7	U	3.6	UJ	3.55	UJ	3.5	UJ
Arsenic	mg/kg	3.1		15.3		9.3		3.7		7.6	
Barium	mg/kg	27.9		76.3		91.4		53.8		165	
Beryllium	mg/kg	.29	U	0.83		0.63	J	.295	U	0.64	J
Cadmium	mg/kg	.29	U	0.68		.3	U	.295	U	.295	U
Calcium	mg/kg	4680		3580		31400		2480		3480	
Chromium	mg/kg	10.3		22.2		19.7	J	13.0	J	12.9	J
Cobalt	mg/kg	6.0		18.4		13.0		6.2		16.2	
Copper	mg/kg	14.0		29.1		22.7		9.6		18.0	
Iron	mg/kg	10900		34000		24700		13400		24500	
Lead	mg/kg	4.9		14.0		10.7		5.9		13.2	
Magnesium	mg/kg	2050		4310		12200		2010		4220	
Manganese	mg/kg	231		780		781		269		1900	
Mercury	mg/kg	.019	U	.0205	U	.02	U	.0195	U	.0195	U
Nickel	mg/kg	10.3		45.0		32.1		13.6		40.8	
Potassium	mg/kg	289.5	U	1630		2640	J	1370	J	2070	J
Selenium	mg/kg	.29	U	.31	U	.3	U	.295	U	.295	U
Silver	mg/kg	.6	U	.6	U	.6	U	.6	U	.6	U
Sodium	mg/kg	289.5	U	1030		301	U	295.5	U	293	U
Thallium	mg/kg	.6	U	.6	U	.6	U	.6	U	.6	U
Vanadium	mg/kg	17.0		36.7		36.3	J	23.2	J	27.7	J
Zinc	mg/kg	27.2		82.9		63.4		45.3		75.7	

Sample Location:		WARP-DP16		WARP-DP16		WARP-DP16		WARP-DP17		WARP-DP17	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8700		8710		8720		8740		8750	
Sample Date:		24-JUN-98		24-JUN-98		24-JUN-98		25-JUN-98		25-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	20600		12400		18400		11200		9420	
Antimony	mg/kg	7.4	J	3.7	UJ	3.85	UJ	3.5	UJ	3.65	UJ
Arsenic	mg/kg	11.4		11.0		9.5		5.1		11.6	
Barium	mg/kg	130		117		118		61.9		67.7	
Beryllium	mg/kg	1.2	J	.305	U	0.82	J	.295	U	.305	U
Cadmium	mg/kg	.3	U	.305	U	.32	U	.295	U	.305	U
Calcium	mg/kg	3760		31700		13300		1460		2240	
Chromium	mg/kg	25.4	J	15.8	J	22.7	J	14.8	J	15.5	J
Cobalt	mg/kg	17.1		13.0		15.0		11.5		15.5	
Copper	mg/kg	30.9		26.2		26.4		15.4		19.2	
Iron	mg/kg	36000		29200		31100		19800		26100	
Lead	mg/kg	11.4		9.1		10.1		10.6		9.0	
Magnesium	mg/kg	4870		10100		6970		2500	J	2530	J
Manganese	mg/kg	982		1280		1170		207		326	
Mercury	mg/kg	0.040		.02	U	.021	U	.0195	U	.02	U
Nickel	mg/kg	46.9		33.9		39.3		20.5		31.6	
Potassium	mg/kg	2590	J	1830	J	3240	J	898	J	1030	J
Selenium	mg/kg	.3	U	.305	U	.32	U	0.65		.305	U
Silver	mg/kg	.6	U	.6	U	.65	U	.6	U	.6	U
Sodium	mg/kg	681		306.5	U	726		292.5	U	858	
Thallium	mg/kg	.6	U	.6	U	.65	U	.6	U	.6	U
Vanadium	mg/kg	40.5	J	31.0	J	40.3	J	19.2		22.1	
Zinc	mg/kg	103		70.9		81.2		65.4		66.1	

Sample Location:		WARP-DP17		WARP-DP18		WARP-DP18		WARP-DP18		WARP-DP19	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8760		8780		8790		8800		8820	
Sample Date:		25-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98		24-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	12500		10700		8670		21000		6680	
Antimony	mg/kg	3.6	UJ	3.4	UJ	3.4	UJ	4.05	UJ	3.35	UJ
Arsenic	mg/kg	10.0		5.3		4.1		4.9		2.1	
Barium	mg/kg	74.8		61.9		58.8		92.7		26.4	
Beryllium	mg/kg	0.74		0.59		.285	U	1.0		.28	U
Cadmium	mg/kg	.3	U	.285	U	.285	U	.34	U	.28	U
Calcium	mg/kg	2460		7330		4890		39100		1620	
Chromium	mg/kg	19.6	J	15.3	J	13.0	J	28.6	J	9.1	J
Cobalt	mg/kg	13.8		11.1		8.1		11.5		2.8	U
Copper	mg/kg	21.7		17.3		14.0		25.2		5.8	
Iron	mg/kg	26600		18400		15400		26000		10600	
Lead	mg/kg	8.7		9.6		7.6		11.0		3.4	
Magnesium	mg/kg	2920	J	4680	J	2860	J	10300	J	1290	
Manganese	mg/kg	362		453		261		374		184	
Mercury	mg/kg	.0195	U	.0185	U	.019	U	.0225	U	.0185	U
Nickel	mg/kg	31.1		23.5		20.4		35.9		9.8	
Potassium	mg/kg	1580	J	1270	J	1080	J	5630	J	742	J
Selenium	mg/kg	.3	U	.285	U	.285	U	.34	U	.28	U
Silver	mg/kg	.6	U	.55	U	.55	U	.7	U	.55	U
Sodium	mg/kg	952		283.5	U	284.5	U	339	U	280	U
Thallium	mg/kg	.6	U	.55	U	.55	U	.7	U	.55	U
Vanadium	mg/kg	27.5		23.0		17.8		37.2		19.8	J
Zinc	mg/kg	74.3		60.3		55.2		64.9		28.7	

Sample Location:		WARP-DP19		WARP-DP19		WARP-DP20		WARP-DP20		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8830		8840		8860		8870		8880	
Sample Date:		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	18000		17000		13000		10900		12000	
Antimony	mg/kg	3.65	UJ	3.85	UJ	3.4	UJ	3.45	UJ	3.5	UJ
Arsenic	mg/kg	9.4		9.8		8.5		7.0		4.6	
Barium	mg/kg	70.0		83.3		66.0		56.1		80.3	
Beryllium	mg/kg	0.83	J	0.75	J	.285	U	.285	U	.29	U
Cadmium	mg/kg	.305	U	.32	U	.285	U	.285	U	.29	U
Calcium	mg/kg	2600		34600		35600		23500		5120	
Chromium	mg/kg	23.3	J	25.1	J	16.7	J	16.1	J	16.9	J
Cobalt	mg/kg	19.0		14.5		11.9		7.8		10.1	
Copper	mg/kg	30.6		30.9		15.1	B	15.1	B	15.7	B
Iron	mg/kg	32000		30000		20900		19100		18800	
Lead	mg/kg	13.2		11.2		9.4		7.4		7.4	
Magnesium	mg/kg	4480		14700		9970		8670		3690	
Manganese	mg/kg	898		568		551		320		484	
Mercury	mg/kg	.02	U	.021	U	.0185	U	.019	U	.019	U
Nickel	mg/kg	42.3		37.9		19.3		18.6		28.7	
Potassium	mg/kg	2430	J	3960	J	2040	J	1350	J	1710	J
Selenium	mg/kg	.305	U	.32	U	.285	U	.285	U	.29	U
Silver	mg/kg	.6	U	.65	U	.55	U	.55	U	.6	U
Sodium	mg/kg	305	U	320	U	283	U	287.5	U	619	
Thallium	mg/kg	.6	U	.65	U	.55	U	.55	U	.6	U
Vanadium	mg/kg	38.9	J	37.3	J	35.0	J	29.1	J	24.1	J
Zinc	mg/kg	85.1		81.6		49.8		48.2		77.5	

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Sample Location:		PB-PR-S13	
Associated Site:		WARP	
Sample No:		PB-PR-S13-3.0-10.0	
Sample Date:		31-OCT-94	
Depth:		3 - 10	
GEN CHEMISTRY	Units	Result	Val Qlfr
Alkalinity	mg/kg	830	
Nitrate	mg/kg	150	
Phosphorous	mg/kg	31	
Sulfate	mg/kg	3330	
Total organic carbon	mg/kg	1990	

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Sample Location:		PB-BG-S1		PB-BG-S1		PB-BG-S2		PB-BG-S2		PB-BG-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S1-0.5-3.0		PB-BG-S1-3.0-5.0		PB-BG-S2-0.5-3.0		PB-BG-S2-3.0-5.0		PB-BG-S3-0.5-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		.5 - 3		3 - 5		.5 - 3		3 - 5		.5 - 3	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Plum Brook Ordnance Works
West Area Red Water Ponds
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Sample Location:		PB-BG-S3		PB-BG-S4		PB-BG-S5		PB-BG-S5		PB-BG-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S3-3.0-4.0		PB-BG-S4-0.5-3.0		PB-BG-S5-0.5-3.0		PB-BG-S5-3.0-5.0		PB-BG-S6-0.5-3.0	
Sample Date:		01-NOV-94		30-OCT-94		30-OCT-94		30-OCT-94		01-NOV-94	
Depth:		3 - 4		.5 - 3		.5 - 3		3 - 5		.5 - 3	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Report Date: 09/19/00

Sample Location:		PB-BG-S6		PB-BG-S7		PB-BG-S8		PB-BG-S9		PB-BG-S9	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-BG-S6-3.0-4.5		PB-BG-S7-0.5-3.0		PB-BG-S8-0.5-3.0		PB-BG-S9-0.5-3.0		PB-BG-S9-3.0-5.0	
Sample Date:		01-NOV-94		01-NOV-94		30-OCT-94		01-NOV-94		01-NOV-94	
Depth:		3 - 4.5		.5 - 3		.5 - 3		.5 - 3		3 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S1		PB-PR-S1		PB-PR-S10		PB-PR-S10		PB-PR-S10	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S1-0.0-2.0		PB-PR-S1-2.0-5.0		PB-PR-S10-0.0-3.0		PB-PR-S10-3.0-5.0		PB-PR-S10-5.0-10.0	
Sample Date:		31-OCT-94		31-OCT-94		29-OCT-94		29-OCT-94		29-OCT-94	
Depth:		0 - 2		2 - 5		0 - 3		3 - 5		5 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		2.8		5.2	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		1.6		2.5	
2,4,6-Trinitrotoluene	mg/kg	.125		0.3		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		0.4		.125		2.6		2.2	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Plum Brook Ordnance Works
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Report Date: 09/19/00

Sample Location:		PB-PR-S11		PB-PR-S11		PB-PR-S11		PB-PR-S12		PB-PR-S12	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S11-0.0-3.0		PB-PR-S11-3.0-5.0		PB-PR-S11-5.0-10.0		PB-PR-S12-0.0-3.0		PB-PR-S12-3.0-5.0	
Sample Date:		29-OCT-94		29-OCT-94		29-OCT-94		30-OCT-94		30-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 3		3 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125		2.7	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125		1.1	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		1.2	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		0.3	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S12		PB-PR-S13		PB-PR-S13		PB-PR-S13		PB-PR-S13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S12-5.0-10.0		PB-PR-S13-0.0-3.0		PB-PR-S13-3.0-5.0		PB-PR-S13-5.0-10.0		PB-PR-S13-0.0-0.5	
Sample Date:		30-OCT-94		31-OCT-94		31-OCT-94		31-OCT-94		11-DEC-94	
Depth:		5 - 10		0 - 3		3 - 5		5 - 10		0 - 0.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	2.8		.125		.125		9.4		.125	
1,3-Dinitrobenzene	mg/kg	1.5		.125		.125		3.2		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		0.5		.125	
2,4-Dinitrotoluene	mg/kg	1.6		.125		0.4		5.2		.125	
2,6-Dinitrotoluene	mg/kg	0.3		.13		.13		0.5		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		0.5		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		0.7		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-PR-S14		PB-PR-S14		PB-PR-S14		PB-PR-S14		PB-PR-S15	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S14-0.0-3.0		PB-PR-S14-3.0-5.0		PB-PR-S14-5.0-10.0		PB-PR-S14-0.0-0.5		PB-PR-S15-0.0-3.0	
Sample Date:		07-NOV-94		07-NOV-94		07-NOV-94		11-DEC-94		30-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 0.5		0 - 3	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		58		18		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		6.4		6.7		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		12000		340		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		19		.125		0.6	
2,6-Dinitrotoluene	mg/kg	.13		.13		2.9		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		0.9		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		4.5		1.7		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		9.5		2		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S15		PB-PR-S15		PB-PR-S16		PB-PR-S16		PB-PR-S16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S15-3.0-5.0		PB-PR-S15-5.0-10.0		PB-PR-S16-0.0-3.0		PB-PR-S16-3.0-5.0		PB-PR-S16-5.0-10.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94	
Depth:		3 - 5		5 - 10		0 - 3		3 - 5		5 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		23		.125		.125		14	
1,3-Dinitrobenzene	mg/kg	.125		6.6		.125		.125		4.3	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	0.3		14		.125		.125		8.9	
2,6-Dinitrotoluene	mg/kg	.13		2		.13		.13		1	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		1.1		.125		.125		0.8	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		0.9		.125		.125		0.6	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-PR-S17		PB-PR-S17		PB-PR-S17		PB-PR-S18		PB-PR-S18	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S17-0.0-2.0		PB-PR-S17-2.0-5.0		PB-PR-S17-0.0-0.5		PB-PR-S18-0.0-2.0		PB-PR-S18-2.0-5.0	
Sample Date:		31-OCT-94		31-OCT-94		15-DEC-94		30-OCT-94		30-OCT-94	
Depth:		0 - 2		2 - 5		0 - 0.5		0 - 2		2 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13	UJ	.13	UJ	.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
2-Nitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
3-Nitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
4-Nitrotoluene	mg/kg	.125	UJ	.125	UJ	.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13	UJ	.13	UJ	.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S19		PB-PR-S19		PB-PR-S19		PB-PR-S19		PB-PR-S2	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S19-0.0-3.0		PB-PR-S19-3.0-5.0		PB-PR-S19-5.0-10.0		PB-PR-S19-0.0-0.5		PB-PR-S2-0.0-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		11-DEC-94		28-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 0.5		0 - 3	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		1.5		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		1.4		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		1		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-PR-S2		PB-PR-S2		PB-PR-S20		PB-PR-S20		PB-PR-S21	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S2-3.0-5.0		PB-PR-S2-5.0-10.0		PB-PR-S20-0.0-2.0		PB-PR-S20-2.0-5.0		PB-PR-S21-0.0-0.5	
Sample Date:		28-OCT-94		28-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94	
Depth:		3 - 5		5 - 10		0 - 2		2 - 5		0 - 0.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.5		2.4		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		0.3		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		0.3	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S22		PB-PR-S23		PB-PR-S24		PB-PR-S25		PB-PR-S26	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S22-0.0-0.5		PB-PR-S23-0.0-0.5		PB-PR-S24-0.0-0.5		PB-PR-S25-5.0-10.0		PB-PR-S26-5.0-10.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		29-OCT-94		29-OCT-94	
Depth:		0 - 0.5		0 - 0.5		0 - 0.5		5 - 10		5 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.4		.125		.125		.125		3.9	
1,3-Dinitrobenzene	mg/kg	.125		0.4		.125		.125		2.1	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	0.4		1		1.1		.125		1.1	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		0.3		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-PR-S27		PB-PR-S28		PB-PR-S29		PB-PR-S3		PB-PR-S3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S27-5.0-10.0		PB-PR-S28-5.0-10.0		PB-PR-S29-2.0-5.0		PB-PR-S3-0.0-2.0		PB-PR-S3-2.0-5.0	
Sample Date:		30-OCT-94		07-NOV-94		31-OCT-94		30-OCT-94		30-OCT-94	
Depth:		5 - 10		5 - 10		2 - 5		0 - 2		2 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	2.8		8.5		.125	UJ	.125		.125	
1,3-Dinitrobenzene	mg/kg	0.9		3.9		.125	UJ	.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		280		.125	UJ	.125		.125	
2,4-Dinitrotoluene	mg/kg	0.8		10		.125	UJ	.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		1.8		.13	UJ	.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125	UJ	.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125	UJ	.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125	UJ	.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		1.1		.125	UJ	.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125	UJ	.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		0.8		.125	UJ	.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125	UJ	.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125	UJ	.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13	UJ	.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S30		PB-PR-S4		PB-PR-S4		PB-PR-S4		PB-PR-S5	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S30-0.0-0.5		PB-PR-S4-0.0-3.0		PB-PR-S4-3.0-5.0		PB-PR-S4-5.0-10.0		PB-PR-S5-0.0-3.0	
Sample Date:		30-OCT-94		30-OCT-94		30-OCT-94		30-OCT-94		28-OCT-94	
Depth:		0 - 0.5		0 - 3		3 - 5		5 - 10		0 - 3	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		1.7		12		6.8		.125	
1,3-Dinitrobenzene	mg/kg	0.4		0.8		3.2		2.1		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	0.9		1.1		5.7		2.8		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		0.5		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S5		PB-PR-S5		PB-PR-S6		PB-PR-S6		PB-PR-S6	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S5-3.0-5.0		PB-PR-S5-5.0-10.0		PB-PR-S6-0.0-3.0		PB-PR-S6-3.0-5.0		PB-PR-S6-5.0-10.0	
Sample Date:		28-OCT-94		28-OCT-94		29-OCT-94		29-OCT-94		29-OCT-94	
Depth:		3 - 5		5 - 10		0 - 3		3 - 5		5 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.7		0.4		0.7		13		18	
1,3-Dinitrobenzene	mg/kg	.125		.125		0.9		3.4		3.8	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		2.1		8.7		7.6	
2,6-Dinitrotoluene	mg/kg	.13		.13		0.4		3.6		0.5	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		0.3		1	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		1.1		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S7		PB-PR-S7		PB-PR-S7		PB-PR-S8		PB-PR-S8	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S7-0.0-3.0		PB-PR-S7-3.0-5.0		PB-PR-S7-5.0-10.0		PB-PR-S8-0.0-2.0		PB-PR-S8-2.0-5.0	
Sample Date:		28-OCT-94		28-OCT-94		28-OCT-94		31-OCT-94		31-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 2		2 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.5		6.6		1.3		.125	UJ	.125	UJ
1,3-Dinitrobenzene	mg/kg	0.3		2.1		0.5		.125	UJ	.125	UJ
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
2,4-Dinitrotoluene	mg/kg	0.4		3.4		0.3		.125	UJ	.125	UJ
2,6-Dinitrotoluene	mg/kg	.13		0.4		.13		.13	UJ	.13	UJ
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
2-Nitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
3-Nitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
4-Amino-2,6-dinitrotoluene	mg/kg	.125		0.3		.125		.125	UJ	.125	UJ
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
4-Nitrotoluene	mg/kg	.125		.125		.125		.125	UJ	.125	UJ
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13	UJ	.13	UJ
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-PR-S8		PB-PR-S9		PB-PR-S9		PB-PR-S9		PB-WA-S1	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-PR-S8-0.0-0.5		PR-PR-S9-0.0-3.0		PB-PR-S9-3.0-5.0		PB-PR-S9-5.0-10.0		PB-WA-S1-0.0-0.5	
Sample Date:		15-DEC-94		29-OCT-94		29-OCT-94		29-OCT-94		27-OCT-94	
Depth:		0 - 0.5		0 - 3		3 - 5		5 - 10		0 - 0.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		1.1		6.6		4.9		.125	
1,3-Dinitrobenzene	mg/kg	.125		1.6		1.5		2.2		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		2.4		3.8		2		.125	
2,6-Dinitrotoluene	mg/kg	.13		0.8		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-WA-S10		PB-WA-S10		PB-WA-S11		PB-WA-S11		PB-WA-S12	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S10-3.0-5.0		PB-WA-S10-5.0-10.0		PB-WA-S11-0.0-2.0		PB-WA-S11-2.0-5.0		PB-WA-S12-0.0-2.0	
Sample Date:		27-OCT-94		27-OCT-94		25-OCT-94		25-OCT-94		25-OCT-94	
Depth:		3 - 5		5 - 10		0 - 2		2 - 5		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	5.5		1.1		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	2.3		0.5		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	0.4		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	5.1		.125		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	0.3		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		0.3		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	0.7		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-WA-S12		PB-WA-S13		PB-WA-S13		PB-WA-S13		PB-WA-S13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S12-2.0-5.0		PB-WA-S13-0.0-3.0		PB-WA-S13-3.0-5.0		PB-WA-S13-5.0-10.0		PB-WA-S13-0.0-0.5	
Sample Date:		25-OCT-94		18-OCT-94		18-OCT-94		18-OCT-94		13-DEC-94	
Depth:		2 - 5		0 - 3		3 - 5		5 - 10		0 - 0.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.6		.125		1.6		0.5		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.15		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		0.6		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		0.3		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-WA-S14		PB-WA-S14		PB-WA-S15		PB-WA-S15		PB-WA-S16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S14-0.0-2.0		PB-WA-S14-2.0-5.0		PB-WA-S15-0.0-2.0		PB-WA-S15-2.0-5.0		PB-WA-S16-0.0-2.0	
Sample Date:		25-OCT-94		25-OCT-94		24-OCT-94		24-OCT-94		18-OCT-94	
Depth:		0 - 2		2 - 5		0 - 2		2 - 5		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		0.4		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		0.3		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	0.4		0.3		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		0.5		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-WA-S16		PB-WA-S17		PB-WA-S17		PB-WA-S17		PB-WA-S17	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S16-2.0-4.0		PB-WA-S17-0.0-3.0		PB-WA-S17-3.0-5.0		PB-WA-S17-5.0-10.0		PB-WA-S17-0.0-0.5	
Sample Date:		18-OCT-94		19-OCT-94		19-OCT-94		19-OCT-94		13-DEC-94	
Depth:		2 - 4		0 - 3		3 - 5		5 - 10		0 - 0.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		0.5		4.2		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		1.9		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		0.3		.125		2.1		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		3.3		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		0.3		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		0.5		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		0.3		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Report Date: 09/19/00

Sample Location:		PB-WA-S18		PB-WA-S18		PB-WA-S18		PB-WA-S19		PB-WA-S19	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S18-0.0-3.0		PB-WA-S18-3.0-5.0		PB-WA-S18-5.0-10.0		PB-WA-S19-0.0-2.0		PB-WA-S19-2.0-5.0	
Sample Date:		18-OCT-94		18-OCT-94		18-OCT-94		24-OCT-94		24-OCT-94	
Depth:		0 - 3		3 - 5		5 - 10		0 - 2		2 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		0.9		0.9		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		0.3		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		0.7		0.3		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-WA-S2		PB-WA-S20		PB-WA-S21		PB-WA-S22		PB-WA-S23	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S2-0.0-0.5		PB-WA-S20-0.0-0.5		PB-WA-S21-0.0-2.0		PB-WA-S22-2.0-5.0		PB-WA-S23-0.0-0.5	
Sample Date:		27-OCT-94		29-OCT-94		17-OCT-94		18-OCT-94		29-OCT-94	
Depth:		0 - 0.5		0 - 0.5		0 - 2		2 - 5		0 - 0.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		0.7		0.5		.125		0.5	
1,3-Dinitrobenzene	mg/kg	.125		0.3		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		0.4		.125		.125		0.4	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

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Sample Location:		PB-WA-S24		PB-WA-S3		PB-WA-S4		PB-WA-S5		PB-WA-S5	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S24-5.0-10		PB-WA-S3-0.0-0.5		PB-WA-S4-0.0-0.5		PB-WA-S5-0.0-2.0		PB-WA-S5-2.0-5.0	
Sample Date:		19-OCT-94		27-OCT-94		29-OCT-94		17-OCT-94		17-OCT-94	
Depth:		5 - 10		0 - 0.5		0 - 0.5		0 - 2		2 - 5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	3.1		.125		.125		0.6		3	
1,3-Dinitrobenzene	mg/kg	1.5		.125		.125		.125		0.7	
2,4,6-Trinitrotoluene	mg/kg	3		.125		.125		.125		0.3	
2,4-Dinitrotoluene	mg/kg	3.8		.125		.125		0.3		1.3	
2,6-Dinitrotoluene	mg/kg	0.3		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	0.3		.125		.125		.125		0.4	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-WA-S6		PB-WA-S6		PB-WA-S7		PB-WA-S7		PB-WA-S8	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S6-0.0-2.0		PB-WA-S6-2.0-5.0		PB-WA-S7-0.0-2.0		PB-WA-S7-2.0-5.0		PB-WA-S8-0.0-2.0	
Sample Date:		17-OCT-94		17-OCT-94		18-OCT-94		18-OCT-94		18-OCT-94	
Depth:		0 - 2		2 - 5		0 - 2		2 - 5		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.3		4.2		.125		0.4		.125	
1,3-Dinitrobenzene	mg/kg	.125		2.4		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		3		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		0.6		.125		0.3		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Sample Location:		PB-WA-S8		PB-WA-S9		PB-WA-S9		WARP-DP01		WARP-DP01	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-S8-2.0-5.0		PB-WA-S9-0.0-2.0		PB-WA-S9-2.0-5.0		8100		8110	
Sample Date:		18-OCT-94		18-OCT-94		18-OCT-94		23-JUN-98		23-JUN-98	
Depth:		2 - 5		0 - 2		2 - 5		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125					
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125					
2-Nitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
3,4-Dinitrotoluene	mg/kg	.125		.125		.125					
3-Nitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125					
4-Nitrotoluene	mg/kg	.125		.125		.125					
HMX	mg/kg							.25	U	.25	U
Nitrobenzene	mg/kg	.13		.13		.13		.125	U	.125	U
RDX	mg/kg							.25	U	.25	U
Tetryl	mg/kg							.325	U	.325	U

Sample Location:		WARP-DP01		WARP-DP02		WARP-DP02		WARP-DP02		WARP-DP03	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8120		8140		8150		8160		8180	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP03		WARP-DP03		WARP-DP04		WARP-DP04		WARP-DP04	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8190		8200		8220		8230		8240	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	0.28		.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP05		WARP-DP05		WARP-DP05		WARP-DP06		WARP-DP06	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8260		8270		8280		8300		8310	
Sample Date:		16-JUN-98		16-JUN-98		16-JUN-98		23-JUN-98		23-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP06		WARP-DP07		WARP-DP07		WARP-DP07		WARP-DP08	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8320		8340		8350		8360		8380	
Sample Date:		23-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98		15-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP08		WARP-DP08		WARP-DP09		WARP-DP09		WARP-DP09	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8390		8400		8420		8430		8440	
Sample Date:		15-JUN-98		15-JUN-98		16-JUN-98		16-JUN-98		16-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	0.31	
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	0.49	
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP10		WARP-DP10		WARP-DP11		WARP-DP11		WARP-DP11	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8460		8470		8500		8510		8520	
Sample Date:		26-JUN-98		26-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98	
Depth:		0 - 2		4 - 6		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	4.4		.125	U	.125	U	0.74	
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	0.38		.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	1.4		.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	1.5		.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP12		WARP-DP12		WARP-DP12		WARP-DP13		WARP-DP13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8540		8550		8560		8580		8590	
Sample Date:		15-JUN-98		15-JUN-98		15-JUN-98		15-JUN-98		15-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP13		WARP-DP15		WARP-DP15		WARP-DP15		WARP-DP16	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8600		8660		8670		8680		8700	
Sample Date:		15-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	4.4		.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	6.3		.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	1.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.6	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	1.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	1.6	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		WARP-DP16		WARP-DP16		WARP-DP17		WARP-DP17		WARP-DP17	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8710		8720		8740		8750		8760	
Sample Date:		24-JUN-98		24-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Report Date: 09/19/00

Sample Location:		WARP-DP18		WARP-DP18		WARP-DP18		WARP-DP19		WARP-DP19	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8780		8790		8800		8820		8830	
Sample Date:		25-JUN-98		25-JUN-98		25-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	0.98		.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg										
2-Amino-4-nitrotoluene	mg/kg										
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg										
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg										
4-Nitrotoluene	mg/kg										
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		WARP-DP19		WARP-DP20		WARP-DP20		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8840		8860		8870		8880	
Sample Date:		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg								
2-Amino-4-nitrotoluene	mg/kg								
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg								
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg								
4-Nitrotoluene	mg/kg								
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
WET CHEMISTRY	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total organic carbon	mg/kg	5430		3960		9650		5520		40200	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD06	
Associated Site:		WARP	
Sample No:		11150	
Sample Date:		05-NOV-98	
Depth:		0 - .5	
WET CHEMISTRY	Units	Result	Val Qlfr
Total organic carbon	mg/kg	93400	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
1,1,2,2-Tetrachloroethane	mg/kg	.0031	UJ	.003	UJ	.00345	UJ	.00305	UJ	.0065	UJ
1,1,2-Trichloroethane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
1,1-Dichloroethane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
1,1-Dichloroethene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
1,2-Dichloroethane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
1,2-Dichloroethene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
1,2-Dichloropropane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
2-Butanone	mg/kg	.0125	U	.012	U	.029	J	.012	U	.021	J
2-Hexanone	mg/kg	.0125	U	.012	U	.014	U	.012	U	.0265	U
4-Methyl-2-pentanone	mg/kg	.0125	U	.012	U	.014	U	.012	U	.0265	U
Acetone	mg/kg	.017	B	.012	R	.019	B	.0078	B	.11	J
Benzene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Bromodichloromethane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Bromoform	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Bromomethane	mg/kg	.006	U	.006	U	.007	U	.006	U	.0135	U
Carbon disulfide	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Carbon tetrachloride	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Chlorobenzene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Chloroethane	mg/kg	.006	U	.006	U	.007	U	.006	U	.0135	U
Chloroform	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Chloromethane	mg/kg	.006	U	.006	U	.007	U	.006	U	.0135	U
Dibromochloromethane	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Ethylbenzene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Methylene chloride	mg/kg	.0056	B	.0057	B	.0066	B	.0059	B	.011	B
Styrene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Tetrachloroethene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Toluene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Total xylenes	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
Trichloroethene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD06	
Associated Site:		WARP	
Sample No:		11150	
Sample Date:		05-NOV-98	
Depth:		0 - .5	
VOLATILES	Units	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0125	U
1,1,2,2-Tetrachloroethane	mg/kg	.0125	UJ
1,1,2-Trichloroethane	mg/kg	.0125	U
1,1-Dichloroethane	mg/kg	.0125	U
1,1-Dichloroethene	mg/kg	.0125	U
1,2-Dichloroethane	mg/kg	.0125	U
1,2-Dichloroethene	mg/kg	.0125	U
1,2-Dichloropropane	mg/kg	.0125	U
2-Butanone	mg/kg	.0495	U
2-Hexanone	mg/kg	.0495	U
4-Methyl-2-pentanone	mg/kg	.0495	U
Acetone	mg/kg	.071	J
Benzene	mg/kg	.0125	U
Bromodichloromethane	mg/kg	.0125	U
Bromoform	mg/kg	.0125	U
Bromomethane	mg/kg	.0245	U
Carbon disulfide	mg/kg	.0125	U
Carbon tetrachloride	mg/kg	.0125	U
Chlorobenzene	mg/kg	.0125	U
Chloroethane	mg/kg	.0245	U
Chloroform	mg/kg	.0125	U
Chloromethane	mg/kg	.0245	U
Dibromochloromethane	mg/kg	.0125	U
Ethylbenzene	mg/kg	.0125	U
Methylene chloride	mg/kg	.02	B
Styrene	mg/kg	.0125	U
Tetrachloroethene	mg/kg	.0125	U
Toluene	mg/kg	.0125	U
Total xylenes	mg/kg	.0125	U
Trichloroeth	mg/kg	.0125	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.006	U	.006	U	.007	U	.006	U	.0135	U
cis-1,3-Dichloropropene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U
trans-1,3-Dichloropropene	mg/kg	.0031	U	.003	U	.00345	U	.00305	U	.0065	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD06	
Associated Site:		WARP	
Sample No:		11150	
Sample Date:		05-NOV-98	
Depth:		0 - .5	
VOLATILES	Units	Result	Val Qlfr
Vinyl chloride	mg/kg	.0245	U
cis-1,3-Dichloropropene	mg/kg	.0125	U
trans-1,3-Dichloropropene	mg/kg	.0125	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
1,2-Dichlorobenzene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
1,3-Dichlorobenzene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
1,4-Dichlorobenzene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2,4,5-Trichlorophenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2,4,6-Trichlorophenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2,4-Dichlorophenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2,4-Dimethylphenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2,4-Dinitrophenol	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
2,4-Dinitrotoluene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2,6-Dinitrotoluene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2-Chloronaphthalene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2-Chlorophenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2-Methylnaphthalene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2-Methylphenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
2-Nitroaniline	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
2-Nitrophenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
3,3'-Dichlorobenzidine	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
3-Nitroaniline	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
4,6-Dinitro-2-methylphenol	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
4-Bromophenyl phenyl ether	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
4-Chloro-3-methylphenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
4-Chloroaniline	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
4-Chlorophenyl phenyl ether	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
4-Methylphenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
4-Nitroaniline	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
4-Nitrophenol	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
Acenaphthene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Acenaphthylene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Anthracene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U

Report Date: 09/20/00

Sample Location:		WARP-SD06	
Associated Site:		WARP	
Sample No:		11150	
Sample Date:		05-NOV-98	
Depth:		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.8	U
1,2-Dichlorobenzene	mg/kg	.8	U
1,3-Dichlorobenzene	mg/kg	.8	U
1,4-Dichlorobenzene	mg/kg	.8	U
2,4,5-Trichlorophenol	mg/kg	.8	U
2,4,6-Trichlorophenol	mg/kg	.8	U
2,4-Dichlorophenol	mg/kg	.8	U
2,4-Dimethylphenol	mg/kg	.8	U
2,4-Dinitrophenol	mg/kg	3.95	U
2,4-Dinitrotoluene	mg/kg	.8	U
2,6-Dinitrotoluene	mg/kg	.8	U
2-Chloronaphthalene	mg/kg	.8	U
2-Chlorophenol	mg/kg	.8	U
2-Methylnaphthalene	mg/kg	.8	U
2-Methylphenol	mg/kg	.8	U
2-Nitroaniline	mg/kg	3.95	U
2-Nitrophenol	mg/kg	.8	U
3,3'-Dichlorobenzidine	mg/kg	3.95	U
3-Nitroaniline	mg/kg	3.95	U
4,6-Dinitro-2-methylphenol	mg/kg	3.95	U
4-Bromophenyl phenyl ether	mg/kg	.8	U
4-Chloro-3-methylphenol	mg/kg	.8	U
4-Chloroaniline	mg/kg	.8	U
4-Chlorophenyl phenyl ether	mg/kg	.8	U
4-Methylphenol	mg/kg	.8	U
4-Nitroaniline	mg/kg	3.95	U
4-Nitrophenol	mg/kg	3.95	U
Acenaphthene	mg/kg	.8	U
Acenaphthylene	mg/kg	.8	U
Anthracene	mg/kg	.8	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.051	J	.2	U	.23	U	.2	U	.44	U
Benzo(a)pyrene	mg/kg	.053	J	.2	U	.23	U	.2	U	.44	U
Benzo(b)fluoranthene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Benzo(ghi)perylene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Benzo(k)fluoranthene	mg/kg	.052	J	.2	U	.23	U	.2	U	.44	U
Butyl benzyl phthalate	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Carbazole	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Chrysene	mg/kg	.06	J	.2	U	.23	U	.2	U	.44	U
Dibenz(a,h)anthracene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Dibenzofuran	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Diethyl phthalate	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Dimethyl phthalate	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Fluoranthene	mg/kg	.11	J	.2	U	.23	U	.047	J	.44	U
Fluorene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Hexachlorobenzene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Hexachlorobutadiene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Hexachlorocyclopentadiene	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
Hexachloroethane	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Indeno(1,2,3-cd)pyrene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Isophorone	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Naphthalene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Nitrobenzene	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Pentachlorophenol	mg/kg	1	U	.95	U	1.1	U	.95	U	2.15	U
Phenanthrene	mg/kg	.055	J	.2	U	.23	U	.2	U	.44	U
Phenol	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
Pyrene	mg/kg	.079	J	.2	U	.23	U	.2	U	.44	U
bis(2-Chloroethoxy)methane	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
bis(2-Chloroethyl)ether	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
bis(2-Chloroisopropyl)ether	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
bis(2-Ethylhexyl)phthalate	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U

Report Date: 09/20/00

Sample Location:		WARP-SD06	
Associated Site:		WARP	
Sample No:		11150	
Sample Date:		05-NOV-98	
Depth:		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.8	U
Benzo(a)pyrene	mg/kg	.8	U
Benzo(b)fluoranthene	mg/kg	.8	U
Benzo(ghi)perylene	mg/kg	.8	U
Benzo(k)fluoranthene	mg/kg	.8	U
Butyl benzyl phthalate	mg/kg	.8	U
Carbazole	mg/kg	.8	U
Chrysene	mg/kg	.8	U
Dibenz(a,h)anthracene	mg/kg	.8	U
Dibenzofuran	mg/kg	.8	U
Diethyl phthalate	mg/kg	.8	U
Dimethyl phthalate	mg/kg	.8	U
Fluoranthene	mg/kg	.8	U
Fluorene	mg/kg	.8	U
Hexachlorobenzene	mg/kg	.8	U
Hexachlorobutadiene	mg/kg	.8	U
Hexachlorocyclopentadiene	mg/kg	3.95	U
Hexachloroethane	mg/kg	.8	U
Indeno(1,2,3-cd)pyrene	mg/kg	.8	U
Isophorone	mg/kg	.8	U
Naphthalene	mg/kg	.8	U
Nitrobenzene	mg/kg	.8	U
Pentachlorophenol	mg/kg	3.95	U
Phenanthrene	mg/kg	.8	U
Phenol	mg/kg	.8	U
Pyrene	mg/kg	.8	U
bis(2-Chloroethoxy)methane	mg/kg	.8	U
bis(2-Chloroethyl)ether	mg/kg	.8	U
bis(2-Chloroisopropyl)ether	mg/kg	.8	U
bis(2-Ethylhe thalate	mg/kg	.8	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
di-n-Octyl phthalate	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
n-Nitroso-di-n-propylamine	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U
n-Nitrosodiphenylamine	mg/kg	.205	U	.2	U	.23	U	.2	U	.44	U

Report Date: 09/20/00

Sample Location:	WARP-SD06
Associated Site:	WARP
Sample No:	11150
Sample Date:	05-NOV-98
Depth:	0 - .5

SEMIVOLATILES	Units	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.8	U
di-n-Octyl phthalate	mg/kg	.8	U
n-Nitroso-di-n-propylamine	mg/kg	.8	U
n-Nitrosodiphenylamine	mg/kg	.8	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U
Aroclor 1221	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U
Aroclor 1232	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U
Aroclor 1242	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U
Aroclor 1248	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U
Aroclor 1254	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U
Aroclor 1260	mg/kg	.0205	U	.02	U	.023	U	.02	U	.044	U

Report Date: 09/20/00

Sample Location:	WARP-SD06
Associated Site:	WARP
Sample No:	11150
Sample Date:	05-NOV-98
Depth:	0 - .5

PEST/PCB	Units	Result	Val Qlfr
Aroclor 1016	mg/kg	.08	U
Aroclor 1221	mg/kg	.08	U
Aroclor 1232	mg/kg	.08	U
Aroclor 1242	mg/kg	.08	U
Aroclor 1248	mg/kg	.08	U
Aroclor 1254	mg/kg	.08	U
Aroclor 1260	mg/kg	.08	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PB-WA-SED1		PB-WA-SED1		PB-WA-SED2		PB-WA-SED2		PB-WA-SED3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-SED1-0.2-1.7		PB-WA-SED1-1.7-2.5		PB-WA-SED2-0.2-1.0		PB-WA-SED2-1-2		PB-WA-SED3-0.2-1.0	
Sample Date:		27-OCT-94		27-OCT-94		27-OCT-94		27-OCT-94		27-OCT-94	
Depth:		.2 - 1.7		1.7 - 2.5		.2 - 1		1 - 2		.2 - 1	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.4		3.2		3.95		3.05		3.25	
Arsenic	mg/kg	2.05		1.9		2.4		11.3		1.95	
Barium	mg/kg										
Beryllium	mg/kg	.7		.65		.8		.6		.65	
Cadmium	mg/kg	.7		.65		.8		.6		.65	
Calcium	mg/kg										
Chromium	mg/kg	11		17		22		17		16	
Cobalt	mg/kg										
Copper	mg/kg	1.35		1.3		1.6		3.2		1.3	
Iron	mg/kg										
Lead	mg/kg	19		15		17		12		16	
Magnesium	mg/kg										
Manganese	mg/kg	180		220		190		159		180	
Mercury	mg/kg	.17		.16		.2		.15		.16	
Nickel	mg/kg	12		23		19		20		16	
Potassium	mg/kg	1500									
Selenium	mg/kg	2.7		2.55		3.15		2.45		2.6	
Silver	mg/kg	.7		.65		.8		.6		.65	
Sodium	mg/kg										
Thallium	mg/kg	3.4		3.2		3.95		3.05		3.25	
Vanadium	mg/kg										
Zinc	mg/kg	46		74		94		70		57	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PB-WA-SED3		PB-WA-SED4		PB-WA-SED4		PB-WA-SED5		PB-WA-SED5	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-SED3-1.0-2.0		PB-WA-SED4-0.2-0.5		PB-WA-SED4-0.5-1.5		PB-WA-SED5-0.2-0.5		PB-WA-SED5-0.5-1.5	
Sample Date:		27-OCT-94		28-OCT-94		28-OCT-94		28-OCT-94		28-OCT-94	
Depth:		1 - 2		.2 - 0.5		.5 - 1.5		.2 - 0.5		.5 - 1.5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg										
Antimony	mg/kg	3.05		3.4		3		3.5		3.05	
Arsenic	mg/kg	5.2		2.05		4		4.2		7.2	
Barium	mg/kg										
Beryllium	mg/kg	.6		.7		.6		.7		.6	
Cadmium	mg/kg	.6		.7		.6		.7		.6	
Calcium	mg/kg										
Chromium	mg/kg	22		9.9		13		11.5		17	
Cobalt	mg/kg										
Copper	mg/kg	1.2		3.9		3.9		1.4		1.2	
Iron	mg/kg										
Lead	mg/kg	12		19		10.7		21		13	
Magnesium	mg/kg										
Manganese	mg/kg	220		149		262		169		329	
Mercury	mg/kg	.15		.17		.15		.175		.15	
Nickel	mg/kg	23		8.8		18		10.7		20	
Potassium	mg/kg										
Selenium	mg/kg	2.45		2.7		2.4		2.8		2.45	
Silver	mg/kg	.6		.7		.6		.7		.6	
Sodium	mg/kg										
Thallium	mg/kg	3.05		3.4		3		3.5		3.05	
Vanadium	mg/kg										
Zinc	mg/kg	73		36		50		44		62	

Report Date: 09/20/00

Sample Location:		PB-WA-SED6		PB-WA-SED6		PB-WA-SED7		WARP-SD01		WARP-SD02	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-SED6-0.2-1.3		PB-WA-SED6-1.3-1.7		PB-WA-SED7-0.2-1.0		11100		11110	
Sample Date:		28-OCT-94		28-OCT-94		27-OCT-94		05-NOV-98		05-NOV-98	
Depth:		.2 - 1.3		1.3 - 1.7		.2 - 1		0 - .5		0 - .5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg							3170		2450	
Antimony	mg/kg	3.4		3.15		4.05		3.75	UJ	3.6	UJ
Arsenic	mg/kg	2.05		1.9		2.4		5.4		3.5	
Barium	mg/kg							26.6		12.05	U
Beryllium	mg/kg	.7		.65		.8		.31	U	.3	U
Cadmium	mg/kg	.7		.65		.8		.31	U	.3	U
Calcium	mg/kg							10800		13900	
Chromium	mg/kg	14		19		10		6.7		5.3	
Cobalt	mg/kg							10.9		6.4	
Copper	mg/kg	1.35		1.25		1.6		13.7		8.8	
Iron	mg/kg							14900		9900	
Lead	mg/kg	16		13		16		9.7		6.5	
Magnesium	mg/kg							2110		2720	
Manganese	mg/kg	164		250		160		305		231	
Mercury	mg/kg	.17		.155		.2		.0205	U	.02	U
Nickel	mg/kg	14		21		13		23.0		13.7	
Potassium	mg/kg							311.5	U	301.5	U
Selenium	mg/kg	2.75		2.55		3.25		.31	U	.3	U
Silver	mg/kg	.7		.65		.8		.6	U	.6	U
Sodium	mg/kg							311.5	U	301.5	U
Thallium	mg/kg	3.4		3.15		4.05		.6	U	.6	U
Vanadium	mg/kg							3.1	U	3	U
Zinc	mg/kg	59		73		63		48.0		35.1	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD03		WARP-SD04		WARP-SD05		WARP-SD06	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		11120		11130		11140		11150	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4260		3230		6880		9600	
Antimony	mg/kg	4.15	UJ	3.65	UJ	8	UJ	14.8	UJ
Arsenic	mg/kg	7.3		8.6		4.6		8.7	
Barium	mg/kg	36.0		34.8		65.0		49.25	U
Beryllium	mg/kg	.345	U	.305	U	.65	U	1.25	U
Cadmium	mg/kg	.345	U	.305	U	.65	U	1.25	U
Calcium	mg/kg	12300		16000		6710		74700	
Chromium	mg/kg	8.1		7.4		12.6		28.7	
Cobalt	mg/kg	10.6		10.8		6.65	U	12.3	U
Copper	mg/kg	15.0		9.8		15.2		24.5	
Iron	mg/kg	16500		24300		16000		18000	
Lead	mg/kg	9.4		8.1		22.6		32.1	
Magnesium	mg/kg	2520		2950		3130		6770	
Manganese	mg/kg	290		255		338		726	
Mercury	mg/kg	.023	U	.02	U	.044	U	.08	U
Nickel	mg/kg	24.4		18.3		15.2		24.5	
Potassium	mg/kg	821		303	U	665	U	1230	U
Selenium	mg/kg	.345	U	.305	U	.65	U	1.25	U
Silver	mg/kg	.7	U	.6	U	1.35	U	2.45	U
Sodium	mg/kg	346.5	U	303	U	665	U	1230	U
Thallium	mg/kg	.7	U	.6	U	1.35	U	2.45	U
Vanadium	mg/kg	3.45	U	3.05	U	6.65	U	25.0	
Zinc	mg/kg	58.4		45.3		54.4		77.0	

Report Date: 09/20/00

Sample Location:		PB-WA-SED1		PB-WA-SED7	
Associated Site:		WARP		WARP	
Sample No:		PB-WA-SED1-0.2-1.7		PB-WA-SED8-0.2-1.7	
Sample Date:		27-OCT-94		27-OCT-94	
Depth:		.2 - 1.7		.2 - 1.7	
GEN CHEMISTRY	Units	Result	Val Qlfr	Result	Val Qlfr
Alkalinity	mg/kg	680			
Nitrate	mg/kg	3.4			
Phosphorous	mg/kg	3.1			
Sulfate	mg/kg	84.5			
Total organic carbon	mg/kg	46		44	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PB-WA-SED1		PB-WA-SED1		PB-WA-SED2		PB-WA-SED2		PB-WA-SED3	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-SED1-0.2-1.7		PB-WA-SED1-1.7-2.5		PB-WA-SED2-0.2-1.0		PB-WA-SED2-1-2		PB-WA-SED3-0.2-1.0	
Sample Date:		27-OCT-94		27-OCT-94		27-OCT-94		27-OCT-94		27-OCT-94	
Depth:		.2 - 1.7		1.7 - 2.5		.2 - 1		1 - 2		.2 - 1	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
1,3-Dinitrobenzene	mg/kg	.125		.125		.125		.125		.125	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13			
RDX	mg/kg										
Tetryl	mg/kg										

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PB-WA-SED3		PB-WA-SED4		PB-WA-SED4		PB-WA-SED5		PB-WA-SED5	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-SED3-1.0-2.0		PB-WA-SED4-0.2-0.5		PB-WA-SED4-0.5-1.5		PB-WA-SED5-0.2-0.5		PB-WA-SED5-0.5-1.5	
Sample Date:		27-OCT-94		28-OCT-94		28-OCT-94		28-OCT-94		28-OCT-94	
Depth:		1 - 2		.2 - 0.5		.5 - 1.5		.2 - 0.5		.5 - 1.5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.6		.125		0.8		.125		0.6	
1,3-Dinitrobenzene	mg/kg	0.7		.125		0.3		.125		0.7	
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2,4-Dinitrotoluene	mg/kg	0.5		0.3		0.4		.125		0.7	
2,6-Dinitrotoluene	mg/kg	.13		.13		.13		.13		.13	
2-Amino-4,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
2-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3,4-Dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
3-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
4-Nitrotoluene	mg/kg	.125		.125		.125		.125		.125	
HMX	mg/kg										
Nitrobenzene	mg/kg	.13		.13		.13		.13		.13	
RDX	mg/kg										
Tetryl	mg/kg										

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PB-WA-SED6		PB-WA-SED6		PB-WA-SED7		WARP-SD01		WARP-SD02	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		PB-WA-SED6-0.2-1.3		PB-WA-SED6-1.3-1.7		PB-WA-SED7-0.2-1.0		11100		11110	
Sample Date:		28-OCT-94		28-OCT-94		27-OCT-94		05-NOV-98		05-NOV-98	
Depth:		.2 - 1.3		1.3 - 1.7		.2 - 1		0 - .5		0 - .5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125		.125		.125		.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125		0.7		.125		.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	0.4		0.7		.125		.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	0.4		.13		.13		.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg	.125		0.3		.125		.125	U	.125	U
2-Amino-4-nitrotoluene	mg/kg	.125		.125		.125					
2-Nitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
3,4-Dinitrotoluene	mg/kg	.125		.125		.125					
3-Nitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125		.125		.125		.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg	.125		.125		.125					
4-Nitrotoluene	mg/kg	.125		.125		.125					
HMX	mg/kg							.25	U	.25	U
Nitrobenzene	mg/kg	.13		.13		.13		.125	U	.125	U
RDX	mg/kg							.25	U	.25	U
Tetryl	mg/kg							.325	U	.325	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		WARP-SD03		WARP-SD04		WARP-SD05		WARP-SD06	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		11120		11130		11140		11150	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2-Amino-4-nitrotoluene	mg/kg								
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
3,4-Dinitrotoluene	mg/kg								
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
4-Amino-2-nitrotoluene	mg/kg								
4-Nitrotoluene	mg/kg								
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
WATER QUALITY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Hardness		ug/L	380000		408000		400000		420000		372000	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
WATER QUALITY	Fltr	Units	Result	Val Qlfr
Hardness		ug/L	592000	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,1,2,2-Tetrachloroethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,1,2-Trichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,1-Dichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,1-Dichloroethene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,2-Dichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,2-Dichloroethene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
1,2-Dichloropropane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
2-Butanone		ug/L	2.5	R	2.5	R	2.5	R	2.5	R	2.5	R
2-Hexanone		ug/L	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
4-Methyl-2-pentanone		ug/L	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
Acetone		ug/L	1.4	B	2.6	B	2.4	B	3.1	B	1.6	B
Benzene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Bromodichloromethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Bromoform		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Bromomethane		ug/L	0.22	J	1	U	0.16	J	0.21	J	0.21	J
Carbon disulfide		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Carbon tetrachloride		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Chlorobenzene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Chloroethane		ug/L	1	U	1	U	1	U	1	U	1	U
Chloroform		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Chloromethane		ug/L	1	U	1	U	1	U	1	U	1	U
Dibromochloromethane		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Ethylbenzene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Methylene chloride		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Styrene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Tetrachloroethene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Toluene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Total xylenes		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr
1,1,1-Trichloroethane		ug/L	.5	U
1,1,2,2-Tetrachloroethane		ug/L	.5	U
1,1,2-Trichloroethane		ug/L	.5	U
1,1-Dichloroethane		ug/L	.5	U
1,1-Dichloroethene		ug/L	.5	U
1,2-Dichloroethane		ug/L	.5	U
1,2-Dichloroethene		ug/L	.5	U
1,2-Dichloropropane		ug/L	.5	U
2-Butanone		ug/L	2.5	R
2-Hexanone		ug/L	2.5	U
4-Methyl-2-pentanone		ug/L	2.5	U
Acetone		ug/L	2.7	B
Benzene		ug/L	.5	U
Bromodichloromethane		ug/L	.5	U
Bromoform		ug/L	.5	U
Bromomethane		ug/L	0.16	J
Carbon disulfide		ug/L	.5	U
Carbon tetrachloride		ug/L	.5	U
Chlorobenzene		ug/L	.5	U
Chloroethane		ug/L	1	U
Chloroform		ug/L	.5	U
Chloromethane		ug/L	1	U
Dibromochloromethane		ug/L	.5	U
Ethylbenzene		ug/L	.5	U
Methylene chloride		ug/L	.5	U
Styrene		ug/L	.5	U
Tetrachloroethene		ug/L	.5	U
Toluene		ug/L	.5	U
Total xylenes		ug/L	.5	U

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Trichloroethene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Vinyl chloride		ug/L	1	U	1	U	1	U	1	U	1	U
cis-1,3-Dichloropropene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
trans-1,3-Dichloropropene		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr
Trichloroethene		ug/L	.5	U
Vinyl chloride		ug/L	1	U
cis-1,3-Dichloropropene		ug/L	.5	U
trans-1,3-Dichloropropene		ug/L	.5	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene		ug/L	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene		ug/L	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene		ug/L	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene		ug/L	5	U	5	U	5	U	5	U	5	U
2,4,5-Trichlorophenol		ug/L	5	U	5	U	5	U	5	U	5	U
2,4,6-Trichlorophenol		ug/L	5	U	5	U	5	U	5	U	5	U
2,4-Dichlorophenol		ug/L	5	U	5	U	5	U	5	U	5	U
2,4-Dimethylphenol		ug/L	5	U	5	U	5	U	5	U	5	U
2,4-Dinitrophenol		ug/L	25	U	25	U	25	U	25	U	25	U
2,4-Dinitrotoluene		ug/L	5	U	5	U	5	U	5	U	5	U
2,6-Dinitrotoluene		ug/L	5	U	5	U	5	U	5	U	5	U
2-Chloronaphthalene		ug/L	5	U	5	U	5	U	5	U	5	U
2-Chlorophenol		ug/L	5	U	5	U	5	U	5	U	5	U
2-Methylnaphthalene		ug/L	5	U	5	U	5	U	5	U	5	U
2-Methylphenol		ug/L	5	U	5	U	5	U	5	U	5	U
2-Nitroaniline		ug/L	25	U	25	U	25	U	25	U	25	U
2-Nitrophenol		ug/L	5	U	5	U	5	U	5	U	5	U
3,3'-Dichlorobenzidine		ug/L	25	U	25	U	25	U	25	U	25	U
3-Nitroaniline		ug/L	25	U	25	U	25	U	25	U	25	U
4,6-Dinitro-2-methylphenol		ug/L	25	U	25	U	25	U	25	U	25	U
4-Bromophenyl phenyl ether		ug/L	5	U	5	U	5	U	5	U	5	U
4-Chloro-3-methylphenol		ug/L	5	U	5	U	5	U	5	U	5	U
4-Chloroaniline		ug/L	5	U	5	U	5	U	5	U	5	U
4-Chlorophenyl phenyl ether		ug/L	5	U	5	U	5	U	5	U	5	U
4-Methylphenol		ug/L	5	U	5	U	5	U	5	U	5	U
4-Nitroaniline		ug/L	25	U	25	U	25	U	25	U	25	U
4-Nitrophenol		ug/L	25	U	25	U	25	U	25	U	25	U
Acenaphthene		ug/L	5	U	5	U	5	U	5	U	5	U
Acenaphthylene		ug/L	5	U	5	U	5	U	5	U	5	U

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr
1,2,4-Trichlorobenzene		ug/L	5	UJ
1,2-Dichlorobenzene		ug/L	5	UJ
1,3-Dichlorobenzene		ug/L	5	UJ
1,4-Dichlorobenzene		ug/L	5	UJ
2,4,5-Trichlorophenol		ug/L	5	UJ
2,4,6-Trichlorophenol		ug/L	5	UJ
2,4-Dichlorophenol		ug/L	5	UJ
2,4-Dimethylphenol		ug/L	5	UJ
2,4-Dinitrophenol		ug/L	25	UJ
2,4-Dinitrotoluene		ug/L	5	UJ
2,6-Dinitrotoluene		ug/L	5	UJ
2-Chloronaphthalene		ug/L	5	UJ
2-Chlorophenol		ug/L	5	UJ
2-Methylnaphthalene		ug/L	5	UJ
2-Methylphenol		ug/L	5	UJ
2-Nitroaniline		ug/L	25	UJ
2-Nitrophenol		ug/L	5	UJ
3,3'-Dichlorobenzidine		ug/L	25	UJ
3-Nitroaniline		ug/L	25	UJ
4,6-Dinitro-2-methylphenol		ug/L	25	UJ
4-Bromophenyl phenyl ether		ug/L	5	UJ
4-Chloro-3-methylphenol		ug/L	5	UJ
4-Chloroaniline		ug/L	5	UJ
4-Chlorophenyl phenyl ether		ug/L	5	UJ
4-Methylphenol		ug/L	5	UJ
4-Nitroaniline		ug/L	25	UJ
4-Nitrophenol		ug/L	25	UJ
Acenaphthene		ug/L	5	UJ
Acenaphthylene		ug/L	5	UJ

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Anthracene		ug/L	5	U	5	U	5	U	5	U	5	U
Benzo(a)anthracene		ug/L	5	U	5	U	5	U	5	U	5	U
Benzo(a)pyrene		ug/L	5	U	5	U	5	U	5	U	5	U
Benzo(b)fluoranthene		ug/L	5	U	5	U	5	U	5	U	5	U
Benzo(ghi)perylene		ug/L	5	U	5	U	5	U	5	U	5	U
Benzo(k)fluoranthene		ug/L	5	U	5	U	5	U	5	U	5	U
Butyl benzyl phthalate		ug/L	5	U	5	U	5	U	5	U	5	U
Carbazole		ug/L	5	U	5	U	5	U	5	U	5	U
Chrysene		ug/L	5	U	5	U	5	U	5	U	5	U
Dibenz(a,h)anthracene		ug/L	5	U	5	U	5	U	5	U	5	U
Dibenzofuran		ug/L	5	U	5	U	5	U	5	U	5	U
Diethyl phthalate		ug/L	5	U	5	U	5	U	5	U	5	U
Dimethyl phthalate		ug/L	5	U	5	U	5	U	5	U	5	U
Fluoranthene		ug/L	5	U	5	U	5	U	5	U	5	U
Fluorene		ug/L	5	U	5	U	5	U	5	U	5	U
Hexachlorobenzene		ug/L	5	U	5	U	5	U	5	U	5	U
Hexachlorobutadiene		ug/L	5	U	5	U	5	U	5	U	5	U
Hexachlorocyclopentadiene		ug/L	25	U	25	U	25	U	25	U	25	U
Hexachloroethane		ug/L	5	U	5	U	5	U	5	U	5	U
Indeno(1,2,3-cd)pyrene		ug/L	5	U	5	U	5	U	5	U	5	U
Isophorone		ug/L	5	U	5	U	5	U	5	U	5	U
Naphthalene		ug/L	5	U	5	U	5	U	5	U	5	U
Nitrobenzene		ug/L	5	U	5	U	5	U	5	U	5	U
Pentachlorophenol		ug/L	25	U	25	U	25	U	25	U	25	U
Phenanthrene		ug/L	5	U	5	U	5	U	5	U	5	U
Phenol		ug/L	6.9	B	4.0	B	4.5	B	1.4	B	1.7	B
Pyrene		ug/L	5	U	5	U	5	U	5	U	5	U
bis(2-Chloroethoxy)methane		ug/L	5	U	5	U	5	U	5	U	5	U
bis(2-Chloroethyl)ether		ug/L	5	U	5	U	5	U	5	U	5	U

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr
Anthracene		ug/L	5	UJ
Benzo(a)anthracene		ug/L	5	UJ
Benzo(a)pyrene		ug/L	5	UJ
Benzo(b)fluoranthene		ug/L	5	UJ
Benzo(ghi)perylene		ug/L	5	UJ
Benzo(k)fluoranthene		ug/L	5	UJ
Butyl benzyl phthalate		ug/L	5	UJ
Carbazole		ug/L	5	UJ
Chrysene		ug/L	5	UJ
Dibenz(a,h)anthracene		ug/L	5	UJ
Dibenzofuran		ug/L	5	UJ
Diethyl phthalate		ug/L	5	UJ
Dimethyl phthalate		ug/L	5	UJ
Fluoranthene		ug/L	5	UJ
Fluorene		ug/L	5	UJ
Hexachlorobenzene		ug/L	5	UJ
Hexachlorobutadiene		ug/L	5	UJ
Hexachlorocyclopentadiene		ug/L	25	UJ
Hexachloroethane		ug/L	5	UJ
Indeno(1,2,3-cd)pyrene		ug/L	5	UJ
Isophorone		ug/L	5	UJ
Naphthalene		ug/L	5	UJ
Nitrobenzene		ug/L	5	UJ
Pentachlorophenol		ug/L	25	UJ
Phenanthrene		ug/L	5	UJ
Phenol		ug/L	2.2	B
Pyrene		ug/L	5	UJ
bis(2-Chloroethoxy)methane		ug/L	5	UJ
bis(2-Chloroethyl)		ug/L	5	UJ

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether		ug/L	5	U	5	U	5	U	5	U	5	U
bis(2-Ethylhexyl)phthalate		ug/L	5	U	2.7	B	5	U	5	U	5	U
di-n-Butyl phthalate		ug/L	5	U	5	U	5	U	5	U	5	U
di-n-Octyl phthalate		ug/L	5	U	5	U	5	U	5	U	7.8	J
n-Nitroso-di-n-propylamine		ug/L	5	U	5	U	5	U	5	U	5	U
n-Nitrosodiphenylamine		ug/L	5	U	5	U	5	U	5	U	5	U

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr
bis(2-Chloroisopropyl)ether		ug/L	5	UJ
bis(2-Ethylhexyl)phthalate		ug/L	1.7	B
di-n-Butyl phthalate		ug/L	5	UJ
di-n-Octyl phthalate		ug/L	5	UJ
n-Nitroso-di-n-propylamine		ug/L	5	UJ
n-Nitrosodiphenylamine		ug/L	5	UJ

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
PEST/PCB	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Aroclor 1221		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Aroclor 1232		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Aroclor 1242		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Aroclor 1248		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Aroclor 1254		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U
Aroclor 1260		ug/L	.5	U	.5	U	.5	U	.5	U	.5	U

Report Date: 09/20/00

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
PEST/PCB	Fltr	Units	Result	Val Qlfr
Aroclor 1016		ug/L	.5	U
Aroclor 1221		ug/L	.5	U
Aroclor 1232		ug/L	.5	U
Aroclor 1242		ug/L	.5	U
Aroclor 1248		ug/L	.5	U
Aroclor 1254		ug/L	.5	U
Aroclor 1260		ug/L	.5	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Sample Date:			25-OCT-94		25-OCT-94		25-OCT-94		25-OCT-94		27-OCT-94	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L										
Aluminum	Y	ug/L										
Antimony		ug/L	25		25		25		25		25	
Antimony	Y	ug/L	25		25		25		25		25	
Arsenic		ug/L	15		15		15		15		15	
Arsenic	Y	ug/L	15		15		15		15		15	
Barium		ug/L										
Barium	Y	ug/L										
Beryllium		ug/L	5		5		5		5		5	
Beryllium	Y	ug/L	5		5		5		5		5	
Cadmium		ug/L	5		5		5		5		5	
Cadmium	Y	ug/L	5		5		5		5		5	
Calcium		ug/L										
Calcium	Y	ug/L										
Chromium		ug/L	5		5		5		5		10	
Chromium	Y	ug/L	5		5		5		5		5	
Cobalt		ug/L										
Cobalt	Y	ug/L										
Copper		ug/L	10		10		10		10		10	
Copper	Y	ug/L	10		10		10		10		10	
Iron		ug/L										
Iron	Y	ug/L										
Lead		ug/L	12.5		12.5		77		12.5		12.5	
Lead	Y	ug/L	12.5		12.5		12.5		12.5		12.5	
Magnesium		ug/L										
Magnesium	Y	ug/L										
Manganese		ug/L	190		260		230		260		1600	
Manganese	Y	ug/L	150		210		210		200		1300	
Mercury		ug/L	.25		.25		.25		.25		.25	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PB-WA-SW7		WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW7		12100		12110		12120		12130	
Sample Date:			25-OCT-94		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L			631	J	100	U	300	J	100	U
Aluminum	Y	ug/L			100	U	100	U	233		100	U
Antimony		ug/L	25		30	U	30	U	30	U	30	U
Antimony	Y	ug/L	25		30	U	30	U	30	U	30	U
Arsenic		ug/L	15		5	U	5	U	5	U	5	U
Arsenic	Y	ug/L	15		5	U	5	U	5	U	5	U
Barium		ug/L			100	U	100	U	100	U	100	U
Barium	Y	ug/L			100	U	100	U	100	U	100	U
Beryllium		ug/L	5		2.5	U	2.5	U	2.5	U	2.5	U
Beryllium	Y	ug/L	5		2.5	U	2.5	U	2.5	U	2.5	U
Cadmium		ug/L	5		2.5	U	2.5	U	2.5	U	2.5	U
Cadmium	Y	ug/L	5		2.5	U	2.5	U	2.5	U	2.5	U
Calcium		ug/L			107000		106000		106000		105000	
Calcium	Y	ug/L			104000		106000		104000		103000	
Chromium		ug/L	5		5	U	5	U	5	U	5	U
Chromium	Y	ug/L	5		5	U	5	U	5	U	5	U
Cobalt		ug/L			25	U	25	U	25	U	25	U
Cobalt	Y	ug/L			25	U	25	U	25	U	25	U
Copper		ug/L	10		12.5	U	12.5	U	12.5	U	12.5	U
Copper	Y	ug/L	10		12.5	U	12.5	U	12.5	U	12.5	U
Iron		ug/L			1300		126		747		646	
Iron	Y	ug/L			153		50	U	484		589	
Lead		ug/L	54		1.5	U	1.5	U	1.5	U	1.5	U
Lead	Y	ug/L	12.5		1.5	U	1.5	U	1.5	U	1.5	U
Magnesium		ug/L			26000		26500		26200		25800	
Magnesium	Y	ug/L			25600		26500		25700		25400	
Manganese		ug/L	240		890		30.6		261		126	
Manganese	Y	ug/L	230		218		7.5	U	97.2		107	
Mercury		ug/L	.25			U	.1	U	.1	U		U

Report Date: 09/20/00

Sample Location:			WARP-SW05		WARP-SW06	
Associated Site:			WARP		WARP	
Sample No:			12140		12150	
Sample Date:			05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	13800	J	12400	J
Aluminum	Y	ug/L	6340		11400	
Antimony		ug/L	30	U	30	U
Antimony	Y	ug/L	30	U	30	U
Arsenic		ug/L	20.2		21.8	
Arsenic	Y	ug/L	10.9		17.2	
Barium		ug/L	100	U	100	U
Barium	Y	ug/L	100	U	100	U
Beryllium		ug/L	2.5	U	2.5	U
Beryllium	Y	ug/L	2.5	U	2.5	U
Cadmium		ug/L	2.5	U	2.5	U
Cadmium	Y	ug/L	2.5	U	2.5	U
Calcium		ug/L	31100		115000	
Calcium	Y	ug/L	27600		71500	
Chromium		ug/L	17.4		23.3	J
Chromium	Y	ug/L	5	U	21.2	J
Cobalt		ug/L	25	U	25	U
Cobalt	Y	ug/L	25	U	25	U
Copper		ug/L	12.5	U	12.5	U
Copper	Y	ug/L	12.5	U	12.5	U
Iron		ug/L	21100		19000	
Iron	Y	ug/L	8630		15500	
Lead		ug/L	25.0		32.9	
Lead	Y	ug/L	7.2		20.4	J
Magnesium		ug/L	46500		50700	
Magnesium	Y	ug/L	44300		49100	
Manganese		ug/L	1150		1550	
Manganese	Y	ug/L	669		907	
Mercury		ug/L	.1	U	.1	U

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Sample Date:			25-OCT-94		25-OCT-94		25-OCT-94		25-OCT-94		27-OCT-94	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Mercury	Y	ug/L	.25		.25		.25		.25		.25	
Nickel		ug/L	10		10		10		10		20	
Nickel	Y	ug/L	10		10		10		10		10	
Potassium		ug/L										
Potassium	Y	ug/L										
Selenium		ug/L	20		20		20		20		20	
Selenium	Y	ug/L	20		20		20		20		20	
Silver		ug/L	5		5		5		5		5	
Silver	Y	ug/L	5		5		5		5		5	
Sodium		ug/L										
Sodium	Y	ug/L										
Thallium		ug/L	25		25		25		25		25	
Thallium	Y	ug/L	25		25		25		25		25	
Vanadium		ug/L										
Vanadium	Y	ug/L										
Zinc		ug/L	10		10		43		46		70	
Zinc	Y	ug/L	20		23		10		10		10	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PB-WA-SW7		WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW7		12100		12110		12120		12130	
Sample Date:			25-OCT-94		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Mercury	Y	ug/L	.25		.1	U	.1	U	.1	U	.1	U
Nickel		ug/L	10		20	U	20	U	20	U	20	U
Nickel	Y	ug/L	10		20	U	20	U	20	U	20	U
Potassium		ug/L			9400		9730		9750		9910	
Potassium	Y	ug/L			8870		9340		9080		9370	
Selenium		ug/L	20		2.5	U	2.5	U	2.5	U	2.5	U
Selenium	Y	ug/L	20		2.5	U	2.5	U	2.5	U	2.5	U
Silver		ug/L	5		5	U	5	U	5	U	5	U
Silver	Y	ug/L	5	UJ	5	U	5	U	5	U	5	U
Sodium		ug/L			38200		39300		38300		39000	
Sodium	Y	ug/L			37400		38800		37200		37900	
Thallium		ug/L	25		5	U	5	U	5	U	5	U
Thallium	Y	ug/L	25		5	U	5	U	5	U	5	U
Vanadium		ug/L			25	U	25	U	25	U	25	U
Vanadium	Y	ug/L			25	U	25	U	25	U	25	U
Zinc		ug/L	26		27.0		10	U	10	U	10	U
Zinc	Y	ug/L	10		10	U	10	U	10	U	10	U

Report Date: 09/20/00

Sample Location:			WARP-SW05		WARP-SW06	
Associated Site:			WARP		WARP	
Sample No:			12140		12150	
Sample Date:			05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Mercury	Y	ug/L	.1	U	.1	U
Nickel		ug/L	20	U	20	U
Nickel	Y	ug/L	20	U	20	U
Potassium		ug/L	5590		5180	
Potassium	Y	ug/L	2500	U	5900	
Selenium		ug/L	2.5	U	2.5	U
Selenium	Y	ug/L	2.5	U	2.5	U
Silver		ug/L	5	U	5	U
Silver	Y	ug/L	5	U	5	U
Sodium		ug/L	104000		107000	
Sodium	Y	ug/L	103000		112000	
Thallium		ug/L	5	U	5	U
Thallium	Y	ug/L	5	U	5	U
Vanadium		ug/L	25	U	52.2	
Vanadium	Y	ug/L	25	U	25	U
Zinc		ug/L	84.8		92.5	
Zinc	Y	ug/L	42.3		68.0	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Sample Date:			25-OCT-94		25-OCT-94		25-OCT-94		25-OCT-94		27-OCT-94	
GEN CHEMISTRY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total suspended solids		ug/L	17000		21000		21000		24000		220000	

Sample Location:			PB-WA-SW7	
Associated Site:			WARP	
Sample No:			PB-WA-SW7	
Sample Date:			25-OCT-94	
GEN CHEMISTRY	Fltr	Units	Result	Val Qlfr
Total suspended solids		ug/L	20000	

Plum Brook Ordnance Works
West Area Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW1		PB-WA-SW2		PB-WA-SW3		PB-WA-SW4		PB-WA-SW5	
Sample Date:			25-OCT-94		25-OCT-94		25-OCT-94		25-OCT-94		27-OCT-94	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	.225		.225		.225		.225		.225	
1,3-Dinitrobenzene		ug/L	0.3		.075		.075		.075		.075	
2,4,6-Trinitrotoluene		ug/L	.32		.32		.32		.32		.32	
2,4-Dinitrotoluene		ug/L	0.5		.05		.05		.05		.05	
2,6-Dinitrotoluene		ug/L	.05		.05		.05		.05		0.8	
2-Amino-4,6-dinitrotoluene		ug/L	.08		.08		.08		.08		.08	
2-Amino-4-nitrotoluene		ug/L	.47		.47		.47		.47		.47	
2-Nitrotoluene		ug/L	.205		.205		.205		.205		.205	
3,4-Dinitrotoluene		ug/L	0.5		0.6		0.6		0.6		.105	
3-Nitrotoluene		ug/L	.7		2.3		2.4		2.5		54	
4-Amino-2,6-dinitrotoluene		ug/L	.785		.785		.785		.785		.785	
4-Amino-2-nitrotoluene		ug/L	.275		.275		0.6		.275		.275	
4-Nitrotoluene		ug/L	.31		.31		.31		.31		.31	
HMX		ug/L										
Nitrobenzene		ug/L	.325		.325		.325		.325		.325	
RDX		ug/L										
Tetryl		ug/L										

Sample Location:			PB-WA-SW7		WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			PB-WA-SW7		12100		12110		12120		12130	
Sample Date:			25-OCT-94		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	.225		.1	U	.1	U	.1	U	.1	U
1,3-Dinitrobenzene		ug/L	.075		.1	U	.1	U	.1	U	.1	U
2,4,6-Trinitrotoluene		ug/L	.32		.1	U	.1	U	.1	U	.1	U
2,4-Dinitrotoluene		ug/L	.05		.1	U	.1	U	.1	U	.1	U
2,6-Dinitrotoluene		ug/L	.05		.1	U	.1	U	.1	U	.1	U
2-Amino-4,6-dinitrotoluene		ug/L	.08		.1	U	.1	U	.1	U	.1	U
2-Amino-4-nitrotoluene		ug/L	.47									
2-Nitrotoluene		ug/L	.205		.1	U	.1	U	.1	U	.1	U
3,4-Dinitrotoluene		ug/L	.105									
3-Nitrotoluene		ug/L	2.2		.1	U	.1	U	.1	U	.1	U
4-Amino-2,6-dinitrotoluene		ug/L	.785		.1	U	.1	U	.1	U	.1	U
4-Amino-2-nitrotoluene		ug/L	.275									
4-Nitrotoluene		ug/L	.31									
HMX		ug/L			.25	U	.25	U	.25	U	.25	U
Nitrobenzene		ug/L	.325		.1	U	.1	U	.1	U	.1	U
RDX		ug/L			.25	U	.25	U	.25	U	.25	U
Tetryl		ug/L			.1	U	.1	U	.1	U	.1	U

Report Date: 09/20/00

Sample Location:			WARP-SW05		WARP-SW06	
Associated Site:			WARP		WARP	
Sample No:			12140		12150	
Sample Date:			05-NOV-98		05-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	.1	U	.1	U
1,3-Dinitrobenzene		ug/L	.1	U	.1	U
2,4,6-Trinitrotoluene		ug/L	.1	U	.1	U
2,4-Dinitrotoluene		ug/L	.1	U	.1	U
2,6-Dinitrotoluene		ug/L	.1	U	.1	U
2-Amino-4,6-dinitrotoluene		ug/L	.1	U	.1	U
2-Amino-4-nitrotoluene		ug/L				
2-Nitrotoluene		ug/L	.1	U	.1	U
3,4-Dinitrotoluene		ug/L				
3-Nitrotoluene		ug/L	.1	U	.1	U
4-Amino-2,6-dinitrotoluene		ug/L	.1	U	.1	U
4-Amino-2-nitrotoluene		ug/L				
4-Nitrotoluene		ug/L				
HMX		ug/L	.25	U	.25	U
Nitrobenzene		ug/L	.1	U	.1	U
RDX		ug/L	.25	U	.25	U
Tetryl		ug/L	.1	U	.1	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7260		7290		7320		7400	
Sample Date:		11-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		08-JUN-98	
Depth:		0 - 2		8 - 10		4 - 5		0 - 2		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
1,1,2,2-Tetrachloroethane	mg/kg	.0031	UJ	.00335	U	.00315	U	.003	UJ	.00295	U
1,1,2-Trichloroethane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
1,1-Dichloroethane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
1,1-Dichloroethene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
1,2-Dichloroethane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
1,2-Dichloroethene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
1,2-Dichloropropane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
2-Butanone	mg/kg	.0125	U	.0135	U	.0125	U	.012	U	.012	U
2-Hexanone	mg/kg	.0125	U	.0135	U	.0125	U	.012	U	.012	U
4-Methyl-2-pentanone	mg/kg	.0125	U	.0135	U	.0125	U	.012	U	.012	U
Acetone	mg/kg	.0125	R	.0135	U	.0125	U	.012	U	.012	U
Benzene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Bromodichloromethane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Bromoform	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Bromomethane	mg/kg	.006	U	.0065	U	.0065	U	.006	U	.006	U
Carbon disulfide	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Carbon tetrachloride	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Chlorobenzene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Chloroethane	mg/kg	.006	U	.0065	U	.0065	U	.006	U	.006	U
Chloroform	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Chloromethane	mg/kg	.006	U	.0065	U	.0065	U	.006	U	.006	U
Dibromochloromethane	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Ethylbenzene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Methylene chloride	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Styrene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Tetrachloroethene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Toluene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Total xylenes	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
Trichloroethene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U

Plum Brook Ordnance Works

Pentolite Road Red Water Ponds

Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7480		7530R		7560		7600	
Sample Date:		09-JUN-98		10-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98	
Depth:		4 - 6		0 - 2		4 - 6		0 - 1		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
1,1,2,2-Tetrachloroethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	UJ
1,1,2-Trichloroethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
1,1-Dichloroethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
1,1-Dichloroethene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
1,2-Dichloroethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
1,2-Dichloroethene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
1,2-Dichloropropane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
2-Butanone	mg/kg	.0125	U	.0115	U	.0125	U	.011	U	.0115	U
2-Hexanone	mg/kg	.0125	U	.0115	U	.0125	U	.011	U	.0115	U
4-Methyl-2-pentanone	mg/kg	.0125	U	.0115	U	.0125	U	.011	U	.0115	U
Acetone	mg/kg	.0082	J	.0115	U	.0125	U	.011	U	.0115	U
Benzene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Bromodichloromethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Bromoform	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Bromomethane	mg/kg	.006	U	.006	U	.006	U	.0055	U	.006	U
Carbon disulfide	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Carbon tetrachloride	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Chlorobenzene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Chloroethane	mg/kg	.006	U	.006	U	.006	U	.0055	U	.006	U
Chloroform	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Chloromethane	mg/kg	.006	U	.006	U	.006	U	.0055	U	.006	U
Dibromochloromethane	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Ethylbenzene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Methylene chloride	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Styrene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Tetrachloroethene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Toluene	mg/kg	.00305	U	.0029	U	.0017	J	.0028	U	.0029	U
Total xylenes	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
Trichloroeth(	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	29	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7650		7700		7720		7780		7820	
Sample Date:		11-JUN-98		12-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		8 - 10		8 - 10	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
1,1,2,2-Tetrachloroethane	mg/kg	.0031	UJ	.003	U	.0031	U	.00305	U	.00315	U
1,1,2-Trichloroethane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
1,1-Dichloroethane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
1,1-Dichloroethene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
1,2-Dichloroethane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
1,2-Dichloroethene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
1,2-Dichloropropane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
2-Butanone	mg/kg	.0125	U	.012	U	.0125	U	.012	U	.0125	U
2-Hexanone	mg/kg	.0125	U	.012	U	.0125	U	.012	U	.0125	U
4-Methyl-2-pentanone	mg/kg	.0125	U	.012	U	.0125	U	.012	U	.0125	U
Acetone	mg/kg	.0125	R	.012	U	.0125	U	.012	U	.0125	U
Benzene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Bromodichloromethane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Bromoform	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Bromomethane	mg/kg	.006	U	.006	U	.006	U	.006	U	.0065	U
Carbon disulfide	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Carbon tetrachloride	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Chlorobenzene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Chloroethane	mg/kg	.006	U	.006	U	.006	U	.006	U	.0065	U
Chloroform	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Chloromethane	mg/kg	.006	U	.006	U	.006	U	.006	U	.0065	U
Dibromochloromethane	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Ethylbenzene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Methylene chloride	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.0021	J
Styrene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Tetrachloroethene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Toluene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Total xylenes	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
Trichloroethene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7840		7880		7920		7980	
Sample Date:		10-JUN-98		11-JUN-98		12-JUN-98		13-JUN-98	
Depth:		0 - 2		0 - 2		0 - 2		8 - 10	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
1,1,2,2-Tetrachloroethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	UJ
1,1,2-Trichloroethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
1,1-Dichloroethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
1,1-Dichloroethene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
1,2-Dichloroethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
1,2-Dichloroethene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
1,2-Dichloropropane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
2-Butanone	mg/kg	.011	U	.0115	U	.011	U	.0125	U
2-Hexanone	mg/kg	.011	U	.0115	U	.011	U	.0125	U
4-Methyl-2-pentanone	mg/kg	.011	U	.0115	U	.011	U	.0125	U
Acetone	mg/kg	.011	R	.0115	R	.011	U	.0125	U
Benzene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Bromodichloromethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Bromoform	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Bromomethane	mg/kg	.0055	U	.0055	U	.0055	U	.006	U
Carbon disulfide	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Carbon tetrachloride	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Chlorobenzene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Chloroethane	mg/kg	.0055	U	.0055	U	.0055	U	.006	U
Chloroform	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Chloromethane	mg/kg	.0055	U	.0055	U	.0055	U	.006	U
Dibromochloromethane	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Ethylbenzene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Methylene chloride	mg/kg	.00275	U	.00285	U	.0018	J	.0031	U
Styrene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Tetrachloroethene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Toluene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Total xylenes	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
Trichloroethe	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7260		7290		7320		7400	
Sample Date:		11-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		08-JUN-98	
Depth:		0 - 2		8 - 10		4 - 5		0 - 2		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.006	U	.0065	U	.0065	U	.006	U	.006	U
cis-1,3-Dichloropropene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U
trans-1,3-Dichloropropene	mg/kg	.0031	U	.00335	U	.00315	U	.003	U	.00295	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7480		7530R		7560		7600	
Sample Date:		09-JUN-98		10-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98	
Depth:		4 - 6		0 - 2		4 - 6		0 - 1		0 - 2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.006	U	.006	U	.006	U	.0055	U	.006	U
cis-1,3-Dichloropropene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U
trans-1,3-Dichloropropene	mg/kg	.00305	U	.0029	U	.0031	U	.0028	U	.0029	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7650		7700		7720		7780		7820	
Sample Date:		11-JUN-98		12-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		8 - 10		8 - 10	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.006	U	.006	U	.006	U	.006	U	.0065	U
cis-1,3-Dichloropropene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U
trans-1,3-Dichloropropene	mg/kg	.0031	U	.003	U	.0031	U	.00305	U	.00315	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7840		7880		7920		7980	
Sample Date:		10-JUN-98		11-JUN-98		12-JUN-98		13-JUN-98	
Depth:		0 - 2		0 - 2		0 - 2		8 - 10	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.0055	U	.0055	U	.0055	U	.006	U
cis-1,3-Dichloropropene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U
trans-1,3-Dichloropropene	mg/kg	.00275	U	.00285	U	.00275	U	.0031	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7260		7290		7320		7400	
Sample Date:		11-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		08-JUN-98	
Depth:		0 - 2		8 - 10		4 - 5		0 - 2		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
1,2-Dichlorobenzene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
1,3-Dichlorobenzene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
1,4-Dichlorobenzene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2,4,5-Trichlorophenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2,4,6-Trichlorophenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2,4-Dichlorophenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2,4-Dimethylphenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2,4-Dinitrophenol	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
2,4-Dinitrotoluene	mg/kg	2.05	U	.081	J	8.8		.2	U	.195	U
2,6-Dinitrotoluene	mg/kg	2.05	U	.22	U	.58	J	.2	U	.195	U
2-Chloronaphthalene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2-Chlorophenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2-Methylnaphthalene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2-Methylphenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
2-Nitroaniline	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
2-Nitrophenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
3,3'-Dichlorobenzidine	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
3-Nitroaniline	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
4,6-Dinitro-2-methylphenol	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
4-Bromophenyl phenyl ether	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
4-Chloro-3-methylphenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
4-Chloroaniline	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
4-Chlorophenyl phenyl ether	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
4-Methylphenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
4-Nitroaniline	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
4-Nitrophenol	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
Acenaphthene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Acenaphthylene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Anthracene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U

Report Date: 09/19/00

Sample Location:		PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7480		7530R		7560		7600	
Sample Date:		09-JUN-98		10-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98	
Depth:		4 - 6		0 - 2		4 - 6		0 - 1		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
1,2-Dichlorobenzene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
1,3-Dichlorobenzene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
1,4-Dichlorobenzene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2,4,5-Trichlorophenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2,4,6-Trichlorophenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2,4-Dichlorophenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2,4-Dimethylphenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2,4-Dinitrophenol	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
2,4-Dinitrotoluene	mg/kg	.205	U	.19	U	.056	J	.185	U	.16	J
2,6-Dinitrotoluene	mg/kg	.205	U	.19	U	.205	U	.185	U	.05	J
2-Chloronaphthalene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2-Chlorophenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2-Methylnaphthalene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2-Methylphenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
2-Nitroaniline	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
2-Nitrophenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
3,3'-Dichlorobenzidine	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
3-Nitroaniline	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
4,6-Dinitro-2-methylphenol	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
4-Bromophenyl phenyl ether	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
4-Chloro-3-methylphenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
4-Chloroaniline	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
4-Chlorophenyl phenyl ether	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
4-Methylphenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
4-Nitroaniline	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
4-Nitrophenol	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
Acenaphthene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Acenaphthylene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Anthracene	mg/kg	.205	U	.19	U	.205	U	.185	U		U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7650		7700		7720		7780		7820	
Sample Date:		11-JUN-98		12-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		8 - 10		8 - 10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
1,2-Dichlorobenzene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
1,3-Dichlorobenzene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
1,4-Dichlorobenzene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2,4,5-Trichlorophenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2,4,6-Trichlorophenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2,4-Dichlorophenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2,4-Dimethylphenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2,4-Dinitrophenol	mg/kg	1	U	.95	U	1	U	.95	U	1	U
2,4-Dinitrotoluene	mg/kg	.205	U	.2	U	.205	U	.19	J	.0004	J
2,6-Dinitrotoluene	mg/kg	.205	U	.2	U	.205	U	.2	U	.049	J
2-Chloronaphthalene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2-Chlorophenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2-Methylnaphthalene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2-Methylphenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
2-Nitroaniline	mg/kg	1	U	.95	U	1	U	.95	U	1	U
2-Nitrophenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
3,3'-Dichlorobenzidine	mg/kg	1	U	.95	U	1	U	.95	U	1	U
3-Nitroaniline	mg/kg	1	U	.95	U	1	U	.053	J	1	U
4,6-Dinitro-2-methylphenol	mg/kg	1	U	.95	U	1	U	.95	U	1	U
4-Bromophenyl phenyl ether	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
4-Chloro-3-methylphenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
4-Chloroaniline	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
4-Chlorophenyl phenyl ether	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
4-Methylphenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
4-Nitroaniline	mg/kg	1	U	.95	U	1	U	.95	U	1	U
4-Nitrophenol	mg/kg	1	U	.95	U	1	U	.95	U	1	U
Acenaphthene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Acenaphthylene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Anthracene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7840		7880		7920		7980	
Sample Date:		10-JUN-98		11-JUN-98		12-JUN-98		13-JUN-98	
Depth:		0 - 2		0 - 2		0 - 2		8 - 10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.185	U	.19	U	.18	U	.205	U
1,2-Dichlorobenzene	mg/kg	.185	U	.19	U	.18	U	.205	U
1,3-Dichlorobenzene	mg/kg	.185	U	.19	U	.18	U	.205	U
1,4-Dichlorobenzene	mg/kg	.185	U	.19	U	.18	U	.205	U
2,4,5-Trichlorophenol	mg/kg	.185	U	.19	U	.18	U	.205	U
2,4,6-Trichlorophenol	mg/kg	.185	U	.19	U	.18	U	.205	U
2,4-Dichlorophenol	mg/kg	.185	U	.19	U	.18	U	.205	U
2,4-Dimethylphenol	mg/kg	.185	U	.19	U	.18	U	.205	U
2,4-Dinitrophenol	mg/kg	.9	U	.9	U	.9	U	1	U
2,4-Dinitrotoluene	mg/kg	.185	U	.19	U	.18	U	.205	U
2,6-Dinitrotoluene	mg/kg	.185	U	.19	U	.18	U	.205	U
2-Chloronaphthalene	mg/kg	.185	U	.19	U	.18	U	.205	U
2-Chlorophenol	mg/kg	.185	U	.19	U	.18	U	.205	U
2-Methylnaphthalene	mg/kg	.185	U	.19	U	.18	U	.205	U
2-Methylphenol	mg/kg	.185	U	.19	U	.18	U	.205	U
2-Nitroaniline	mg/kg	.9	U	.9	U	.9	U	1	U
2-Nitrophenol	mg/kg	.185	U	.19	U	.18	U	.205	U
3,3'-Dichlorobenzidine	mg/kg	.9	U	.9	U	.9	U	1	U
3-Nitroaniline	mg/kg	.9	U	.9	U	.9	U	1	U
4,6-Dinitro-2-methylphenol	mg/kg	.9	U	.9	U	.9	U	1	U
4-Bromophenyl phenyl ether	mg/kg	.185	U	.19	U	.18	U	.205	U
4-Chloro-3-methylphenol	mg/kg	.185	U	.19	U	.18	U	.205	U
4-Chloroaniline	mg/kg	.185	U	.19	U	.18	U	.205	U
4-Chlorophenyl phenyl ether	mg/kg	.185	U	.19	U	.18	U	.205	U
4-Methylphenol	mg/kg	.185	U	.19	U	.18	U	.205	U
4-Nitroaniline	mg/kg	.9	U	.9	U	.9	U	1	U
4-Nitrophenol	mg/kg	.9	U	.9	U	.9	U	1	U
Acenaphthene	mg/kg	.185	U	.19	U	.18	U	.205	U
Acenaphthylene	mg/kg	.185	U	.19	U	.18	U	.205	U
Anthracene	mg/kg	.185	U	19	U	.18	U	.205	U

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7260		7290		7320		7400	
Sample Date:		11-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		08-JUN-98	
Depth:		0 - 2		8 - 10		4 - 5		0 - 2		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Benzo(a)pyrene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Benzo(b)fluoranthene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Benzo(ghi)perylene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Benzo(k)fluoranthene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Butyl benzyl phthalate	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Carbazole	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Chrysene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Dibenz(a,h)anthracene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Dibenzofuran	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Diethyl phthalate	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Dimethyl phthalate	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Fluoranthene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Fluorene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Hexachlorobenzene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Hexachlorobutadiene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Hexachlorocyclopentadiene	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
Hexachloroethane	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Indeno(1,2,3-cd)pyrene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Isophorone	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Naphthalene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Nitrobenzene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Pentachlorophenol	mg/kg	10	U	1.05	U	10	U	.95	U	.95	U
Phenanthrene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Phenol	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
Pyrene	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
bis(2-Chloroethoxy)methane	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
bis(2-Chloroethyl)ether	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
bis(2-Chloroisopropyl)ether	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
bis(2-Ethylhexyl)phthalate	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7480		7530R		7560		7600	
Sample Date:		09-JUN-98		10-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98	
Depth:		4 - 6		0 - 2		4 - 6		0 - 1		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Benzo(a)pyrene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Benzo(b)fluoranthene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Benzo(ghi)perylene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Benzo(k)fluoranthene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Butyl benzyl phthalate	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Carbazole	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Chrysene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Dibenz(a,h)anthracene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Dibenzofuran	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Diethyl phthalate	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Dimethyl phthalate	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Fluoranthene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Fluorene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Hexachlorobenzene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Hexachlorobutadiene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Hexachlorocyclopentadiene	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
Hexachloroethane	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Indeno(1,2,3-cd)pyrene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Isophorone	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Naphthalene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Nitrobenzene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Pentachlorophenol	mg/kg	1	U	.95	U	1	U	.9	U	.9	U
Phenanthrene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Phenol	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
Pyrene	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
bis(2-Chloroethoxy)methane	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
bis(2-Chloroethyl)ether	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
bis(2-Chloroisopropyl)ether	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
bis(2-Ethylhex halate	mg/kg	.205	U	19	U	.205	U	.185	U		U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7650		7700		7720		7780		7820	
Sample Date:		11-JUN-98		12-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		8 - 10		8 - 10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Benzo(a)pyrene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Benzo(b)fluoranthene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Benzo(ghi)perylene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Benzo(k)fluoranthene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Butyl benzyl phthalate	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Carbazole	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Chrysene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Dibenz(a,h)anthracene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Dibenzofuran	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Diethyl phthalate	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Dimethyl phthalate	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Fluoranthene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Fluorene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Hexachlorobenzene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Hexachlorobutadiene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Hexachlorocyclopentadiene	mg/kg	1	U	.95	U	1	U	.95	U	1	U
Hexachloroethane	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Indeno(1,2,3-cd)pyrene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Isophorone	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Naphthalene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Nitrobenzene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Pentachlorophenol	mg/kg	1	U	.95	U	1	U	.95	U	1	U
Phenanthrene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Phenol	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
Pyrene	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
bis(2-Chloroethoxy)methane	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
bis(2-Chloroethyl)ether	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
bis(2-Chloroisopropyl)ether	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
bis(2-Ethylhexyl)phthalate	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U

Report Date: 09/19/00

Sample Location:		PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7840		7880		7920		7980	
Sample Date:		10-JUN-98		11-JUN-98		12-JUN-98		13-JUN-98	
Depth:		0 - 2		0 - 2		0 - 2		8 - 10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.185	U	.19	U	.18	U	.205	U
Benzo(a)pyrene	mg/kg	.185	U	.19	U	.18	U	.205	U
Benzo(b)fluoranthene	mg/kg	.185	U	.19	U	.18	U	.205	U
Benzo(ghi)perylene	mg/kg	.185	U	.19	U	.18	U	.205	U
Benzo(k)fluoranthene	mg/kg	.185	U	.19	U	.18	U	.205	U
Butyl benzyl phthalate	mg/kg	.185	U	.19	U	.18	U	.205	U
Carbazole	mg/kg	.185	U	.19	U	.18	U	.205	U
Chrysene	mg/kg	.185	U	.19	U	.18	U	.205	U
Dibenz(a,h)anthracene	mg/kg	.185	U	.19	U	.18	U	.205	U
Dibenzofuran	mg/kg	.185	U	.19	U	.18	U	.205	U
Diethyl phthalate	mg/kg	.185	U	.19	U	.18	U	.205	U
Dimethyl phthalate	mg/kg	.185	U	.19	U	.18	U	.205	U
Fluoranthene	mg/kg	.185	U	.19	U	.18	U	.205	U
Fluorene	mg/kg	.185	U	.19	U	.18	U	.205	U
Hexachlorobenzene	mg/kg	.185	U	.19	U	.18	U	.205	U
Hexachlorobutadiene	mg/kg	.185	U	.19	U	.18	U	.205	U
Hexachlorocyclopentadiene	mg/kg	.9	U	.9	U	.9	U	1	U
Hexachloroethane	mg/kg	.185	U	.19	U	.18	U	.205	U
Indeno(1,2,3-cd)pyrene	mg/kg	.185	U	.19	U	.18	U	.205	U
Isophorone	mg/kg	.185	U	.19	U	.18	U	.205	U
Naphthalene	mg/kg	.185	U	.19	U	.18	U	.205	U
Nitrobenzene	mg/kg	.185	U	.19	U	.18	U	.205	U
Pentachlorophenol	mg/kg	.9	U	.9	U	.9	U	1	U
Phenanthrene	mg/kg	.185	U	.19	U	.18	U	.205	U
Phenol	mg/kg	.185	U	.19	U	.18	U	.205	U
Pyrene	mg/kg	.185	U	.19	U	.18	U	.205	U
bis(2-Chloroethoxy)methane	mg/kg	.185	U	.19	U	.18	U	.205	U
bis(2-Chloroethyl)ether	mg/kg	.185	U	.19	U	.18	U	.205	U
bis(2-Chloroisopropyl)ether	mg/kg	.185	U	.19	U	.18	U	.205	U
bis(2-Ethylhe: halate	mg/kg	.185	U	19	U	.18	U	.205	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7260		7290		7320		7400	
Sample Date:		11-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		08-JUN-98	
Depth:		0 - 2		8 - 10		4 - 5		0 - 2		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
di-n-Octyl phthalate	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
n-Nitroso-di-n-propylamine	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U
n-Nitrosodiphenylamine	mg/kg	2.05	U	.22	U	2.1	U	.2	U	.195	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7480		7530R		7560		7600	
Sample Date:		09-JUN-98		10-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98	
Depth:		4 - 6		0 - 2		4 - 6		0 - 1		0 - 2	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
di-n-Octyl phthalate	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
n-Nitroso-di-n-propylamine	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U
n-Nitrosodiphenylamine	mg/kg	.205	U	.19	U	.205	U	.185	U	.19	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7650		7700		7720		7780		7820	
Sample Date:		11-JUN-98		12-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		8 - 10		8 - 10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
di-n-Octyl phthalate	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
n-Nitroso-di-n-propylamine	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U
n-Nitrosodiphenylamine	mg/kg	.205	U	.2	U	.205	U	.2	U	.205	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7840		7880		7920		7980	
Sample Date:		10-JUN-98		11-JUN-98		12-JUN-98		13-JUN-98	
Depth:		0 - 2		0 - 2		0 - 2		8 - 10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.185	U	.19	U	.18	U	.205	U
di-n-Octyl phthalate	mg/kg	.185	U	.19	U	.18	U	.205	U
n-Nitroso-di-n-propylamine	mg/kg	.185	U	.19	U	.18	U	.205	U
n-Nitrosodiphenylamine	mg/kg	.185	U	.19	U	.18	U	.205	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7260		7290		7320		7400	
Sample Date:		11-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		08-JUN-98	
Depth:		0 - 2		8 - 10		4 - 5		0 - 2		0 - 2	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U
Aroclor 1221	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U
Aroclor 1232	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U
Aroclor 1242	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U
Aroclor 1248	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U
Aroclor 1254	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U
Aroclor 1260	mg/kg	.0205	U	.022	U	.105	U	.02	UJ	.0195	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7480		7530R		7560		7600	
Sample Date:		09-JUN-98		10-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98	
Depth:		4 - 6		0 - 2		4 - 6		0 - 1		0 - 2	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U
Aroclor 1221	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U
Aroclor 1232	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U
Aroclor 1242	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U
Aroclor 1248	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U
Aroclor 1254	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U
Aroclor 1260	mg/kg	.0205	U	.019	U	.0205	U	.0185	U	.019	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7650		7700		7720		7780		7820	
Sample Date:		11-JUN-98		12-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		8 - 10		8 - 10	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U
Aroclor 1221	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U
Aroclor 1232	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U
Aroclor 1242	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U
Aroclor 1248	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U
Aroclor 1254	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U
Aroclor 1260	mg/kg	.0205	U	.02	U	.0205	U	.02	U	.0205	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7840		7880		7920		7980	
Sample Date:		10-JUN-98		11-JUN-98		12-JUN-98		13-JUN-98	
Depth:		0 - 2		0 - 2		0 - 2		8 - 10	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.0185	U	.019	U	.018	U	.0205	U
Aroclor 1221	mg/kg	.0185	U	.019	U	.018	U	.0205	U
Aroclor 1232	mg/kg	.0185	U	.019	U	.018	U	.0205	U
Aroclor 1242	mg/kg	.0185	U	.019	U	.018	U	.0205	U
Aroclor 1248	mg/kg	.0185	U	.019	U	.018	U	.0205	U
Aroclor 1254	mg/kg	.0185	U	.019	U	.018	U	.0205	U
Aroclor 1260	mg/kg	.0185	U	.019	U	.018	U	.0205	U

Report Date: 09/19/00

Sample Location:		PRRP-DP01		PRRP-DP01		PRRP-DP01		PRRP-DP02		PRRP-DP02	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7210		7220		7250		7260	
Sample Date:		11-JUN-98		11-JUN-98		11-JUN-98		14-JUN-98		14-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9370		11500		10100		11200		11500	
Antimony	mg/kg	3.7	UJ	7.9	J	3.8	UJ	3.7	U	4	U
Arsenic	mg/kg	4.5	J	27.9	J	9.1	J	6.1		12.5	
Barium	mg/kg	84.3		239		88.5		61.5		91.9	
Beryllium	mg/kg	0.69		0.71		.315	U	0.68		.335	U
Cadmium	mg/kg	.31	U	.31	U	.315	U	.31	U	.335	U
Calcium	mg/kg	5740		35300		35600		3670		7720	
Chromium	mg/kg	14.7		9.0		17.7		20.4		20.8	
Cobalt	mg/kg	11.1		21.2		11.6		11.2		13.6	
Copper	mg/kg	22.6		34.5		23.3		14.5		25.8	
Iron	mg/kg	18000		34500		22500		21900		23800	
Lead	mg/kg	8.6		13.2		10.4		7.8		12.2	
Magnesium	mg/kg	2480		12500		13900		2590		5650	
Manganese	mg/kg	321		2230		706		315		521	
Mercury	mg/kg	.0205	U	.0205	U	.021	U	0.045		.022	U
Nickel	mg/kg	27.2		57.2		32.5		25.6		32.2	
Potassium	mg/kg	777		2330		1790		916		1630	
Selenium	mg/kg	0.84		.6	U	.315	U	0.69		0.82	
Silver	mg/kg	.6	UJ	.6	UJ	.65	UJ	.6	U	.65	U
Sodium	mg/kg	1240		1080		1050		310	U	333.5	U
Thallium	mg/kg	.6	UJ	1.25	UJ	.65	UJ	.6	U	.65	U
Vanadium	mg/kg	19.1		30.0		26.6		27.3	J	26.2	J
Zinc	mg/kg	78.5		83.1		65.9		64.6		70.3	

Sample Location:		PRRP-DP02		PRRP-DP03		PRRP-DP03		PRRP-DP04		PRRP-DP04	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7240R		7280		7290		7320		7330	
Sample Date:		22-JUN-98		08-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98	
Depth:		0 - 2		0 - 2		4 - 5		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9210		6330		9580		7030		6990	
Antimony	mg/kg	3.45	UJ	3.3	U	3.8	U	3.6	U	3.8	U
Arsenic	mg/kg	5.0		5.4		9.7		6.6		5.4	
Barium	mg/kg	45.1		65.7		67.9		37.2		39.4	
Beryllium	mg/kg	.29	U	.275	U	.315	U	.3	U	.315	U
Cadmium	mg/kg	.29	U	.275	U	.315	U	.3	U	.315	U
Calcium	mg/kg	10300		2560		2600		2680		19800	
Chromium	mg/kg	13.3	J	8.7		15.7		15.5		12.4	
Cobalt	mg/kg	6.6		2.75	U	6.3		3	U	7.4	
Copper	mg/kg	12.6		8.4		18.7		7.0		13.3	
Iron	mg/kg	14300		14100		23700		16700		13900	
Lead	mg/kg	12.3	J	9.3	J	11.6	J	4.3	J	9.8	J
Magnesium	mg/kg	5150		1160		2810		1290		10700	
Manganese	mg/kg	234		320		338		144		292	
Mercury	mg/kg	0.040		.018	U	.021	U	.02	U	.021	U
Nickel	mg/kg	14.6		9.3		22.9		12.2		16.6	
Potassium	mg/kg	1460	J	274	U	968		301.5	U	864	
Selenium	mg/kg	.29	U	0.59		.315	U	.3	U	0.64	
Silver	mg/kg	.6	U	.55	U	.65	U	.6	U	.65	U
Sodium	mg/kg	288	U	274	U	3760		301.5	U	315.5	U
Thallium	mg/kg	.6	UJ	.55	U	.65	U	.6	U	.65	U
Vanadium	mg/kg	23.1		17.3	J	23.9	J	28.5	J	19.7	J
Zinc	mg/kg	45.5		34.2		61.3		30.6		43.7	

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Sample Location:		PRRP-DP04		PRRP-DP05		PRRP-DP05		PRRP-DP05		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7340		7370		7360R		7380R		7400	
Sample Date:		09-JUN-98		14-JUN-98		25-JUN-98		25-JUN-98		08-JUN-98	
Depth:		8 - 10		4 - 6		0 - 2		8 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8040		11300		6820		9040		6110	
Antimony	mg/kg	3.8	U	9.3		3.4	U	3.75	U	3.55	U
Arsenic	mg/kg	5.2		42.8		2.9		17.6		3.6	
Barium	mg/kg	50.5		128		27.6		115		11.9	U
Beryllium	mg/kg	.315	U	0.67		.285	U	.315	U	.295	U
Cadmium	mg/kg	.315	U	.315	U	.285	U	.315	U	.295	U
Calcium	mg/kg	61200		58500		1490		57800		945	
Chromium	mg/kg	14.1		18.4		9.3		14.4		10.9	
Cobalt	mg/kg	9.8		19.0		2.85	U	10.2		2.95	U
Copper	mg/kg	23.6		24.6		4.9		19.7		5.9	
Iron	mg/kg	18200		43700		9170		22700		13700	
Lead	mg/kg	10.3	J	10.6		5.5		8.0		3.5	J
Magnesium	mg/kg	19500		17400		1010		17100		885	
Manganese	mg/kg	327		797		127	J	731	J	166	
Mercury	mg/kg	.021	U	.021	U	.0185	U	.0205	U	.0195	U
Nickel	mg/kg	25.9		40.1		7.4		23.8		9.4	
Potassium	mg/kg	1580		2250		283	U	2190		297	U
Selenium	mg/kg	1.1		.315	U	.285	U	.315	U	.295	U
Silver	mg/kg	.65	U	.65	U	.55	U	.65	U	.6	U
Sodium	mg/kg	315	U	315.5	U	283	U	314	U	297	U
Thallium	mg/kg	.65	U	.65	U	.55	U	.65	U	.6	U
Vanadium	mg/kg	23.7	J	38.4	J	16.3	J	25.4	J	23.1	J
Zinc	mg/kg	56.9		104		24.9		52.1		22.6	

Sample Location:		PRRP-DP06		PRRP-DP06		PRRP-DP07		PRRP-DP07		PRRP-DP07	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7410		7420		7440		7450		7460	
Sample Date:		08-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98		09-JUN-98	
Depth:		4 - 5		9 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8710		7260		4120		8560		7960	
Antimony	mg/kg	3.7	U	3.75	U	3.2	U	3.7	U	3.7	U
Arsenic	mg/kg	9.1		5.3		2.5		6.3		6.5	
Barium	mg/kg	57.3		44.9		10.65	U	55.3		54.5	
Beryllium	mg/kg	.305	U	.315	U	.265	U	.305	U	.31	U
Cadmium	mg/kg	.305	U	.315	U	.265	U	.305	U	.31	U
Calcium	mg/kg	62300		43700		1420		62800		62000	
Chromium	mg/kg	15.9		14.4		6.1		14.3		13.0	
Cobalt	mg/kg	3.05	U	3.15	U	2.65	U	13.1		9.8	
Copper	mg/kg	26.2		15.2		4.3		20.3		23.9	
Iron	mg/kg	24200		15300		8330		17500		20000	
Lead	mg/kg	11.3	J	7.6	J	3.2	J	10.3	J	10.9	J
Magnesium	mg/kg	16000		12600		830		19100		19200	
Manganese	mg/kg	430		321		116		536		520	
Mercury	mg/kg	.02	U	.0205	U	.0175	U	.0205	U	.0205	U
Nickel	mg/kg	22.9		17.6		7.0		29.7		26.1	
Potassium	mg/kg	1380		1190		266	U	1720		1660	
Selenium	mg/kg	.305	U	.315	U	.265	U	.305	U	.31	U
Silver	mg/kg	.6	U	.65	U	.55	U	.6	U	.6	U
Sodium	mg/kg	306.5	U	313.5	U	266	U	307	U	308.5	U
Thallium	mg/kg	.6	U	.65	U	.55	U	.6	U	.6	U
Vanadium	mg/kg	27.1	J	21.8	J	12.9	J	24.4	J	22.9	J
Zinc	mg/kg	68.9		45.5		17.9		54.7		61.9	

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Sample Location:		PRRP-DP08		PRRP-DP08		PRRP-DP08		PRRP-DP09		PRRP-DP09	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7480		7490		7500		7520R		7530R	
Sample Date:		10-JUN-98		10-JUN-98		10-JUN-98		25-JUN-98		25-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4450		8700		7140		7220		4410	
Antimony	mg/kg	3.45	U	3.7	U	3.65	U	3.4	U	3.75	U
Arsenic	mg/kg	4.2		12.9		4.2		2.4		2.6	
Barium	mg/kg	11.55	U	42.5		47.4		24.3		12.45	U
Beryllium	mg/kg	.29	U	.305	U	.305	U	.28	U	.31	U
Cadmium	mg/kg	.29	U	.305	U	.305	U	.28	U	.31	U
Calcium	mg/kg	1820		57000		52200		1750		63200	
Chromium	mg/kg	10.6		14.6		12.6		8.8		9.2	
Cobalt	mg/kg	6.0		9.8		7.9		2.8	U	3.1	U
Copper	mg/kg	6.5		21.7		16.5		4.9		11.2	
Iron	mg/kg	13400		19400		16000		8430		9480	
Lead	mg/kg	3.1	J	9.2	J	7.6	J	5.1		4.9	
Magnesium	mg/kg	894		16800		15700		1110		16800	
Manganese	mg/kg	207		283		393		102	J	184	J
Mercury	mg/kg	.019	U	.02	U	.02	U	.0185	U	.0205	U
Nickel	mg/kg	7.9		25.7		19.6		6.3		8.4	
Potassium	mg/kg	289.5	U	1820		1580		281.5	U	1050	
Selenium	mg/kg	.29	U	.305	U	.305	U	.28	U	.6	U
Silver	mg/kg	.6	U	.6	U	.6	U	.55	U	.6	U
Sodium	mg/kg	289.5	U	306.5	U	305	U	281.5	U	311	U
Thallium	mg/kg	.6	U	.6	U	.6	U	.55	U	1.25	U
Vanadium	mg/kg	24.4	J	24.1	J	21.3	J	15.8	J	20.9	J
Zinc	mg/kg	21.7		64.8		46.6		22.5		24.8	

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Sample Location:		PRRP-DP09		PRRP-DP10		PRRP-DP10		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7540R		7560		7570		7580		7600	
Sample Date:		25-JUN-98		10-JUN-98		10-JUN-98		10-JUN-98		13-JUN-98	
Depth:		8 - 10		0 - 1		4 - 5		9 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4630		4620		9510		11600		6200	
Antimony	mg/kg	3.9	U	3.35	U	3.85	U	3.75	U	3.45	U
Arsenic	mg/kg	6.3		3.4		5.6		14.9		7.0	
Barium	mg/kg	26.5		11.15	U	81.5		90.9		39.4	
Beryllium	mg/kg	.325	U	.28	U	0.83		0.77		.29	U
Cadmium	mg/kg	.325	U	.28	U	.32	U	.315	U	.29	U
Calcium	mg/kg	58500		2440		4620		4510		17300	
Chromium	mg/kg	8.7		10.9		12.6		20.1		11.2	
Cobalt	mg/kg	3.25	U	2.8	U	3.2	U	10.2		7.4	
Copper	mg/kg	15.1		5.9		17.5		22.1		10.1	
Iron	mg/kg	10600		13700		16100		28700		14700	
Lead	mg/kg	6.3		3.2	J	11.3	J	14.3	J	7.9	
Magnesium	mg/kg	16900		920		2090		3970		6390	
Manganese	mg/kg	273	J	273		230		484		365	
Mercury	mg/kg	.0215	U	.0185	U	.0215	U	.0205	U	.019	U
Nickel	mg/kg	15.5		9.6		11.4		30.0		14.4	
Potassium	mg/kg	1200		279.5	U	322	U	1080		849	
Selenium	mg/kg	0.87		.28	U	0.71		.315	U	.29	U
Silver	mg/kg	.65	U	.55	U	.65	U	.65	U	.6	U
Sodium	mg/kg	324.5	U	279.5	U	4130		4280		741	
Thallium	mg/kg	.65	U	.55	U	.65	U	.65	U	.6	U
Vanadium	mg/kg	17.5	J	23.6	J	22.1	J	31.6	J	20.1	J
Zinc	mg/kg	35.5		24.4		49.7		72.7		39.1	

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Sample Location:		PRRP-DP11		PRRP-DP11		PRRP-DP12		PRRP-DP12		PRRP-DP12	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7610		7620		7640		7650		7660	
Sample Date:		13-JUN-98		13-JUN-98		11-JUN-98		11-JUN-98		11-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8950		11200		9560		12000		12300	
Antimony	mg/kg	3.6	U	3.75	U	3.4	UJ	3.75	UJ	7.8	J
Arsenic	mg/kg	25.3		5.3		7.3	J	5.7	J	7.4	J
Barium	mg/kg	209		51.5		71.5		60.3		69.5	
Beryllium	mg/kg	0.66		.315	U	0.68		.31	U	.31	U
Cadmium	mg/kg	.3	U	.315	U	.285	U	.31	U	.31	U
Calcium	mg/kg	3380		61600		4310		37100		55600	
Chromium	mg/kg	11.0		19.0		14.0		19.7		20.0	
Cobalt	mg/kg	30.3		10.8		6.4		10.8		12.0	
Copper	mg/kg	13.1		23.3		10.4		26.7		25.4	
Iron	mg/kg	36200		20800		16000		22300		23200	
Lead	mg/kg	9.8		9.9		9.6		10.7		10.6	
Magnesium	mg/kg	2500		20500		1900		16600		19100	
Manganese	mg/kg	1640		457		337		306		521	
Mercury	mg/kg	.02	U	.0205	U	.019	U	.0205	U	.0205	U
Nickel	mg/kg	26.8		30.1		12.1		31.6		30.9	
Potassium	mg/kg	1060		2580		684		2430		2730	
Selenium	mg/kg	.6	U	.315	U	.285	U	.31	U	.31	U
Silver	mg/kg	.6	U	.65	U	.55	UJ	.6	UJ	.6	UJ
Sodium	mg/kg	1200		1520		285.5	U	312	U	311	U
Thallium	mg/kg	1.2	U	.65	U	.55	UJ	.6	UJ	.6	UJ
Vanadium	mg/kg	34.2	J	31.0	J	23.7		26.8		29.9	
Zinc	mg/kg	68.5		62.2		38.5		71.9		65.3	

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Sample Location:		PRRP-DP13		PRRP-DP13		PRRP-DP13		PRRP-DP14		PRRP-DP14	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7680		7690		7700		7720		7730	
Sample Date:		12-JUN-98		12-JUN-98		12-JUN-98		11-JUN-98		11-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	7760		6380		5930		12700		9640	
Antimony	mg/kg	3.35	U	3.6	U	3.6	U	3.7	U	3.65	U
Arsenic	mg/kg	3.4		5.3		4.1		7.4		8.2	
Barium	mg/kg	11.1	U	29.2		42.4		49.6		39.0	
Beryllium	mg/kg	.28	U	.3	U	.3	U	0.69		.3	U
Cadmium	mg/kg	.28	U	.3	U	.3	U	.31	U	.3	U
Calcium	mg/kg	278	U	2100		67100		3010		4340	
Chromium	mg/kg	9.4		11.3		10.7		20.2		17.4	
Cobalt	mg/kg	2.8	U	7.0		7.2		8.3		8.4	
Copper	mg/kg	6.5		13.7		16.2		14.7		14.3	
Iron	mg/kg	11200		15400		13000		22900		20100	
Lead	mg/kg	4.1		5.1		7.7		6.8		6.5	
Magnesium	mg/kg	938		1560		25300		2310		2940	
Manganese	mg/kg	74.5		313		472		173		275	
Mercury	mg/kg	.0185	U	.02	U	.02	U	0.043		.02	U
Nickel	mg/kg	8.4		20.2		19.4		20.5		19.4	
Potassium	mg/kg	278	U	301	U	1330		771		713	
Selenium	mg/kg	.28	U	.3	U	.3	U	.31	U	.3	U
Silver	mg/kg	.55	U	.6	U	.6	U	.6	U	.6	U
Sodium	mg/kg	278	U	301	U	302	U	310	U	302.5	U
Thallium	mg/kg	.55	U	.6	U	.6	U	.6	U	.6	U
Vanadium	mg/kg	19.8		19.1		21.0		35.2		27.0	
Zinc	mg/kg	23.1		40.6		43.7		46.1		41.2	

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Sample Location:		PRRP-DP14		PRRP-DP15		PRRP-DP15		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7740		7760		7770		7780		7800	
Sample Date:		11-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8710		6680		8870		6010		7300	
Antimony	mg/kg	3.65	U	3.45	U	3.7	U	3.65	U	3.7	U
Arsenic	mg/kg	8.1		5.8		15.9		6.9		5.4	
Barium	mg/kg	64.8		34.9		176		41.5		30.4	
Beryllium	mg/kg	.305	U	.29	U	.31	U	.305	U	.31	U
Cadmium	mg/kg	.305	U	.29	U	.31	U	.305	U	.31	U
Calcium	mg/kg	53400		2880		53300		67400		7980	
Chromium	mg/kg	15.9		12.1		5.2		11.6		11.0	
Cobalt	mg/kg	10.3		5.8		26.7		9.0		3.1	U
Copper	mg/kg	21.1		7.0		24.6		19.3		11.2	
Iron	mg/kg	18700		14700		20500		18300		13300	
Lead	mg/kg	9.6		5.5		13.4		8.1		7.7	J
Magnesium	mg/kg	21100		1660		17200		20300		3100	
Manganese	mg/kg	506		93.2		2270		467		147	
Mercury	mg/kg	.02	U	.019	U	.0205	U	.02	U	.0205	U
Nickel	mg/kg	26.5		13.9		56.1		22.2		12.0	
Potassium	mg/kg	1850		288.5	U	1380		1370		308	U
Selenium	mg/kg	.305	U	.29	U	.6	U	.305	U	.31	U
Silver	mg/kg	.6	U	.6	U	.6	U	.6	U	.6	U
Sodium	mg/kg	304	U	288.5	U	310	U	1030		308	U
Thallium	mg/kg	.6	U	.6	U	1.25	U	.6	U	.6	U
Vanadium	mg/kg	25.2		23.0		26.7		19.3		21.4	J
Zinc	mg/kg	57.3		30.4		59.7		52.0		37.4	

Sample Location:		PRRP-DP16		PRRP-DP16		PRRP-DP17		PRRP-DP17		PRRP-DP17	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7810		7820		7840		7850		7860	
Sample Date:		12-JUN-98		12-JUN-98		10-JUN-98		10-JUN-98		10-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9850		9430		7140		5570		3320	
Antimony	mg/kg	3.3	U	3.75	U	3.3	UJ	3.6	UJ	3.65	UJ
Arsenic	mg/kg	9.7		4.8		2.3	J	3.1	J	4.5	J
Barium	mg/kg	59.5		47.5		11.05	U	11.95	U	12.2	U
Beryllium	mg/kg	0.55		.315	U	.275	U	.3	U	.305	U
Cadmium	mg/kg	.275	U	.315	U	.275	U	.3	U	.305	U
Calcium	mg/kg	3080		57600		817		1850		61500	
Chromium	mg/kg	17.5		16.8		10.8		15.5		7.3	
Cobalt	mg/kg	14.4		9.1		2.75	U	7.3		3.05	U
Copper	mg/kg	21.7		24.3		3.8		5.3		10.6	
Iron	mg/kg	22000		19300		13100		16400		8940	
Lead	mg/kg	10.7	J	10.5	J	3.3		2.9		4.3	
Magnesium	mg/kg	4020		18100		791		917		16200	
Manganese	mg/kg	437		303		104		323		252	
Mercury	mg/kg	.018	U	.0205	U	.0185	U	.0195	U	.02	U
Nickel	mg/kg	31.1		27.0		6.4		8.1		11.0	
Potassium	mg/kg	1210		1750		277	U	298.5	U	726	
Selenium	mg/kg	.275	U	.315	U	.275	U	.3	U	.305	U
Silver	mg/kg	.55	U	.65	U	.55	UJ	.6	UJ	.6	UJ
Sodium	mg/kg	1160		1090		277	U	298.5	U	305.5	U
Thallium	mg/kg	.55	U	.65	U	.55	UJ	.6	UJ	.6	UJ
Vanadium	mg/kg	23.3	J	26.1	J	23.4		29.3		15.0	
Zinc	mg/kg	67.2		64.2		21.3		22.7		31.6	

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Sample Location:		PRRP-DP18		PRRP-DP18		PRRP-DP18		PRRP-DP19		PRRP-DP19	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7880		7890		7900		7920		7930	
Sample Date:		11-JUN-98		11-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	10700		7340		9140		2370		7060	
Antimony	mg/kg	3.45	UJ	3.85	UJ	3.75	UJ	3.3	U	3.6	U
Arsenic	mg/kg	4.0	J	27.3	J	5.8	J	14.1		4.7	
Barium	mg/kg	32.3		41.8		66.2		33.6		51.2	
Beryllium	mg/kg	.285	U	.32	U	.31	U	.275	U	.3	U
Cadmium	mg/kg	.285	U	.32	U	0.63		.275	U	.3	U
Calcium	mg/kg	1040		38400		61600		54000		56900	
Chromium	mg/kg	14.6		13.6		15.7		4.2		12.5	
Cobalt	mg/kg	6.2		8.7		10.6		2.75	U	8.7	
Copper	mg/kg	7.5		19.0		24.3		10.6		19.1	
Iron	mg/kg	17800		20000		20600		15900		16200	
Lead	mg/kg	5.6		7.6		9.6		3.2		8.5	
Magnesium	mg/kg	1120		12800		19200		11500		22500	
Manganese	mg/kg	158		300		534		658		495	
Mercury	mg/kg	.019	U	.021	U	.0205	U	.018	U	.02	U
Nickel	mg/kg	9.8		21.5		29.0		11.6		22.8	
Potassium	mg/kg	287	U	1310		1990		274.5	U	1490	
Selenium	mg/kg	.285	U	.32	U	.31	U	.275	U	.3	U
Silver	mg/kg	.55	UJ	.65	UJ	.6	UJ	.55	U	.6	U
Sodium	mg/kg	287	U	319.5	U	312	U	274.5	U	301.5	U
Thallium	mg/kg	.55	UJ	.65	UJ	.6	UJ	.55	U	.6	U
Vanadium	mg/kg	30.3		25.7		24.6		13.2		21.4	
Zinc	mg/kg	27.9		56.2		64.5		26.8		52.8	

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Sample Location:		PRRP-DP19		PRRP-DP20		PRRP-DP20		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7940		7960		7970		7980	
Sample Date:		12-JUN-98		13-JUN-98		13-JUN-98		13-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9590		5360		7580		10800	
Antimony	mg/kg	3.65	U	3.45	U	3.65	U	7.7	
Arsenic	mg/kg	4.9		3.6		4.7		5.5	
Barium	mg/kg	61.0		11.55	U	58.2		69.3	
Beryllium	mg/kg	.305	U	.29	U	.305	U	.31	U
Cadmium	mg/kg	.305	U	.29	U	.305	U	.31	U
Calcium	mg/kg	68000		2160		61900		70400	
Chromium	mg/kg	15.7		11.4		13.1		17.0	
Cobalt	mg/kg	9.4		5.8		9.3		11.3	
Copper	mg/kg	22.4		7.2		18.3		20.1	
Iron	mg/kg	19900		16000		18000		22500	
Lead	mg/kg	9.4		3.2		9.0		9.7	
Magnesium	mg/kg	21300		999		24600		20200	
Manganese	mg/kg	512		262		527		513	
Mercury	mg/kg	.02	U	.019	U	.02	U	.0205	U
Nickel	mg/kg	26.1		9.3		24.0		29.6	
Potassium	mg/kg	2330		289	U	1610		2640	
Selenium	mg/kg	.305	U	.29	U	.305	U	.31	U
Silver	mg/kg	.6	U	.6	U	.6	U	.6	U
Sodium	mg/kg	303.5	U	289	U	305.5	U	307.5	U
Thallium	mg/kg	.6	U	.6	U	.6	U	.6	U
Vanadium	mg/kg	26.2		27.6	J	23.8	J	28.6	J
Zinc	mg/kg	60.5		26.0		50.6		69.5	

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Sample Location:		PRRP-DP01		PRRP-DP01		PRRP-DP01		PRRP-DP02		PRRP-DP02	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7210		7220		7250		7260	
Sample Date:		11-JUN-98		11-JUN-98		11-JUN-98		14-JUN-98		14-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	0.56		2.7		.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	0.38	
2,4-Dinitrotoluene	mg/kg	.125	U	0.96		0.29		.125	U	0.28	
2,6-Dinitrotoluene	mg/kg	.125	U	0.35		.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.195	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

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Sample Location:		PRRP-DP02		PRRP-DP03		PRRP-DP03		PRRP-DP04		PRRP-DP04	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7240R		7280		7290		7320		7330	
Sample Date:		22-JUN-98		08-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98	
Depth:		0 - 2		0 - 2		4 - 5		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	43		.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	9.3		.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	1.25	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	1.2		25		.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	1.25	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	1.25	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	1.25	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	1.25	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	2.5	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	1.25	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	2.5	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	3.25	U	.325	U	.325	U

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Sample Location:		PRRP-DP04		PRRP-DP05		PRRP-DP05		PRRP-DP05		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7340		7370		7360R		7380R		7400	
Sample Date:		09-JUN-98		14-JUN-98		25-JUN-98		25-JUN-98		08-JUN-98	
Depth:		8 - 10		4 - 6		0 - 2		8 - 10		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		PRRP-DP06		PRRP-DP06		PRRP-DP07		PRRP-DP07		PRRP-DP07	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7410		7420		7440		7450		7460	
Sample Date:		08-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98		09-JUN-98	
Depth:		4 - 5		9 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	1.8		.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	1.1		.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

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Sample Location:		PRRP-DP08		PRRP-DP08		PRRP-DP08		PRRP-DP09		PRRP-DP09	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7480		7490		7500		7520R		7530R	
Sample Date:		10-JUN-98		10-JUN-98		10-JUN-98		25-JUN-98		25-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

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Sample Location:		PRRP-DP09		PRRP-DP10		PRRP-DP10		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7540R		7560		7570		7580		7600	
Sample Date:		25-JUN-98		10-JUN-98		10-JUN-98		10-JUN-98		13-JUN-98	
Depth:		8 - 10		0 - 1		4 - 5		9 - 10		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	1.3		.125	U	.125	U	18		.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	5.2		.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.6	U	0.27	
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	15		0.32	
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	1.7		.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.6	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.6	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	1.1	U	2.7	
HMX	mg/kg	.25	U	.25	U	.25	U	1.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.6	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	1.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	1.6	U	.325	U

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Sample Location:		PRRP-DP11		PRRP-DP11		PRRP-DP12		PRRP-DP12		PRRP-DP12	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7610		7620		7640		7650		7660	
Sample Date:		13-JUN-98		13-JUN-98		11-JUN-98		11-JUN-98		11-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	0.43		7.0		.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	0.43		5.8		.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	1.6		1.2		.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	0.29		0.30		.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Sample Location:		PRRP-DP13		PRRP-DP13		PRRP-DP13		PRRP-DP14		PRRP-DP14	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7680		7690		7700		7720		7730	
Sample Date:		12-JUN-98		12-JUN-98		12-JUN-98		11-JUN-98		11-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP14		PRRP-DP15		PRRP-DP15		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7740		7760		7770		7780		7800	
Sample Date:		11-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10		0 - 2	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.5	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.25	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.5	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.65	U	.325	U

Sample Location:		PRRP-DP16		PRRP-DP16		PRRP-DP17		PRRP-DP17		PRRP-DP17	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7810		7820		7840		7850		7860	
Sample Date:		12-JUN-98		12-JUN-98		10-JUN-98		10-JUN-98		10-JUN-98	
Depth:		4 - 6		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	1.9		.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	0.25		.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	0.50		.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	0.50		.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP18		PRRP-DP18		PRRP-DP18		PRRP-DP19		PRRP-DP19	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7880		7890		7900		7920		7930	
Sample Date:		11-JUN-98		11-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		0 - 2		4 - 6		8 - 10		0 - 2		4 - 6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Soils

Report Date: 09/19/00

Sample Location:		PRRP-DP19		PRRP-DP20		PRRP-DP20		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7940		7960		7970		7980	
Sample Date:		12-JUN-98		13-JUN-98		13-JUN-98		13-JUN-98	
Depth:		8 - 10		0 - 2		4 - 6		8 - 10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
WET CHEMISTRY	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total organic carbon	mg/kg	33000		5450		17000		12000	J

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane	mg/kg	.0065	U	.00315	U	.00435	U	.0033	U
1,1,2,2-Tetrachloroethane	mg/kg	.0065	UJ	.00315	UJ	.00435	UJ	.0033	UJ
1,1,2-Trichloroethane	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
1,1-Dichloroethane	mg/kg	.0065	U	.00315	U	.00435	U	.0033	U
1,1-Dichloroethene	mg/kg	.0065	U	.00315	U	.00435	U	.0033	U
1,2-Dichloroethane	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
1,2-Dichloroethene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
1,2-Dichloropropane	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
2-Butanone	mg/kg	.011	J	.0125	U	.01	J	.013	U
2-Hexanone	mg/kg	.026	U	.0125	U	.0175	UJ	.013	U
4-Methyl-2-pentanone	mg/kg	.026	U	.0125	U	.0175	UJ	.013	U
Acetone	mg/kg	.051	J	.0125	R	.049	J	.017	B
Benzene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Bromodichloromethane	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Bromoform	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Bromomethane	mg/kg	.0052	B	.0065	U	.0085	U	.0065	U
Carbon disulfide	mg/kg	.0065	U	.00315	U	.00435	U	.0033	U
Carbon tetrachloride	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Chlorobenzene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Chloroethane	mg/kg	.013	U	.0065	U	.0085	U	.0065	U
Chloroform	mg/kg	.0065	U	.00315	U	.00435	U	.0033	U
Chloromethane	mg/kg	.013	U	.0065	U	.0085	U	.0065	U
Dibromochloromethane	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Ethylbenzene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Methylene chloride	mg/kg	.013	B	.0056	B	.0069	B	.0059	B
Styrene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Tetrachloroethene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Toluene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Total xylenes	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
Trichloroethe	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Vinyl chloride	mg/kg	.013	U	.0065	U	.0085	U	.0065	U
cis-1,3-Dichloropropene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U
trans-1,3-Dichloropropene	mg/kg	.0065	U	.00315	U	.00435	UJ	.0033	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene	mg/kg	.43	U	.21	U	.285	U	.22	U
1,2-Dichlorobenzene	mg/kg	.43	U	.21	U	.285	U	.22	U
1,3-Dichlorobenzene	mg/kg	.43	U	.21	U	.285	U	.22	U
1,4-Dichlorobenzene	mg/kg	.43	U	.21	U	.285	U	.22	U
2,4,5-Trichlorophenol	mg/kg	.43	U	.21	U	.285	U	.22	U
2,4,6-Trichlorophenol	mg/kg	.43	U	.21	U	.285	U	.22	U
2,4-Dichlorophenol	mg/kg	.43	U	.21	U	.285	U	.22	U
2,4-Dimethylphenol	mg/kg	.43	U	.21	U	.285	U	.22	U
2,4-Dinitrophenol	mg/kg	2.1	U	1	U	1.4	U	1.05	U
2,4-Dinitrotoluene	mg/kg	.43	U	.21	U	.285	U	.22	U
2,6-Dinitrotoluene	mg/kg	.43	U	.21	U	.285	U	.22	U
2-Chloronaphthalene	mg/kg	.43	U	.21	U	.285	U	.22	U
2-Chlorophenol	mg/kg	.43	U	.21	U	.285	U	.22	U
2-Methylnaphthalene	mg/kg	.43	U	.21	U	.285	U	.22	U
2-Methylphenol	mg/kg	.43	U	.21	U	.285	U	.22	U
2-Nitroaniline	mg/kg	2.1	U	1	U	1.4	U	1.05	U
2-Nitrophenol	mg/kg	.43	U	.21	U	.285	U	.22	U
3,3'-Dichlorobenzidine	mg/kg	2.1	U	1	U	1.4	U	1.05	U
3-Nitroaniline	mg/kg	2.1	U	1	U	1.4	U	1.05	U
4,6-Dinitro-2-methylphenol	mg/kg	2.1	U	1	U	1.4	U	1.05	U
4-Bromophenyl phenyl ether	mg/kg	.43	U	.21	U	.285	U	.22	U
4-Chloro-3-methylphenol	mg/kg	.43	U	.21	U	.285	U	.22	U
4-Chloroaniline	mg/kg	.43	U	.21	U	.285	U	.22	U
4-Chlorophenyl phenyl ether	mg/kg	.43	U	.21	U	.285	U	.22	U
4-Methylphenol	mg/kg	.43	U	.21	U	.285	U	.22	U
4-Nitroaniline	mg/kg	2.1	U	1	U	1.4	U	1.05	U
4-Nitrophenol	mg/kg	2.1	U	1	U	1.4	U	1.05	U
Acenaphthene	mg/kg	.43	U	.11	J	.285	U	.22	U
Acenaphthylene	mg/kg	.43	U	.21	U	.285	U	.22	U
Anthracene	mg/kg	.43	U	.077	J	.285	U	.029	J

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	mg/kg	.43	U	.21	U	.285	U	.084	J
Benzo(a)pyrene	mg/kg	.43	U	.21	U	.285	U	.096	J
Benzo(b)fluoranthene	mg/kg	.43	U	.21	U	.285	U	.1	J
Benzo(ghi)perylene	mg/kg	.43	U	.21	U	.285	U	.053	J
Benzo(k)fluoranthene	mg/kg	.43	U	.21	U	.285	U	.084	J
Butyl benzyl phthalate	mg/kg	.43	U	.21	U	.285	U	.22	U
Carbazole	mg/kg	.43	U	.18	J	.285	U	.22	U
Chrysene	mg/kg	.43	U	.21	U	.285	U	.11	J
Dibenz(a,h)anthracene	mg/kg	.43	U	.21	U	.285	U	.22	U
Dibenzofuran	mg/kg	.43	U	.06	J	.285	U	.22	U
Diethyl phthalate	mg/kg	.43	U	.21	U	.285	U	.22	U
Dimethyl phthalate	mg/kg	.43	U	.21	U	.285	U	.22	U
Fluoranthene	mg/kg	.43	U	.14	J	.285	U	.23	J
Fluorene	mg/kg	.43	U	.11	J	.285	U	.22	U
Hexachlorobenzene	mg/kg	.43	U	.21	U	.285	U	.22	U
Hexachlorobutadiene	mg/kg	.43	U	.21	U	.285	U	.22	U
Hexachlorocyclopentadiene	mg/kg	2.1	U	1	U	1.4	U	1.05	U
Hexachloroethane	mg/kg	.43	U	.21	U	.285	U	.22	U
Indeno(1,2,3-cd)pyrene	mg/kg	.43	U	.21	U	.285	U	.054	J
Isophorone	mg/kg	.43	U	.21	U	.285	U	.22	U
Naphthalene	mg/kg	.43	U	.21	U	.285	U	.22	U
Nitrobenzene	mg/kg	.43	U	.21	U	.285	U	.22	U
Pentachlorophenol	mg/kg	2.1	U	1	U	1.4	U	1.05	U
Phenanthrene	mg/kg	.43	U	.32	J	.285	U	.12	J
Phenol	mg/kg	.43	U	.21	U	.285	U	.22	U
Pyrene	mg/kg	.43	U	.11	J	.285	U	.16	J
bis(2-Chloroethoxy)methane	mg/kg	.43	U	.21	U	.285	U	.22	U
bis(2-Chloroethyl)ether	mg/kg	.43	U	.21	U	.285	U	.22	U
bis(2-Chloroisopropyl)ether	mg/kg	.43	U	.21	U	.285	U	.22	U
bis(2-Ethylhexyl)phthalate	mg/kg	.43	U	.21	U	.285	U	.22	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Butyl phthalate	mg/kg	.43	U	.21	U	.285	U	.22	U
di-n-Octyl phthalate	mg/kg	.43	U	.21	U	.285	U	.22	U
n-Nitroso-di-n-propylamine	mg/kg	.43	U	.21	U	.285	U	.22	U
n-Nitrosodiphenylamine	mg/kg	.43	U	.21	U	.285	U	.22	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
PEST/PCB	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016	mg/kg	.043	U	.021	U	.0285	U	.022	U
Aroclor 1221	mg/kg	.043	U	.021	U	.0285	U	.022	U
Aroclor 1232	mg/kg	.043	U	.021	U	.0285	U	.022	U
Aroclor 1242	mg/kg	.043	U	.021	U	.0285	U	.022	U
Aroclor 1248	mg/kg	.043	U	.021	U	.0285	U	.022	U
Aroclor 1254	mg/kg	.043	U	.021	U	.0285	U	.022	U
Aroclor 1260	mg/kg	.043	U	.021	U	.0285	U	.022	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6020		2830		5130		3400	
Antimony	mg/kg	7.85	UJ	3.8	UJ	5.2	UJ	3.95	UJ
Arsenic	mg/kg	4.5		5.1		4.3		4.4	
Barium	mg/kg	53.4		12.65	U	48.1		30.9	
Beryllium	mg/kg	.65	U	.315	U	.435	U	.33	U
Cadmium	mg/kg	.65	U	.315	U	.435	U	.33	U
Calcium	mg/kg	96000		46300		62000		8110	
Chromium	mg/kg	11.5		6.3		10.4		6.8	
Cobalt	mg/kg	6.55	U	3.15	U	4.35	U	3.3	U
Copper	mg/kg	17.9		7.6		14.5		7.4	
Iron	mg/kg	16200		9620		13700		9330	
Lead	mg/kg	12.8		4.8		7.8		5.6	
Magnesium	mg/kg	10700		19300		13500		2710	
Manganese	mg/kg	865		421		404		104	
Mercury	mg/kg	.043	U	.021	U	.0285	U	.022	U
Nickel	mg/kg	18.6		9.5		17.9		10.4	
Potassium	mg/kg	655	U	315.5	U	1040		330	U
Selenium	mg/kg	.65	U	.315	U	.435	U	.33	U
Silver	mg/kg	1.3	U	.65	U	.85	U	.65	U
Sodium	mg/kg	655	U	315.5	U	432.5	U	330	U
Thallium	mg/kg	1.3	U	.65	U	.85	U	.65	U
Vanadium	mg/kg	17.4		12.9		14.2		7.9	
Zinc	mg/kg	73.3		23.2		58.4		42.1	

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Sediments

Report Date: 09/20/00

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
1,3-Dinitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4,6-Trinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,4-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2,6-Dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2-Amino-4,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
2-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
3-Nitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
4-Amino-2,6-dinitrotoluene	mg/kg	.125	U	.125	U	.125	U	.125	U
HMX	mg/kg	.25	U	.25	U	.25	U	.25	U
Nitrobenzene	mg/kg	.125	U	.125	U	.125	U	.125	U
RDX	mg/kg	.25	U	.25	U	.25	U	.25	U
Tetryl	mg/kg	.325	U	.325	U	.325	U	.325	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
WATER QUALITY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Hardness		ug/L	328000		284000		488000		432000	

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,1,1-Trichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U
1,1,2,2-Tetrachloroethane		ug/L	.5	U	.5	U	.5	U	.5	U
1,1,2-Trichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U
1,1-Dichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U
1,1-Dichlorocthene		ug/L	.5	U	.5	U	.5	U	.5	U
1,2-Dichloroethane		ug/L	.5	U	.5	U	.5	U	.5	U
1,2-Dichloroethene		ug/L	.5	U	.5	U	.5	U	.5	U
1,2-Dichloropropane		ug/L	.5	U	.5	U	.5	U	.5	U
2-Butanone		ug/L	2.5	R	2.5	R	2.5	R	2.5	R
2-Hexanone		ug/L	2.5	U	2.5	U	2.5	U	2.5	U
4-Methyl-2-pentanone		ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Acetone		ug/L	2.5	B	1.7	B	2.5	B	1.2	B
Benzene		ug/L	.5	U	.5	U	.5	U	.5	U
Bromodichloromethane		ug/L	0.72	J	.5	U	.5	U	.5	U
Bromoform		ug/L	.5	U	.5	U	.5	U	.5	U
Bromomethane		ug/L	0.17	J	0.11	J	1	U	1	U
Carbon disulfide		ug/L	.5	U	.5	U	.5	U	.5	U
Carbon tetrachloride		ug/L	.5	U	.5	U	.5	U	.5	U
Chlorobenzene		ug/L	.5	U	.5	U	.5	U	.5	U
Chloroethanc		ug/L	1	U	1	U	1	U	1	U
Chloroform		ug/L	3.5	B	0.55	B	.5	U	.5	U
Chloromethane		ug/L	1	U	1	U	1	U	1	U
Dibromochloromethane		ug/L	0.21	J	.5	U	.5	U	.5	U
Ethylbenzene		ug/L	.5	U	.5	U	.5	U	.5	U
Methylene chloride		ug/L	.5	U	.5	U	.5	U	.5	U
Styrene		ug/L	.5	U	.5	U	.5	U	.5	U
Tetrachloroethene		ug/L	.5	U	.5	U	.5	U	.5	U
Toluene		ug/L	.5	U	.5	U	.5	U	.5	U
Total xylenes		ug/L	.5	U		U	.5	U	.5	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Trichloroethene		ug/L	.5	U	.5	U	.5	U	.5	U
Vinyl chloride		ug/L	1	U	1	U	1	U	1	U
cis-1,3-Dichloropropene		ug/L	.5	U	.5	U	.5	U	.5	U
trans-1,3-Dichloropropene		ug/L	.5	U	.5	U	.5	U	.5	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,2,4-Trichlorobenzene		ug/L	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene		ug/L	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene		ug/L	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene		ug/L	5	U	5	U	5	U	5	U
2,4,5-Trichlorophenol		ug/L	5	U	5	U	5	U	5	U
2,4,6-Trichlorophenol		ug/L	5	U	5	U	5	U	5	U
2,4-Dichlorophenol		ug/L	5	U	5	U	5	U	5	U
2,4-Dimethylphenol		ug/L	5	U	5	U	5	U	5	U
2,4-Dinitrophenol		ug/L	25	U	25	U	25	U	25	U
2,4-Dinitrotoluene		ug/L	5	U	5	U	5	U	5	U
2,6-Dinitrotoluene		ug/L	5	U	5	U	5	U	5	U
2-Chloronaphthalene		ug/L	5	U	5	U	5	U	5	U
2-Chlorophenol		ug/L	5	U	5	U	5	U	5	U
2-Methylnaphthalene		ug/L	5	U	5	U	5	U	5	U
2-Methylphenol		ug/L	5	U	5	U	5	U	5	U
2-Nitroaniline		ug/L	25	U	25	U	25	U	25	U
2-Nitrophenol		ug/L	5	U	5	U	5	U	5	U
3,3'-Dichlorobenzidine		ug/L	25	U	25	U	25	U	25	U
3-Nitroaniline		ug/L	25	U	25	U	25	U	25	U
4,6-Dinitro-2-methylphenol		ug/L	25	U	25	U	25	U	25	U
4-Bromophenyl phenyl ether		ug/L	5	U	5	U	5	U	5	U
4-Chloro-3-methylphenol		ug/L	5	U	5	U	5	U	5	U
4-Chloroaniline		ug/L	5	U	5	U	5	U	5	U
4-Chlorophenyl phenyl ether		ug/L	5	U	5	U	5	U	5	U
4-Methylphenol		ug/L	5	U	5	U	5	U	5	U
4-Nitroaniline		ug/L	25	U	25	U	25	U	25	U
4-Nitrophenol		ug/L	25	U	25	U	25	U	25	U
Acenaphthene		ug/L	5	U	5	U	5	U	5	U
Acenaphthylene		ug/L	5	U		U	5	U	5	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Anthracene		ug/L	5	U	5	U	5	U	5	U
Benzo(a)anthracene		ug/L	5	U	5	U	5	U	5	U
Benzo(a)pyrene		ug/L	5	U	5	U	5	U	5	U
Benzo(b)fluoranthene		ug/L	5	U	5	U	5	U	5	U
Benzo(ghi)perylene		ug/L	5	U	5	U	5	U	5	U
Benzo(k)fluoranthene		ug/L	5	U	5	U	5	U	5	U
Butyl benzyl phthalate		ug/L	5	U	5	U	5	U	5	U
Carbazole		ug/L	5	U	5	U	5	U	5	U
Chrysene		ug/L	5	U	5	U	5	U	5	U
Dibenz(a,h)anthracene		ug/L	5	U	5	U	5	U	5	U
Dibenzofuran		ug/L	5	U	5	U	5	U	5	U
Diethyl phthalate		ug/L	5	U	5	U	5	U	5	U
Dimethyl phthalate		ug/L	5	U	5	U	5	U	5	U
Fluoranthene		ug/L	5	U	5	U	5	U	5	U
Fluorene		ug/L	5	U	5	U	5	U	5	U
Hexachlorobenzene		ug/L	5	U	5	U	5	U	5	U
Hexachlorobutadiene		ug/L	5	U	5	U	5	U	5	U
Hexachlorocyclopentadiene		ug/L	25	U	25	U	25	U	25	U
Hexachloroethane		ug/L	5	U	5	U	5	U	5	U
Indeno(1,2,3-cd)pyrene		ug/L	5	U	5	U	5	U	5	U
Isophorone		ug/L	5	U	5	U	5	U	5	U
Naphthalene		ug/L	5	U	5	U	5	U	5	U
Nitrobenzene		ug/L	5	U	5	U	5	U	5	U
Pentachlorophenol		ug/L	25	U	25	U	25	U	25	U
Phenanthrene		ug/L	5	U	5	U	5	U	5	U
Phenol		ug/L	2.2	B	1.9	B	2.3	B	5	U
Pyrene		ug/L	5	U	5	U	5	U	5	U
bis(2-Chloroethoxy)methane		ug/L	5	U	5	U	5	U	5	U
bis(2-Chloroethyl)ether		ug/L	5	U	5	U	5	U	5	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
bis(2-Chloroisopropyl)ether		ug/L	5	U	5	U	5	U	5	U
bis(2-Ethylhexyl)phthalate		ug/L	5	U	2.1	B	5	U	5	U
di-n-Butyl phthalate		ug/L	5	U	5	U	5	U	5	U
di-n-Octyl phthalate		ug/L	5	U	5	U	5	U	5	U
n-Nitroso-di-n-propylamine		ug/L	5	U	5	U	5	U	5	U
n-Nitrosodiphenylamine		ug/L	5	U	5	U	5	U	5	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
PEST/PCB	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aroclor 1016		ug/L	.5	U	.5	U	.5	U	.5	U
Aroclor 1221		ug/L	.5	U	.5	U	.5	U	.5	U
Aroclor 1232		ug/L	.5	U	.5	U	.5	U	.5	U
Aroclor 1242		ug/L	.5	U	.5	U	.5	U	.5	U
Aroclor 1248		ug/L	.5	U	.5	U	.5	U	.5	U
Aroclor 1254		ug/L	.5	U	.5	U	.5	U	.5	U
Aroclor 1260		ug/L	.5	U	.5	U	.5	U	.5	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	778	J	530	J	3040	J	100	U
Aluminum	Y	ug/L	463		874		10200		100	U
Antimony		ug/L	30	U	30	U	30	U	30	U
Antimony	Y	ug/L	30	U	30	U	30	U	30	U
Arsenic		ug/L	5	U	5	U	5	U	5	U
Arsenic	Y	ug/L	5	U	5	U	5	U	5	U
Barium		ug/L	100	U	100	U	100	U	100	U
Barium	Y	ug/L	100	U	100	U	215		100	U
Beryllium		ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Beryllium	Y	ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Cadmium		ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Cadmium	Y	ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Calcium		ug/L	74200		71700		118000		97900	
Calcium	Y	ug/L	74000		71400		179000		98100	
Chromium		ug/L	5	U	5	U	5	U	5	U
Chromium	Y	ug/L	5	U	5	U	17.2		5	U
Cobalt		ug/L	25	U	25	U	25	U	25	U
Cobalt	Y	ug/L	25	U	25	U	25	U	25	U
Copper		ug/L	12.5	U	12.5	U	12.5	U	12.5	U
Copper	Y	ug/L	12.5	U	12.5	U	12.5	U	12.5	U
Iron		ug/L	1420		972		5790		948	
Iron	Y	ug/L	809		1260		16800		550	
Lead		ug/L	1.5	U	1.5	U	1.5	U	1.5	U
Lead	Y	ug/L	1.5	U	1.5	U	8.7		1.5	U
Magnesium		ug/L	16000		15800		37300		36800	
Magnesium	Y	ug/L	15700		15800		46700		36900	
Manganese		ug/L	245		261		404		67.1	
Manganese	Y	ug/L	144		249		649		34.4	
Mercury		ug/L	.1	U		U	.1	U	.1	U

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Mercury	Y	ug/L	.1	U	.1	U	.1	U	.1	U
Nickel		ug/L	20	U	20	U	20	U	20	U
Nickel	Y	ug/L	20	U	20	U	20	U	20	U
Potassium		ug/L	2500	U	2500	U	2500	U	2500	U
Potassium	Y	ug/L	2500	U	2500	U	7130		2500	U
Selenium		ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Selenium	Y	ug/L	2.5	U	2.5	U	2.5	U	2.5	U
Silver		ug/L	5	U	5	U	5	U	5	U
Silver	Y	ug/L	5	U	5	U	5	U	5	U
Sodium		ug/L	24900		24700		13700		14800	
Sodium	Y	ug/L	25700		24500		15000		15300	
Thallium		ug/L	5	U	5	U	5	U	5	U
Thallium	Y	ug/L	5	U	5	U	5	U	5	U
Vanadium		ug/L	25	U	25	U	25	U	25	U
Vanadium	Y	ug/L	25	U	25	U	53.9		25	U
Zinc		ug/L	10	U	10	U	58.0		20.2	
Zinc	Y	ug/L	10	U	10	U	145		10	U

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds
Data Summary - Surface Waters

Report Date: 09/20/00

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	.1	U	.1	U	.1	U	.1	U
1,3-Dinitrobenzene		ug/L	.1	U	.1	U	.1	U	.1	U
2,4,6-Trinitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
2,4-Dinitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
2,6-Dinitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
2-Amino-4,6-dinitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
2-Nitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
3-Nitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
4-Amino-2,6-dinitrotoluene		ug/L	.1	U	.1	U	.1	U	.1	U
HMX		ug/L	.25	U	.25	U	.25	U	.25	U
Nitrobenzene		ug/L	.1	U	.1	U	.1	U	.1	U
RDX		ug/L	.25	U	.25	U	.25	U	.25	U
Tetryl		ug/L	.1	U	.1	U	.1	U	.1	U

APPENDIX F

BLANK EVALUATED ANALYTICAL DATA

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP01		WARP-DP02		WARP-DP04		WARP-DP06		WARP-DP08	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8110		8140		8240		8300		8380	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		15-JUN-98	
Depth:		4-6		0-2		8-10		0-2		0-2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Acetone	ug/kg									35	
Methylene chloride	ug/kg									2.0	J
Toluene	ug/kg	2.2	J	1.8	J	2.5	J	2.3	J		

PLUMBROOK

West Area Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP11		WARP-DP12		WARP-DP13		WARP-DP15		WARP-DP17	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8500		8550		8580		8670		8750	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		25-JUN-98	
Depth:		0-2		4-6		0-2		4-6		4-6	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Acetone	ug/kg										
Methylene chloride	ug/kg			2.0	J	2.3	J				
Toluene	ug/kg	3.2	J					2.1	J	2.2	J

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected HIts Summary

Sample Location:		WARP-DP20	
Associated Site:		WARP	
Sample No:		8870	
Sample Date:		24-JUN-98	
Depth:		4-6	
VOLATILES	Units	Result	Val Qlfr
Acetone	ug/kg		
Methylene chloride	ug/kg		
Toluene	ug/kg	1.5	J

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP09		WARP-DP11		WARP-DP13		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP	
Sample No:		8430		8500		8580		8870	
Sample Date:		16-JUN-98		25-JUN-98		15-JUN-98		24-JUN-98	
Depth:		4-6		0-2		0-2		4-6	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2,4-Dinitrotoluene	ug/kg			43	J				
Acenaphthylene	ug/kg					41	J	40	J
Anthracene	ug/kg					230	J	120	J
Benzo(a)anthracene	ug/kg					400		170	J
Benzo(a)pyrene	ug/kg					390		140	J
Benzo(b)fluoranthene	ug/kg					300	J	140	J
Benzo(ghi)perylene	ug/kg					220	J	76	J
Benzo(k)fluoranthene	ug/kg					350	J	110	J
Chrysene	ug/kg					420		170	J
Fluoranthene	ug/kg	58	J			760		380	
Indeno(1,2,3-cd)pyrene	ug/kg					230	J	76	J
Phenanthrene	ug/kg					360	J	250	J
Pyrene	ug/kg	43	J			550		280	J

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP01		WARP-DP01		WARP-DP01		WARP-DP02		WARP-DP02	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8100		8110		8120		8140		8150	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6880		9190		6010		17900		7540	
Antimony	mg/kg										
Arsenic	mg/kg	2.8		8.6		4.5		7.2		2.5	
Barium	mg/kg			40.3		27.9		124		32.1	
Beryllium	mg/kg							1.0			
Cadmium	mg/kg										
Calcium	mg/kg	1490		35700		67600		5930		3010	
Chromium	mg/kg	9.9	J	16.1	J	10.9	J	20.8	J	12.1	J
Cobalt	mg/kg			8.5		6.2		16.2			
Copper	mg/kg	4.0		20.1		17.1		20.0		7.0	
Iron	mg/kg	10300		19600		15000		26800		11500	
Lead	mg/kg	3.6	J	8.1	J	7.1	J	13.5	J	4.8	J
Magnesium	mg/kg	1090		14500		20700		4020		2110	
Manganese	mg/kg	89.6		282		329		1190		92.5	
Mercury	mg/kg							0.061			
Nickel	mg/kg	7.6		19.4		14.0		29.1		13.0	
Potassium	mg/kg			2010	J	1480	J	2490	J	1210	J
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	18.9		28.0		20.5		37.7		17.8	
Zinc	mg/kg	21.7		51.2		40.0		87.4		33.9	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP02		WARP-DP03		WARP-DP03		WARP-DP03		WARP-DP04	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8160		8180		8190		8200		8220	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98		23-JUN-98	
Depth:		8-10		0-2		4-6		8-10		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	14500		16500		7040		9400		17000	
Antimony	mg/kg										
Arsenic	mg/kg	11.7		8.1		6.8		5.8		6.1	
Barium	mg/kg	75.3		112		87.2		58.0		85.4	
Beryllium	mg/kg	0.70		0.76	J					0.78	J
Cadmium	mg/kg			0.59							
Calcium	mg/kg	56600		2710		2200		40200		1900	
Chromium	mg/kg	22.2	J	19.9	J	11.4	J	14.8	J	19.2	J
Cobalt	mg/kg	10		17.9		21.0		8.5		14.7	
Copper	mg/kg	25.6		21.4				20.3		21.9	
Iron	mg/kg	26400		30200		19600		20100		23900	
Lead	mg/kg	10.8	J	11.7		9.4		7.6		10.3	
Magnesium	mg/kg	15100		3760		2020		10800		3220	
Manganese	mg/kg	423		1340		495		372		915	
Mercury	mg/kg										
Nickel	mg/kg	27.8		44.3		24.0		23.0		29.7	
Potassium	mg/kg	3370	J	2970	J	941	J	2460	J	2510	J
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	34.6		32.5	J	19.6	J	23.3	J	32.9	J
Zinc	mg/kg	68.1		111		64.1		54.7		88.1	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP04		WARP-DP04		WARP-DP05		WARP-DP05		WARP-DP05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8230		8240		8260		8270		8280	
Sample Date:		23-JUN-98		23-JUN-98		16-JUN-98		16-JUN-98		16-JUN-98	
Depth:		4-6		8-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8640		13400		8120		8840		9510	
Antimony	mg/kg										
Arsenic	mg/kg	4.5		11.2		4.8		4.6		6.7	
Barium	mg/kg	45.7		35.3		51.2		62.4		54.3	
Beryllium	mg/kg										
Cadmium	mg/kg										
Calcium	mg/kg	1860		40300		2390		54500		50400	
Chromium	mg/kg	11.9	J	20.0	J	13.1		15.3		17.4	
Cobalt	mg/kg	9.2		11.6		8.5		9.6		9.2	
Copper	mg/kg			34.7		11.7		19.3		19.0	
Iron	mg/kg	14500		27800		17600		17000		18200	
Lead	mg/kg	6.2		12.3		6.1		10.5		8.4	
Magnesium	mg/kg	1990		11000		2150		23400		14800	
Manganese	mg/kg	267		363		468		527		362	
Mercury	mg/kg										
Nickel	mg/kg	20.9		36.0		17.0		23.2		21.7	
Potassium	mg/kg	1370	J	3570	J	813		1740		1730	
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	18.2	J	24.7	J	24.1	J	27.1	J	25.9	J
Zinc	mg/kg	53.8		80.0		40.4		53.6		53.4	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP06		WARP-DP06		WARP-DP06		WARP-DP07		WARP-DP07	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8300		8310		8320		8340		8350	
Sample Date:		23-JUN-98		23-JUN-98		23-JUN-98		25-JUN-98		25-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	5600		8610		12100		11500		9160	
Antimony	mg/kg										
Arsenic	mg/kg	2.3		6.8		6.6		3.7		3.1	
Barium	mg/kg			31.3		82.3		69.7		43.3	
Beryllium	mg/kg							0.70			
Cadmium	mg/kg										
Calcium	mg/kg	1620		2530		55700		2700		2410	
Chromium	mg/kg	8.9	J	15.5	J	17.9	J	15.8	J	14.1	J
Cobalt	mg/kg			7.9		12.8		9.0		7.3	
Copper	mg/kg	4.5		12.4		23.5		15.9		12.5	
Iron	mg/kg	10200		17000		21500		16800		13900	
Lead	mg/kg	2.8	J	7.1	J	11.6	J	10.1	J	6.9	J
Magnesium	mg/kg	1060		1860		17700		2720		2340	
Manganese	mg/kg	143		413		768		186		123	
Mercury	mg/kg										
Nickel	mg/kg	7.1		14.8		31.4		22.3		18.3	
Potassium	mg/kg			924	J	2860	J	1650	J	1650	J
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	17.9		25.4		30.8		21.1		20.4	
Zinc	mg/kg	21.1		39.3		62.2		70.5		57.5	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected HIts Summary

Report Date: 09/24/98

Sample Location:		WARP-DP07		WARP-DP08		WARP-DP08		WARP-DP08		WARP-DP09	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8360		8380		8390		8400		8420	
Sample Date:		25-JUN-98		15-JUN-98		15-JUN-98		15-JUN-98		16-JUN-98	
Depth:		8-10		0-2		4-6		8-10		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	10900		4880		8740		5570		7610	
Antimony	mg/kg										
Arsenic	mg/kg	7.4		2.2		6.9		4.0		6.8	
Barium	mg/kg	55.4				43.8				53.9	
Beryllium	mg/kg	0.65									
Cadmium	mg/kg										
Calcium	mg/kg	25000		1480		1810		1460		58600	
Chromium	mg/kg	17.1	J	6.8		17.4		7.5		22.2	
Cobalt	mg/kg	13.8				7.4					
Copper	mg/kg	21.4		2.9		10.4		6.9		18.5	
Iron	mg/kg	20700		8460		22000		10000		14200	
Lead	mg/kg	11.6	J	2.2		5.4		4.4		11.7	
Magnesium	mg/kg	5620				1810		832		4510	
Manganese	mg/kg	472		107		231		215		213	
Mercury	mg/kg									0.10	
Nickel	mg/kg	29.7		7.5		17.0		10.8		10.6	
Potassium	mg/kg	2390	J			643					
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	24.2		15.8		30.0		17.8		21.1	J
Zinc	mg/kg	75.6		15.9		37.8		26.5		36.9	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP09		WARP-DP09		WARP-DP10		WARP-DP10		WARP-DP11	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8430		8440		8460		8470		8500	
Sample Date:		16-JUN-98		16-JUN-98		26-JUN-98		26-JUN-98		25-JUN-98	
Depth:		4-6		8-10		0-2		4-6		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6470		11100		12300		12000		11300	
Antimony	mg/kg			7.7							
Arsenic	mg/kg	2.2		14.0		5.2		7.9		3.7	
Barium	mg/kg	41.3		78.2		77.4		80.3		72.9	
Beryllium	mg/kg			0.65		0.73		0.86		0.64	
Cadmium	mg/kg										
Calcium	mg/kg	1220		7860		3260		2130		2600	
Chromium	mg/kg	8.2		20.9		15.7	J	17.9	J	15.8	J
Cobalt	mg/kg			11.9		15.7		11.2		11.5	
Copper	mg/kg	4.9		24.2		16.5		20.4		12.3	
Iron	mg/kg	8490		29000		20000		27000		18700	
Lead	mg/kg	5.8		10.6		11.0	J	11.5	J	9.1	J
Magnesium	mg/kg	2010		4980		2930		2850		3030	
Manganese	mg/kg	83.4		405		681		243		375	
Mercury	mg/kg					0.045					
Nickel	mg/kg	7.4		36.6		29.0		33.5		22.6	
Potassium	mg/kg			1160		1600	J	1340	J	1660	J
Selenium	mg/kg										
Sodium	mg/kg							1270			
Vanadium	mg/kg	14.2	J	27.5	J	22.4		24.6		21.1	
Zinc	mg/kg	30.6		72.5		74.6		94.6		75.4	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP11		WARP-DP11		WARP-DP12		WARP-DP12		WARP-DP12	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8510		8520		8540		8550		8560	
Sample Date:		25-JUN-98		25-JUN-98		15-JUN-98		15-JUN-98		15-JUN-98	
Depth:		4-6		8-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	5980		11400		4720		5080		9320	
Antimony	mg/kg										
Arsenic	mg/kg	6.5		7.9		2.0		23.6		8.3	
Barium	mg/kg	35.5		51.5		24.8		39.3		54.5	
Beryllium	mg/kg			0.59							
Cadmium	mg/kg										
Calcium	mg/kg	1570		51000		757		18800		57200	
Chromium	mg/kg	9.4	J	16.8	J	5.4		10.6		16.2	
Cobalt	mg/kg	6.9		10.1				8.2		8.9	
Copper	mg/kg	10.4		24.3		3.5		19.3		22.6	
Iron	mg/kg	16800		22500		7190		23200		19500	
Lead	mg/kg	6.2	J	8.2	J	2.9		6.4		9.8	
Magnesium	mg/kg	1580		11300		684		6810		17400	
Manganese	mg/kg	114		392		172		551		433	
Mercury	mg/kg										
Nickel	mg/kg	16.6		30.2		8.6		24.9		23.9	
Potassium	mg/kg	903	J	3140	J			803		1860	
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	13.9		24.2		10.1		22.3		25.9	
Zinc	mg/kg	42.4		58.9		22.9		55.0		60.6	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		WARP-DP13		WARP-DP13		WARP-DP13		WARP-DP15		WARP-DP15	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8580		8590		8600		8660		8670	
Sample Date:		15-JUN-98		15-JUN-98		15-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	11900		5910		13700		14300		11100	
Antimony	mg/kg										
Arsenic	mg/kg	11.5		3.1		15.3		9.3		3.7	
Barium	mg/kg	82.0		27.9		76.3		91.4		53.8	
Beryllium	mg/kg	0.67				0.83		0.63	J		
Cadmium	mg/kg					0.68					
Calcium	mg/kg	16600		4680		3580		31400		2480	
Chromium	mg/kg	20.3		10.3		22.2		19.7	J	13.0	J
Cobalt	mg/kg	11.1		6.0		18.4		13.0		6.2	
Copper	mg/kg	26.8		14.0		29.1		22.7			
Iron	mg/kg	27400		10900		34000		24700		13400	
Lead	mg/kg	11.3		4.9		14.0		10.7		5.9	
Magnesium	mg/kg	8890		2050		4310		12200		2010	
Manganese	mg/kg	391		231		780		781		269	
Mercury	mg/kg										
Nickel	mg/kg	29.1		10.3		45.0		32.1		13.6	
Potassium	mg/kg	1830				1630		2640	J	1370	J
Selenium	mg/kg										
Sodium	mg/kg					1030					
Vanadium	mg/kg	31.0		17.0		36.7		36.3	J	23.2	J
Zinc	mg/kg	69.9		27.2		82.9		63.4		45.3	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Sample Location:		WARP-DP15		WARP-DP16		WARP-DP16		WARP-DP16		WARP-DP17	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8680		8700		8710		8720		8740	
Sample Date:		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98		25-JUN-98	
Depth:		8-10		0-2		4-6		8-10		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	13800		20600		12400		18400		11200	
Antimony	mg/kg			7.4	J						
Arsenic	mg/kg	7.6		11.4		11.0		9.5		5.1	
Barium	mg/kg	165		130		117		118		61.9	
Beryllium	mg/kg	0.64	J	1.2	J			0.82	J		
Cadmium	mg/kg										
Calcium	mg/kg	3480		3760		31700		13300		1460	
Chromium	mg/kg	12.9	J	25.4	J	15.8	J	22.7	J	14.8	J
Cobalt	mg/kg	16.2		17.1		13.0		15.0		11.5	
Copper	mg/kg	18.0		30.9		26.2		26.4		15.4	
Iron	mg/kg	24500		36000		29200		31100		19800	
Lead	mg/kg	13.2		11.4		9.1		10.1		10.6	
Magnesium	mg/kg	4220		4870		10100		6970		2500	J
Manganese	mg/kg	1900		982		1280		1170		207	
Mercury	mg/kg			0.040							
Nickel	mg/kg	40.8		46.9		33.9		39.3		20.5	
Potassium	mg/kg	2070	J	2590	J	1830	J	3240	J	898	J
Selenium	mg/kg									0.65	
Sodium	mg/kg			681				726			
Vanadium	mg/kg	27.7	J	40.5	J	31.0	J	40.3	J	19.2	
Zinc	mg/kg	75.7		103		70.9		81.2		65.4	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Sample Location:		WARP-DP17		WARP-DP17		WARP-DP18		WARP-DP18		WARP-DP18	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8750		8760		8780		8790		8800	
Sample Date:		25-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98		25-JUN-98	
Depth:		4-6		8-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9420		12500		10700		8670		21000	
Antimony	mg/kg										
Arsenic	mg/kg	11.6		10.0		5.3		4.1		4.9	
Barium	mg/kg	67.7		74.8		61.9		58.8		92.7	
Beryllium	mg/kg			0.74		0.59				1.0	
Cadmium	mg/kg										
Calcium	mg/kg	2240		2460		7330		4890		39100	
Chromium	mg/kg	15.5	J	19.6	J	15.3	J	13.0	J	28.6	J
Cobalt	mg/kg	15.5		13.8		11.1		8.1		11.5	
Copper	mg/kg	19.2		21.7		17.3		14.0		25.2	
Iron	mg/kg	26100		26600		18400		15400		26000	
Lead	mg/kg	9.0		8.7		9.6		7.6		11.0	
Magnesium	mg/kg	2530	J	2920	J	4680	J	2860	J	10300	J
Manganese	mg/kg	326		362		453		261		374	
Mercury	mg/kg										
Nickel	mg/kg	31.6		31.1		23.5		20.4		35.9	
Potassium	mg/kg	1030	J	1580	J	1270	J	1080	J	5630	J
Selenium	mg/kg										
Sodium	mg/kg	858		952							
Vanadium	mg/kg	22.1		27.5		23.0		17.8		37.2	
Zinc	mg/kg	66.1		74.3		60.3		55.2		64.9	

PLUMBROOK
West Area Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Sample Location:		WARP-DP19		WARP-DP19		WARP-DP19		WARP-DP20		WARP-DP20	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8820		8830		8840		8860		8870	
Sample Date:		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98		24-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6680		18000		17000		13000		10900	
Antimony	mg/kg										
Arsenic	mg/kg	2.1		9.4		9.8		8.5		7.0	
Barium	mg/kg	26.4		70.0		83.3		66.0		56.1	
Beryllium	mg/kg			0.83	J	0.75	J				
Cadmium	mg/kg										
Calcium	mg/kg	1620		2600		34600		35600		23500	
Chromium	mg/kg	9.1	J	23.3	J	25.1	J	16.7	J	16.1	J
Cobalt	mg/kg			19.0		14.5		11.9		7.8	
Copper	mg/kg			30.6		30.9					
Iron	mg/kg	10600		32000		30000		20900		19100	
Lead	mg/kg	3.4		13.2		11.2		9.4		7.4	
Magnesium	mg/kg	1290		4480		14700		9970		8670	
Manganese	mg/kg	184		898		568		551		320	
Mercury	mg/kg										
Nickel	mg/kg	9.8		42.3		37.9		19.3		18.6	
Potassium	mg/kg	742	J	2430	J	3960	J	2040	J	1350	J
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	19.8	J	38.9	J	37.3	J	35.0	J	29.1	J
Zinc	mg/kg	28.7		85.1		81.6		49.8		48.2	

Sample Location:		WARP-DP20	
Associated Site:		WARP	
Sample No:		8880	
Sample Date:		24-JUN-98	
Depth:		8-10	
METALS	Units	Result	Val Qlfr
Aluminum	mg/kg	12000	
Antimony	mg/kg		
Arsenic	mg/kg	4.6	
Barium	mg/kg	80.3	
Beryllium	mg/kg		
Cadmium	mg/kg		
Calcium	mg/kg	5120	
Chromium	mg/kg	16.9	J
Cobalt	mg/kg	10.1	
Copper	mg/kg		
Iron	mg/kg	18800	
Lead	mg/kg	7.4	
Magnesium	mg/kg	3690	
Manganese	mg/kg	484	
Mercury	mg/kg		
Nickel	mg/kg	28.7	
Potassium	mg/kg	1710	J
Selenium	mg/kg		
Sodium	mg/kg	619	
Vanadium	mg/kg	24.1	J
Zinc	mg/kg	77.5	

Sample Location:		WARP-DP03		WARP-DP09		WARP-DP10		WARP-DP11		WARP-DP13	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		8200		8440		8470		8520		8600	
Sample Date:		23-JUN-98		16-JUN-98		26-JUN-98		25-JUN-98		15-JUN-98	
Depth:		8-10		8-10		4-6		8-10		8-10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	ug/kg	280		310		4400		740		4400	
2,4,6-Trinitrotoluene	ug/kg					380					
2,4-Dinitrotoluene	ug/kg			490		1400				6300	
2,6-Dinitrotoluene	ug/kg					1500					

Sample Location:		WARP-DP18	
Associated Site:		WARP	
Sample No:		8800	
Sample Date:		25-JUN-98	
Depth:		8-10	
EXPLOSIVES	Units	Result	Val Qlfr
1,3,5-Trinitrobenzene	ug/kg	980	
2,4,6-Trinitrotoluene	ug/kg		
2,4-Dinitrotoluene	ug/kg		
2,6-Dinitrotoluene	ug/kg		

PLUMBROOK

West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP02		WARP-DP08		WARP-DP09		WARP-DP11		WARP-DP13	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			8170		8410		8450		8530		8610	
Sample Date:			24-JUN-98		16-JUN-98		16-JUN-98		26-JUN-98		15-JUN-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2-Butanone		ug/L										
Benzene		ug/L	0.15	J					0.13	J		
Carbon disulfide		ug/L			0.15	J						
Ethylbenzene		ug/L									0.19	J
Tetrachloroethene		ug/L			0.20	J	0.15	J				

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West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP15		WARP-DP19	
Associated Site:			WARP		WARP	
Sample No:			8690		8850	
Sample Date:			26-JUN-98		26-JUN-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
2-Butanone		ug/L	1.2	J	1.8	J
Benzene		ug/L				
Carbon disulfide		ug/L			0.18	J
Ethylbenzene		ug/L				
Tetrachloroethene		ug/L				

PLUMBROOK

West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP09		WARP-DP13	
Associated Site:			WARP		WARP	
Sample No:			8450		8610	
Sample Date:			16-JUN-98		15-JUN-98	
TSS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Total suspended solids		ug/L	85000		15000	

PLUMBROOK

West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP09		WARP-DP13	
Associated Site:			WARP		WARP	
Sample No:			8450		8610	
Sample Date:			16-JUN-98		15-JUN-98	
TOC-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Total organic carbon		ug/L	32000		36600	

PLUMBROOK

West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP09		WARP-DP13	
Associated Site:			WARP		WARP	
Sample No:			8450		8610	
Sample Date:			16-JUN-98		15-JUN-98	
TDS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Total dissolved solids		ug/L	1710000		1260000	

PLUMBROOK

West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP09		WARP-DP13	
Associated Site:			WARP		WARP	
Sample No:			8450		8610	
Sample Date:			16-JUN-98		15-JUN-98	
SULFATE-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Sulfate		ug/L	305000		278000	

PLUMBROOK
West Area Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP04		WARP-DP09		WARP-DP11		WARP-DP13		WARP-DP16	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			8250B		8450		8530		8610		8730	
Sample Date:			25-JUN-98		16-JUN-98		26-JUN-98		15-JUN-98		25-JUN-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2,4-Dinitrotoluene		ug/L			60		1.8	J	660		60	J
2,6-Dinitrotoluene		ug/L			6.3	J			56	J	15	J
3-Nitroaniline		ug/L	3.2	J	5.1	J	2.1	J	15	J	43	J
4,6-Dinitro-2-methylphenol		ug/L			24	J						
4-Nitrophenol		ug/L			2.4	J						

Sample Location:			WARP-DP17	
Associated Site:			WARP	
Sample No:			8770	
Sample Date:			25-JUN-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr
2,4-Dinitrotoluene		ug/L	52	J
2,6-Dinitrotoluene		ug/L	18	J
3-Nitroaniline		ug/L	49	J
4,6-Dinitro-2-methylphenol		ug/L		
4-Nitrophenol		ug/L		

Sample Location:			WARP-DP13	
Associated Site:			WARP	
Sample No:			8610	
Sample Date:			15-JUN-98	
NITRATE-W	Fltr	Units	Result	Val Qlfr
Nitrate		ug/L	1600	

PLUMBROOK
West Area Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP02		WARP-DP04		WARP-DP07		WARP-DP09		WARP-DP11	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			8170		8250B		8370		8450		8530	
Sample Date:			24-JUN-98		25-JUN-98		26-JUN-98		16-JUN-98		26-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	13100		1240		51100		11100		59700	
Aluminum	Y	ug/L										
Antimony		ug/L										
Arsenic		ug/L	21.4						15.2		56.2	
Barium		ug/L					248				386	
Beryllium		ug/L										
Cadmium	Y	ug/L										
Calcium		ug/L	336000		569000		644000		230000		982000	
Calcium	Y	ug/L	211000		549000		364000		237000		395000	
Chromium		ug/L	28.8				91.6				96.8	
Chromium	Y	ug/L										
Cobalt		ug/L					68.4				85.2	
Cobalt	Y	ug/L										
Copper		ug/L	90.2				126				214	
Copper	Y	ug/L	42.1								67.0	
Iron		ug/L	39900		2650		123000		28500		137000	
Iron	Y	ug/L							120		121	
Lead		ug/L	14.4						11.8		68.3	
Lead	Y	ug/L							4.4			
Magnesium		ug/L	95100	J	234000	J	105000	J	219000		242000	J
Magnesium	Y	ug/L	62800	J	242000	J	71400	J	227000		80100	J
Manganese		ug/L	750		1410		3310		8610		4840	
Manganese	Y	ug/L	84.5		1450		480		8480		1070	
Mercury		ug/L									0.24	
Nickel		ug/L	61.5				220				249	
Nickel	Y	ug/L									62.0	
Potassium		ug/L	6880		17400		17100				20500	
Potassium	Y	ug/L			18200		6170				10200	
Selenium		ug/L										

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West Area Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP13		WARP-DP16		WARP-DP17	
Associated Site:			WARP		WARP		WARP	
Sample No:			8610		8730		8770	
Sample Date:			15-JUN-98		25-JUN-98		25-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	77200		206000		38500	
Aluminum	Y	ug/L			203		1350	
Antimony		ug/L			106			
Arsenic		ug/L	1780		111			
Barium		ug/L			773		217	
Beryllium		ug/L			9.5			
Cadmium	Y	ug/L			46.0			
Calcium		ug/L	315000		2680000		555000	
Calcium	Y	ug/L	156000		735000		301000	
Chromium		ug/L	127		296		58.7	
Chromium	Y	ug/L					32.9	
Cobalt		ug/L			264		173	
Cobalt	Y	ug/L			162		142	
Copper		ug/L			654		153	
Copper	Y	ug/L			117		94.6	
Iron		ug/L	153000		339000		73000	
Iron	Y	ug/L			373		2600	
Lead		ug/L	459		157		28.9	
Lead	Y	ug/L						
Magnesium		ug/L	86200		651000	J	178000	J
Magnesium	Y	ug/L			193000	J	145000	J
Manganese		ug/L	12600		9280		2470	
Manganese	Y	ug/L	7870		635		891	
Mercury		ug/L	0.65		0.47		0.25	
Nickel		ug/L			515		134	
Nickel	Y	ug/L			46.3			
Potassium		ug/L			33100		7640	
Potassium	Y	ug/L						
Selenium		ug/L	1790					

PLUMBROOK
West Area Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP02		WARP-DP04		WARP-DP07		WARP-DP09		WARP-DP11	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			8170		8250B		8370		8450		8530	
Sample Date:			24-JUN-98		25-JUN-98		26-JUN-98		16-JUN-98		26-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sodium		ug/L	408000		81800		182000		44300		503000	
Sodium	Y	ug/L	443000		114000		185000		44800		614000	
Thallium		ug/L										
Vanadium		ug/L	62.0				125				161	
Zinc		ug/L	123		22.1		411				467	
Zinc	Y	ug/L										

PLUMBROOK
West Area Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP13		WARP-DP16		WARP-DP17	
Associated Site:			WARP		WARP		WARP	
Sample No:			8610		8730		8770	
Sample Date:			15-JUN-98		25-JUN-98		25-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sodium		ug/L	187000		907000		1060000	
Sodium	Y	ug/L	192000		1040000		993000	
Thallium		ug/L	1770					
Vanadium		ug/L			381		113	
Zinc		ug/L	397		1260		265	
Zinc	Y	ug/L			28.2			

Sample Location:			WARP-DP09		WARP-DP13	
Associated Site:			WARP		WARP	
Sample No:			8450		8610	
Sample Date:			16-JUN-98		15-JUN-98	
HARDNESS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Hardness		ug/L	1400000		960000	

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West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP06		WARP-DP08		WARP-DP09		WARP-DP11		WARP-DP12	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			8330		8410		8450		8530		8570	
Sample Date:			23-JUN-98		16-JUN-98		16-JUN-98		26-JUN-98		15-JUN-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L					9.4		7.2			
1,3-Dinitrobenzene		ug/L	0.20		0.74		8.6				0.69	
2,4,6-Trinitrotoluene		ug/L							7.1			
2,4-Dinitrotoluene		ug/L			2.3		28				2.0	
2,6-Dinitrotoluene		ug/L			0.28		2.7				0.25	

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West Area Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			WARP-DP13		WARP-DP15		WARP-DP16		WARP-DP17		WARP-DP19	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			8610		8690		8730		8770		8850	
Sample Date:			15-JUN-98		26-JUN-98		25-JUN-98		25-JUN-98		26-JUN-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L	680				40		32			
1,3-Dinitrobenzene		ug/L	270								0.24	
2,4,6-Trinitrotoluene		ug/L										
2,4-Dinitrotoluene		ug/L	950		1.1				22			
2,6-Dinitrotoluene		ug/L										

Sample Location:			WARP-DP09		WARP-DP13	
Associated Site:			WARP		WARP	
Sample No:			8450		8610	
Sample Date:			16-JUN-98		15-JUN-98	
ALKALINITY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
Alkalinity		ug/L	1000000		643000	

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP07		PRRP-DP09		PRRP-DP16		PRRP-DP19	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7450		7530R		7820		7920	
Sample Date:		09-JUN-98		25-JUN-98		12-JUN-98		12-JUN-98	
Depth:		4-6		4-6		8-10		0-2	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Acetone	ug/kg	8.2	J						
Methylene chloride	ug/kg					2.1	J	1.8	J
Toluene	ug/kg			1.7	J				

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP02		PRRP-DP03		PRRP-DP09		PRRP-DP11		PRRP-DP15	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7260		7290		7530R		7600		7780	
Sample Date:		14-JUN-98		08-JUN-98		25-JUN-98		13-JUN-98		12-JUN-98	
Depth:		8-10		4-5		4-6		0-2		8-10	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2,4-Dinitrotoluene	ug/kg	81	J	8800		56	J	160	J	190	J
2,6-Dinitrotoluene	ug/kg			580	J			50	J		
3-Nitroaniline	ug/kg									53	J

Report Date: 09/24/98

Sample Location:		PRRP-DP16	
Associated Site:		PRRP	
Sample No:		7820	
Sample Date:		12-JUN-98	
Depth:		8-10	
SEMIVOLATILES	Units	Result	Val Qlfr
2,4-Dinitrotoluene	ug/kg	0.40	J
2,6-Dinitrotoluene	ug/kg	49	J
3-Nitroaniline	ug/kg		

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP01		PRRP-DP01		PRRP-DP01		PRRP-DP02		PRRP-DP02	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7200		7210		7220		7250		7260	
Sample Date:		11-JUN-98		11-JUN-98		11-JUN-98		14-JUN-98		14-JUN-98	
Depth:		0-2		4-6		8-10		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9370		11500		10100		11200		11500	
Antimony	mg/kg			7.9	J						
Arsenic	mg/kg	4.5	J	27.9	J	9.1	J	6.1		12.5	
Barium	mg/kg	84.3		239		88.5		61.5		91.9	
Beryllium	mg/kg	0.69		0.71				0.68			
Cadmium	mg/kg										
Calcium	mg/kg	5740		35300		35600		3670		7720	
Chromium	mg/kg	14.7		9.0		17.7		20.4		20.8	
Cobalt	mg/kg	11.1		21.2		11.6		11.2		13.6	
Copper	mg/kg	22.6		34.5		23.3		14.5		25.8	
Iron	mg/kg	18000		34500		22500		21900		23800	
Lead	mg/kg	8.6		13.2		10.4		7.8		12.2	
Magnesium	mg/kg	2480		12500		13900		2590		5650	
Manganese	mg/kg	321		2230		706		315		521	
Mercury	mg/kg							0.045			
Nickel	mg/kg	27.2		57.2		32.5		25.6		32.2	
Potassium	mg/kg	777		2330		1790		916		1630	
Selenium	mg/kg	0.84						0.69		0.82	
Sodium	mg/kg	1240		1080		1050					
Vanadium	mg/kg	19.1		30.0		26.6		27.3	J	26.2	J
Zinc	mg/kg	78.5		83.1		65.9		64.6		70.3	

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP02		PRRP-DP03		PRRP-DP03		PRRP-DP04		PRRP-DP04	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7240R		7280		7290		7320		7330	
Sample Date:		22-JUN-98		08-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98	
Depth:		0-2		0-2		4-5		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9210		6330		9580		7030		6990	
Antimony	mg/kg										
Arsenic	mg/kg	5.0		5.4		9.7		6.6		5.4	
Barium	mg/kg	45.1		65.7		67.9		37.2		39.4	
Beryllium	mg/kg										
Cadmium	mg/kg										
Calcium	mg/kg	10300		2560		2600		2680		19800	
Chromium	mg/kg	13.3	J	8.7		15.7		15.5		12.4	
Cobalt	mg/kg	6.6				6.3				7.4	
Copper	mg/kg	12.6		8.4		18.7		7.0		13.3	
Iron	mg/kg	14300		14100		23700		16700		13900	
Lead	mg/kg	12.3	J	9.3	J	11.6	J	4.3	J	9.8	J
Magnesium	mg/kg	5150		1160		2810		1290		10700	
Manganese	mg/kg	234		320		338		144		292	
Mercury	mg/kg	0.040									
Nickel	mg/kg	14.6		9.3		22.9		12.2		16.6	
Potassium	mg/kg	1460	J			968				864	
Selenium	mg/kg			0.59						0.64	
Sodium	mg/kg					3760					
Vanadium	mg/kg	23.1		17.3	J	23.9	J	28.5	J	19.7	J
Zinc	mg/kg	45.5		34.2		61.3		30.6		43.7	

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP04		PRRP-DP05		PRRP-DP05		PRRP-DP05		PRRP-DP06	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7340		7370		7360R		7380R		7400	
Sample Date:		09-JUN-98		14-JUN-98		25-JUN-98		25-JUN-98		08-JUN-98	
Depth:		8-10		4-6		0-2		8-10		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8040		11300		6820		9040		6110	
Antimony	mg/kg			9.3							
Arsenic	mg/kg	5.2		42.8		2.9		17.6		3.6	
Barium	mg/kg	50.5		128		27.6		115			
Beryllium	mg/kg			0.67							
Cadmium	mg/kg										
Calcium	mg/kg	61200		58500		1490		57800		945	
Chromium	mg/kg	14.1		18.4		9.3		14.4		10.9	
Cobalt	mg/kg	9.8		19.0				10.2			
Copper	mg/kg	23.6		24.6		4.9		19.7		5.9	
Iron	mg/kg	18200		43700		9170		22700		13700	
Lead	mg/kg	10.3	J	10.6		5.5		8.0		3.5	J
Magnesium	mg/kg	19500		17400		1010		17100		885	
Manganese	mg/kg	327		797		127	J	731	J	166	
Mercury	mg/kg										
Nickel	mg/kg	25.9		40.1		7.4		23.8		9.4	
Potassium	mg/kg	1580		2250				2190			
Selenium	mg/kg	1.1									
Sodium	mg/kg										
Vanadium	mg/kg	23.7	J	38.4	J	16.3	J	25.4	J	23.1	J
Zinc	mg/kg	56.9		104		24.9		52.1		22.6	

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP06		PRRP-DP06		PRRP-DP07		PRRP-DP07		PRRP-DP07	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7410		7420		7440		7450		7460	
Sample Date:		08-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98		09-JUN-98	
Depth:		4-5		9-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8710		7260		4120		8560		7960	
Antimony	mg/kg										
Arsenic	mg/kg	9.1		5.3		2.5		6.3		6.5	
Barium	mg/kg	57.3		44.9				55.3		54.5	
Beryllium	mg/kg										
Cadmium	mg/kg										
Calcium	mg/kg	62300		43700		1420		62800		62000	
Chromium	mg/kg	15.9		14.4		6.1		14.3		13.0	
Cobalt	mg/kg							13.1		9.8	
Copper	mg/kg	26.2		15.2		4.3		20.3		23.9	
Iron	mg/kg	24200		15300		8330		17500		20000	
Lead	mg/kg	11.3	J	7.6	J	3.2	J	10.3	J	10.9	J
Magnesium	mg/kg	16000		12600		830		19100		19200	
Manganese	mg/kg	430		321		116		536		520	
Mercury	mg/kg										
Nickel	mg/kg	22.9		17.6		7.0		29.7		26.1	
Potassium	mg/kg	1380		1190				1720		1660	
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	27.1	J	21.8	J	12.9	J	24.4	J	22.9	J
Zinc	mg/kg	68.9		45.5		17.9		54.7		61.9	

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP08		PRRP-DP08		PRRP-DP08		PRRP-DP09		PRRP-DP09	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7480		7490		7500		7520R		7530R	
Sample Date:		10-JUN-98		10-JUN-98		10-JUN-98		25-JUN-98		25-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4450		8700		7140		7220		4410	
Antimony	mg/kg										
Arsenic	mg/kg	4.2		12.9		4.2		2.4		2.6	
Barium	mg/kg			42.5		47.4		24.3			
Beryllium	mg/kg										
Cadmium	mg/kg										
Calcium	mg/kg	1820		57000		52200		1750		63200	
Chromium	mg/kg	10.6		14.6		12.6		8.8		9.2	
Cobalt	mg/kg	6.0		9.8		7.9					
Copper	mg/kg	6.5		21.7		16.5		4.9		11.2	
Iron	mg/kg	13400		19400		16000		8430		9480	
Lead	mg/kg	3.1	J	9.2	J	7.6	J	5.1		4.9	
Magnesium	mg/kg	894		16800		15700		1110		16800	
Manganese	mg/kg	207		283		393		102	J	184	J
Mercury	mg/kg										
Nickel	mg/kg	7.9		25.7		19.6		6.3		8.4	
Potassium	mg/kg			1820		1580				1050	
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	24.4	J	24.1	J	21.3	J	15.8	J	20.9	J
Zinc	mg/kg	21.7		64.8		46.6		22.5		24.8	

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP09		PRRP-DP10		PRRP-DP10		PRRP-DP10		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7540R		7560		7570		7580		7600	
Sample Date:		25-JUN-98		10-JUN-98		10-JUN-98		10-JUN-98		13-JUN-98	
Depth:		8-10		0-1		4-5		9-10		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	4630		4620		9510		11600		6200	
Antimony	mg/kg										
Arsenic	mg/kg	6.3		3.4		5.6		14.9		7.0	
Barium	mg/kg	26.5				81.5		90.9		39.4	
Beryllium	mg/kg					0.83		0.77			
Cadmium	mg/kg										
Calcium	mg/kg	58500		2440		4620		4510		17300	
Chromium	mg/kg	8.7		10.9		12.6		20.1		11.2	
Cobalt	mg/kg							10.2		7.4	
Copper	mg/kg	15.1		5.9		17.5		22.1		10.1	
Iron	mg/kg	10600		13700		16100		28700		14700	
Lead	mg/kg	6.3		3.2	J	11.3	J	14.3	J	7.9	
Magnesium	mg/kg	16900		920		2090		3970		6390	
Manganese	mg/kg	273	J	273		230		484		365	
Mercury	mg/kg										
Nickel	mg/kg	15.5		9.6		11.4		30.0		14.4	
Potassium	mg/kg	1200						1080		849	
Selenium	mg/kg	0.87				0.71					
Sodium	mg/kg					4130		4280		741	
Vanadium	mg/kg	17.5	J	23.6	J	22.1	J	31.6	J	20.1	J
Zinc	mg/kg	35.5		24.4		49.7		72.7		39.1	

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP11		PRRP-DP11		PRRP-DP12		PRRP-DP12		PRRP-DP12	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7610		7620		7640		7650		7660	
Sample Date:		13-JUN-98		13-JUN-98		11-JUN-98		11-JUN-98		11-JUN-98	
Depth:		4-6		8-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8950		11200		9560		12000		12300	
Antimony	mg/kg									7.8	J
Arsenic	mg/kg	25.3		5.3		7.3	J	5.7	J	7.4	J
Barium	mg/kg	209		51.5		71.5		60.3		69.5	
Beryllium	mg/kg	0.66				0.68					
Cadmium	mg/kg										
Calcium	mg/kg	3380		61600		4310		37100		55600	
Chromium	mg/kg	11.0		19.0		14.0		19.7		20.0	
Cobalt	mg/kg	30.3		10.8		6.4		10.8		12.0	
Copper	mg/kg	13.1		23.3		10.4		26.7		25.4	
Iron	mg/kg	36200		20800		16000		22300		23200	
Lead	mg/kg	9.8		9.9		9.6		10.7		10.6	
Magnesium	mg/kg	2500		20500		1900		16600		19100	
Manganese	mg/kg	1640		457		337		306		521	
Mercury	mg/kg										
Nickel	mg/kg	26.8		30.1		12.1		31.6		30.9	
Potassium	mg/kg	1060		2580		684		2430		2730	
Selenium	mg/kg										
Sodium	mg/kg	1200		1520							
Vanadium	mg/kg	34.2	J	31.0	J	23.7		26.8		29.9	
Zinc	mg/kg	68.5		62.2		38.5		71.9		65.3	

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP13		PRRP-DP13		PRRP-DP13		PRRP-DP14		PRRP-DP14	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7680		7690		7700		7720		7730	
Sample Date:		12-JUN-98		12-JUN-98		12-JUN-98		11-JUN-98		11-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	7760		6380		5930		12700		9640	
Antimony	mg/kg										
Arsenic	mg/kg	3.4		5.3		4.1		7.4		8.2	
Barium	mg/kg			29.2		42.4		49.6		39.0	
Beryllium	mg/kg							0.69			
Cadmium	mg/kg										
Calcium	mg/kg			2100		67100		3010		4340	
Chromium	mg/kg	9.4		11.3		10.7		20.2		17.4	
Cobalt	mg/kg			7.0		7.2		8.3		8.4	
Copper	mg/kg	6.5		13.7		16.2		14.7		14.3	
Iron	mg/kg	11200		15400		13000		22900		20100	
Lead	mg/kg	4.1		5.1		7.7		6.8		6.5	
Magnesium	mg/kg	938		1560		25300		2310		2940	
Manganese	mg/kg	74.5		313		472		173		275	
Mercury	mg/kg							0.043			
Nickel	mg/kg	8.4		20.2		19.4		20.5		19.4	
Potassium	mg/kg					1330		771		713	
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	19.8		19.1		21.0		35.2		27.0	
Zinc	mg/kg	23.1		40.6		43.7		46.1		41.2	

Sample Location:		PRRP-DP14		PRRP-DP15		PRRP-DP15		PRRP-DP15		PRRP-DP16	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7740		7760		7770		7780		7800	
Sample Date:		11-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98	
Depth:		8-10		0-2		4-6		8-10		0-2	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	8710		6680		8870		6010		7300	
Antimony	mg/kg										
Arsenic	mg/kg	8.1		5.8		15.9		6.9		5.4	
Barium	mg/kg	64.8		34.9		176		41.5		30.4	
Beryllium	mg/kg										
Cadmium	mg/kg										
Calcium	mg/kg	53400		2880		53300		67400		7980	
Chromium	mg/kg	15.9		12.1		5.2		11.6		11.0	
Cobalt	mg/kg	10.3		5.8		26.7		9.0			
Copper	mg/kg	21.1		7.0		24.6		19.3		11.2	
Iron	mg/kg	18700		14700		20500		18300		13300	
Lead	mg/kg	9.6		5.5		13.4		8.1		7.7	J
Magnesium	mg/kg	21100		1660		17200		20300		3100	
Manganese	mg/kg	506		93.2		2270		467		147	
Mercury	mg/kg										
Nickel	mg/kg	26.5		13.9		56.1		22.2		12.0	
Potassium	mg/kg	1850				1380		1370			
Selenium	mg/kg										
Sodium	mg/kg							1030			
Vanadium	mg/kg	25.2		23.0		26.7		19.3		21.4	J
Zinc	mg/kg	57.3		30.4		59.7		52.0		37.4	

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected HIts Summary

Sample Location:		PRRP-DP16		PRRP-DP16		PRRP-DP17		PRRP-DP17		PRRP-DP17	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7810		7820		7840		7850		7860	
Sample Date:		12-JUN-98		12-JUN-98		10-JUN-98		10-JUN-98		10-JUN-98	
Depth:		4-6		8-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9850		9430		7140		5570		3320	
Antimony	mg/kg										
Arsenic	mg/kg	9.7		4.8		2.3	J	3.1	J	4.5	J
Barium	mg/kg	59.5		47.5							
Beryllium	mg/kg	0.55									
Cadmium	mg/kg										
Calcium	mg/kg	3080		57600		817		1850		61500	
Chromium	mg/kg	17.5		16.8		10.8		15.5		7.3	
Cobalt	mg/kg	14.4		9.1				7.3			
Copper	mg/kg	21.7		24.3		3.8		5.3		10.6	
Iron	mg/kg	22000		19300		13100		16400		8940	
Lead	mg/kg	10.7	J	10.5	J	3.3		2.9		4.3	
Magnesium	mg/kg	4020		18100		791		917		16200	
Manganese	mg/kg	437		303		104		323		252	
Mercury	mg/kg										
Nickel	mg/kg	31.1		27.0		6.4		8.1		11.0	
Potassium	mg/kg	1210		1750						726	
Selenium	mg/kg										
Sodium	mg/kg	1160		1090							
Vanadium	mg/kg	23.3	J	26.1	J	23.4		29.3		15.0	
Zinc	mg/kg	67.2		64.2		21.3		22.7		31.6	

Sample Location:		PRRP-DP18		PRRP-DP18		PRRP-DP18		PRRP-DP19		PRRP-DP19	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7880		7890		7900		7920		7930	
Sample Date:		11-JUN-98		11-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98	
Depth:		0-2		4-6		8-10		0-2		4-6	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	10700		7340		9140		2370		7060	
Antimony	mg/kg										
Arsenic	mg/kg	4.0	J	27.3	J	5.8	J	14.1		4.7	
Barium	mg/kg	32.3		41.8		66.2		33.6		51.2	
Beryllium	mg/kg										
Cadmium	mg/kg					0.63					
Calcium	mg/kg	1040		38400		61600		54000		56900	
Chromium	mg/kg	14.6		13.6		15.7		4.2		12.5	
Cobalt	mg/kg	6.2		8.7		10.6				8.7	
Copper	mg/kg	7.5		19.0		24.3		10.6		19.1	
Iron	mg/kg	17800		20000		20600		15900		16200	
Lead	mg/kg	5.6		7.6		9.6		3.2		8.5	
Magnesium	mg/kg	1120		12800		19200		11500		22500	
Manganese	mg/kg	158		300		534		658		495	
Mercury	mg/kg										
Nickel	mg/kg	9.8		21.5		29.0		11.6		22.8	
Potassium	mg/kg			1310		1990				1490	
Selenium	mg/kg										
Sodium	mg/kg										
Vanadium	mg/kg	30.3		25.7		24.6		13.2		21.4	
Zinc	mg/kg	27.9		56.2		64.5		26.8		52.8	

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Sample Location:		PRRP-DP19		PRRP-DP20		PRRP-DP20		PRRP-DP20	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		7940		7960		7970		7980	
Sample Date:		12-JUN-98		13-JUN-98		13-JUN-98		13-JUN-98	
Depth:		8-10		0-2		4-6		8-10	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	9590		5360		7580		10800	
Antimony	mg/kg							7.7	
Arsenic	mg/kg	4.9		3.6		4.7		5.5	
Barium	mg/kg	61.0				58.2		69.3	
Beryllium	mg/kg								
Cadmium	mg/kg								
Calcium	mg/kg	68000		2160		61900		70400	
Chromium	mg/kg	15.7		11.4		13.1		17.0	
Cobalt	mg/kg	9.4		5.8		9.3		11.3	
Copper	mg/kg	22.4		7.2		18.3		20.1	
Iron	mg/kg	19900		16000		18000		22500	
Lead	mg/kg	9.4		3.2		9.0		9.7	
Magnesium	mg/kg	21300		999		24600		20200	
Manganese	mg/kg	512		262		527		513	
Mercury	mg/kg								
Nickel	mg/kg	26.1		9.3		24.0		29.6	
Potassium	mg/kg	2330				1610		2640	
Selenium	mg/kg								
Sodium	mg/kg								
Vanadium	mg/kg	26.2		27.6	J	23.8	J	28.6	J
Zinc	mg/kg	60.5		26.0		50.6		69.5	

PLUMBROOK

Pentolite Road Red Water Pond

Soils (Surface and Deep)

Detected Hits Summary

Sample Location:		PRRP-DP01		PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP03	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7210		7220		7260		7280		7290	
Sample Date:		11-JUN-98		11-JUN-98		14-JUN-98		08-JUN-98		08-JUN-98	
Depth:		4-6		8-10		8-10		0-2		4-5	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	ug/kg	560		2700						43000	
1,3-Dinitrobenzene	ug/kg									9300	
2,4,6-Trinitrotoluene	ug/kg					380					
2,4-Dinitrotoluene	ug/kg	960		290		280		1200		25000	
2,6-Dinitrotoluene	ug/kg	350									
4-Amino-2,6-dinitrotoluene	ug/kg										

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected Hits Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP06		PRRP-DP09		PRRP-DP10		PRRP-DP11		PRRP-DP11	
Associated Site:		PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:		7420		7540R		7580		7600		7610	
Sample Date:		08-JUN-98		25-JUN-98		10-JUN-98		13-JUN-98		13-JUN-98	
Depth:		9-10		8-10		9-10		0-2		4-6	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	ug/kg	1800		1300		18000				430	
1,3-Dinitrobenzene	ug/kg					5200				430	
2,4,6-Trinitrotoluene	ug/kg							270			
2,4-Dinitrotoluene	ug/kg	1100				15000		320		1600	
2,6-Dinitrotoluene	ug/kg					1700				290	
4-Amino-2,6-dinitrotoluene	ug/kg							2700			

PLUMBROOK
Pentolite Road Red Water Pond
Soils (Surface and Deep)
Detected HIts Summary

Report Date: 09/24/98

Sample Location:		PRRP-DP11		PRRP-DP16	
Associated Site:		PRRP		PRRP	
Sample No:		7620		7820	
Sample Date:		13-JUN-98		12-JUN-98	
Depth:		8-10		8-10	
EXPLOSIVES	Units	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene	ug/kg	7000		1900	
1,3-Dinitrobenzene	ug/kg	5800		250	
2,4,6-Trinitrotoluene	ug/kg				
2,4-Dinitrotoluene	ug/kg	1200		500	
2,6-Dinitrotoluene	ug/kg	300		500	
4-Amino-2,6-dinitrotoluene	ug/kg				

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP05		PRRP-DP07	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7270		7310		7350		7390		7470	
Sample Date:			14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98		10-JUN-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2-Butanone		ug/L			24	J						
2-Hexanone		ug/L			1.8	J						
Acetone		ug/L			20	J						
Benzene		ug/L			0.14	J						
Carbon disulfide		ug/L					0.26	J				
Ethylbenzene		ug/L			0.19	J						
Tetrachloroethene		ug/L	0.14	J	0.22	J			0.26	J	0.17	J
Total xylenes		ug/L			0.88	J						
Trichloroethene		ug/L									0.43	J

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP08		PRRP-DP12		PRRP-DP19	
Associated Site:			PRRP		PRRP		PRRP	
Sample No:			7510		7670		7950	
Sample Date:			10-JUN-98		11-JUN-98		13-JUN-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2-Butanone		ug/L						
2-Hexanone		ug/L						
Acetone		ug/L						
Benzene		ug/L						
Carbon disulfide		ug/L	0.16	J	0.16	J		
Ethylbenzene		ug/L						
Tetrachloroethene		ug/L					0.13	J
Total xylenes		ug/L						
Trichloroethene		ug/L	0.16	J				

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP03		PRRP-DP09		PRRP-DP11		PRRP-DP20	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			7310		7550		7630		7990	
Sample Date:			08-JUN-98		14-JUN-98		14-JUN-98		14-JUN-98	
TSS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total suspended solids		ug/L	110000		12000		34000		6000	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP02		PRRP-DP03		PRRP-DP09		PRRP-DP11		PRRP-DP20	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7270		7310		7550		7630		7990	
Sample Date:			14-JUN-98		08-JUN-98		14-JUN-98		14-JUN-98		14-JUN-98	
TOC-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total organic carbon		ug/L	19300		6600000		671000		3060000		1800	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP09		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7270		7310		7350		7550		7630	
Sample Date:			14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98		14-JUN-98	
TDS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total dissolved solids		ug/L	1410000		15000000		401000		4370000		22100000	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP20	
Associated Site:			PRRP	
Sample No:			7990	
Sample Date:			14-JUN-98	
TDS-W	Fltr	Units	Result	Val Qlfr
Total dissolved solids		ug/L	276000	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP09		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7270		7310		7350		7550		7630	
Sample Date:			14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98		14-JUN-98	
SULFATE-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sulfate		ug/L	574000		10000000		22700		1150000		3730000	

Sample Location:			PRRP-DP20	
Associated Site:			PRRP	
Sample No:			7990	
Sample Date:			14-JUN-98	
SULFATE-W	Fltr	Units	Result	Val Qlfr
Sulfate		ug/L	24700	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP01		PRRP-DP03		PRRP-DP05		PRRP-DP08		PRRP-DP10	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7230		7310		7390		7510		7590	
Sample Date:			12-JUN-98		08-JUN-98		14-JUN-98		10-JUN-98		10-JUN-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2,4-Dinitrophenol		ug/L	8.3	J	5800	D					5900	D
2,4-Dinitrotoluene		ug/L	20		9200	D			2.8	J	4100	D
2,6-Dinitrotoluene		ug/L	3.3	J	550						390	
2-Nitroaniline		ug/L	3.2	J								
2-Nitrophenol		ug/L										
3-Nitroaniline		ug/L	88									
4,6-Dinitro-2-methylphenol		ug/L			2300						1700	
4-Nitrophenol		ug/L			290	J					210	J
Naphthalene		ug/L					1.9	J				
bis(2-Ethylhexyl)phthalate		ug/L										

PLUMBROOK
Pentolite Road Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP11		PRRP-DP12		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7630		7670		7750		7790		7830	
Sample Date:			14-JUN-98		11-JUN-98		12-JUN-98		12-JUN-98		13-JUN-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2,4-Dinitrophenol		ug/L									22	J
2,4-Dinitrotoluene		ug/L	380	J			2.5	J	80	J	35	
2,6-Dinitrotoluene		ug/L									6.2	J
2-Nitroaniline		ug/L									1.3	J
2-Nitrophenol		ug/L									2.1	J
3-Nitroaniline		ug/L										
4,6-Dinitro-2-methylphenol		ug/L							830	J		
4-Nitrophenol		ug/L									5.0	J
Naphthalene		ug/L										
bis(2-Ethylhexyl)phthalate		ug/L			10		3.2	J				

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP17		PRRP-DP19	
Associated Site:			PRRP		PRRP	
Sample No:			7870		7950	
Sample Date:			11-JUN-98		13-JUN-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
2,4-Dinitrophenol		ug/L				
2,4-Dinitrotoluene		ug/L	1.5	J	2.3	J
2,6-Dinitrotoluene		ug/L				
2-Nitroaniline		ug/L				
2-Nitrophenol		ug/L				
3-Nitroaniline		ug/L				
4,6-Dinitro-2-methylphenol		ug/L				
4-Nitrophenol		ug/L				
Naphthalene		ug/L				
bis(2-Ethylhexyl)phthalate		ug/L				

Sample Location:			PRRP-DP03		PRRP-DP09		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP	
Sample No:			7310		7550		7630	
Sample Date:			08-JUN-98		14-JUN-98		14-JUN-98	
NITRATE-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Nitrate		ug/L	465000		16900		350000	J

Sample Location:			PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP05	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7230		7270		7310		7350		7390	
Sample Date:			12-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	52900		52200		88400		280000		32700	
Antimony		ug/L										
Arsenic		ug/L			63.3				305	J	53.9	
Arsenic	Y	ug/L							13.4			
Barium		ug/L							1680			
Barium	Y	ug/L										
Beryllium		ug/L										
Cadmium		ug/L										
Calcium		ug/L	432000		221000		683000		1530000		606000	
Calcium	Y	ug/L	207000		193000		542000		90900		274000	
Chromium		ug/L	112		113		208		561		82.6	
Chromium	Y	ug/L										
Cobalt		ug/L					2610					
Cobalt	Y	ug/L					3090					
Copper		ug/L	277				1410		669			
Copper	Y	ug/L					1600					
Iron		ug/L	125000		100000		200000		679000		98200	
Iron	Y	ug/L			150		7480		166			
Lead		ug/L	58.3	J	42.6		96.7	J	292	J	48.4	
Lead	Y	ug/L										
Magnesium		ug/L	101000		66300		172000		616000		204000	
Magnesium	Y	ug/L	52800		44400		139000		25300		96100	
Manganese		ug/L	4040		1120		39600		12400		3240	
Manganese	Y	ug/L	1680		257		42700		39.3		818	
Mercury		ug/L			0.23				0.55			
Nickel		ug/L					2380		740			
Nickel	Y	ug/L					2760					
Potassium		ug/L							31500			
Sodium		ug/L	788000		266000		5930000				107000	

PLUMBROOK
Pentolite Road Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7470		7510		7550		7590		7630	
Sample Date:			10-JUN-98		10-JUN-98		14-JUN-98		10-JUN-98		14-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	69000		178000		56800		78300		4820	
Antimony		ug/L			118	J						
Arsenic		ug/L			259	J						
Arsenic	Y	ug/L	11.0									
Barium		ug/L	556		1210							
Barium	Y	ug/L										
Beryllium		ug/L			8.8							
Cadmium		ug/L			6.5							
Calcium		ug/L	650000		863000		873000		662000		848000	
Calcium	Y	ug/L	66500		58000		269000		681000		745000	
Chromium		ug/L	114		273		141		223			
Chromium	Y	ug/L									495	
Cobalt		ug/L	77.6		208				5610		3360	
Cobalt	Y	ug/L							6660		3030	
Copper		ug/L	194		472		438		2800		1530	
Copper	Y	ug/L					311		3260		2000	
Iron		ug/L	176000		468000		134000		202000		15500	
Iron	Y	ug/L	190		116				15300		5870	
Lead		ug/L	86.2	J	323	J	67.1					
Lead	Y	ug/L					31.5					
Magnesium		ug/L	217000		253000		195000		326000		249000	
Magnesium	Y	ug/L	15800		12900		73600		348000		218000	
Manganese		ug/L	4310		11800		4050		55100		35300	
Manganese	Y	ug/L	71.4				1120		62400		31300	
Mercury		ug/L			0.20		0.29					
Nickel		ug/L	191		521		407		5040		1950	
Nickel	Y	ug/L							5820		1970	
Potassium		ug/L	12300		22700							
Sodium		ug/L	7060				707000		9410000		[illegible]00	

PLUMBROOK
Pentolite Road Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7670		7710		7750		7790		7830	
Sample Date:			11-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98		13-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	170000		7220		7970				15500	
Antimony		ug/L	105	J								
Arsenic		ug/L	238	J	11.1	J						
Arsenic	Y	ug/L										
Barium		ug/L	896									
Barium	Y	ug/L										
Beryllium		ug/L	8.5									
Cadmium		ug/L										
Calcium		ug/L	926000		249000		281000				283000	
Calcium	Y	ug/L	98800		189000		405000		780000		212000	
Chromium		ug/L	277		16.0		105					
Chromium	Y	ug/L										
Cobalt		ug/L	172								668	
Cobalt	Y	ug/L							1290		784	
Copper		ug/L	515		27.7						510	
Copper	Y	ug/L							531		568	
Iron		ug/L	426000		18800		27500				40200	
Iron	Y	ug/L	125		237		2400		3240		1950	
Lead		ug/L	202	J	9.5	J	38.1	J	33.0	J		
Lead	Y	ug/L										
Magnesium		ug/L	313000		71900		83800				88000	
Magnesium	Y	ug/L	25100		53800		143000		260000		67700	
Manganese		ug/L	6460		496		927				2080	
Manganese	Y	ug/L	150		108		454		1460		1700	
Mercury		ug/L	0.32									
Nickel		ug/L	490								468	
Nickel	Y	ug/L							2370		441	
Potassium		ug/L	21600									
Sodium		ug/L	5960		29700		79400				1180000	

PLUMBROOK
Pentolite Road Red Water Pond
Groundwater
Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			7870		7910		7950		7990	
Sample Date:			11-JUN-98		12-JUN-98		13-JUN-98		14-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	38600				118000		13400	
Antimony		ug/L					77.8	J		
Arsenic		ug/L			584	J	122	J	31.3	
Arsenic	Y	ug/L					22.9		16.9	
Barium		ug/L	218				1020			
Barium	Y	ug/L					237			
Beryllium		ug/L					5.5			
Cadmium		ug/L								
Calcium		ug/L	1270000				787000		300000	
Calcium	Y	ug/L	55000		244000		63400		58800	
Chromium		ug/L	65.8				176		26.9	
Chromium	Y	ug/L								
Cobalt		ug/L					140			
Cobalt	Y	ug/L								
Copper		ug/L	106				334		33.2	
Copper	Y	ug/L								
Iron		ug/L	87000				266000		31500	
Iron	Y	ug/L			1260		119		456	
Lead		ug/L			320	J	142	J	21.6	
Lead	Y	ug/L								
Magnesium		ug/L	286000				240000		75900	
Magnesium	Y	ug/L	13200		80300		16400		14300	
Manganese		ug/L	3280				5940		1220	
Manganese	Y	ug/L	22.4		252		28.4		78.4	
Mercury		ug/L			0.25					
Nickel		ug/L	113				338			
Nickel	Y	ug/L								
Potassium		ug/L	6430				20800			
Sodium		ug/L	6010				14500		6480	

Sample Location:			PRRP-DP01		PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP05	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7230		7270		7310		7350		7390	
Sample Date:			12-JUN-98		14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sodium	Y	ug/L	1130000		288000		7260000				119000	
Vanadium		ug/L							821			
Zinc		ug/L	374		299		597		2010		279	
Zinc	Y	ug/L							21.6			

Sample Location:			PRRP-DP07		PRRP-DP08		PRRP-DP09		PRRP-DP10		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7470		7510		7550		7590		7630	
Sample Date:			10-JUN-98		10-JUN-98		14-JUN-98		10-JUN-98		14-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sodium	Y	ug/L	5490				754000		12600000		3210000	
Vanadium		ug/L	212		438							
Zinc		ug/L	525		1550		441		736			
Zinc	Y	ug/L	77.7		26.5				225		1100	

Sample Location:			PRRP-DP12		PRRP-DP13		PRRP-DP14		PRRP-DP15		PRRP-DP16	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7670		7710		7750		7790		7830	
Sample Date:			11-JUN-98		12-JUN-98		12-JUN-98		12-JUN-98		13-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sodium	Y	ug/L			33500		256000		2560000		1450000	
Vanadium		ug/L	391		52.3		877		1000			
Zinc		ug/L	1350		76.0							
Zinc	Y	ug/L										

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP17		PRRP-DP18		PRRP-DP19		PRRP-DP20	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			7870		7910		7950		7990	
Sample Date:			11-JUN-98		12-JUN-98		13-JUN-98		14-JUN-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Sodium	Y	ug/L			140000		11500		6810	
Vanadium		ug/L	163		101		288		76.5	
Zinc		ug/L	341				799		151	
Zinc	Y	ug/L	28.7							

Sample Location:			PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP09		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7270		7310		7350		7550		7630	
Sample Date:			14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98		14-JUN-98	
HARDNESS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Hardness		ug/L	780000		3400000		940000		1640000		2440000	

Sample Location:			PRRP-DP20	
Associated Site:			PRRP	
Sample No:			7990	
Sample Date:			14-JUN-98	
HARDNESS-W	Fltr	Units	Result	Val Qlfr
Hardness		ug/L	670000	

Sample Location:			PRRP-DP01		PRRP-DP03		PRRP-DP04		PRRP-DP06		PRRP-DP07	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7230		7310		7350		7430		7470	
Sample Date:			12-JUN-98		08-JUN-98		09-JUN-98		09-JUN-98		10-JUN-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L										
1,3-Dinitrobenzene		ug/L			4800		0.28		10		0.42	
2,4-Dinitrotoluene		ug/L	10		6800		0.47		31		0.82	
2,6-Dinitrotoluene		ug/L							5.1			
Tetryl		ug/L										

Sample Location:			PRRP-DP08		PRRP-DP10		PRRP-DP11		PRRP-DP12		PRRP-DP13	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7510		7590		7630R		7670		7710	
Sample Date:			10-JUN-98		10-JUN-98		25-JUN-98		11-JUN-98		12-JUN-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L					600					
1,3-Dinitrobenzene		ug/L	1.2		2100		840		1.3		1.6	
2,4-Dinitrotoluene		ug/L	1.4		2200		150		2.3		2.4	
2,6-Dinitrotoluene		ug/L	0.28		400				0.35		0.36	
Tetryl		ug/L									0.20	

Sample Location:			PRRP-DP17		PRRP-DP18	
Associated Site:			PRRP		PRRP	
Sample No:			7870		7910	
Sample Date:			11-JUN-98		12-JUN-98	
EXPLOSIVES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr
1,3,5-Trinitrobenzene		ug/L				
1,3-Dinitrobenzene		ug/L	6.4		1.1	
2,4-Dinitrotoluene		ug/L	8.9		2.4	
2,6-Dinitrotoluene		ug/L	1.7		0.36	
Tetryl		ug/L				

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP03		PRRP-DP09		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP	
Sample No:			7310		7550		7630	
Sample Date:			08-JUN-98		14-JUN-98		14-JUN-98	
CYANIDE	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Cyanide, total		ug/L	780		23		400	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP02		PRRP-DP04		PRRP-DP20	
Associated Site:			PRRP		PRRP		PRRP	
Sample No:			7270		7350		7990	
Sample Date:			14-JUN-98		09-JUN-98		14-JUN-98	
CHLORIDE-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Chloride		ug/L	9800		2300		2300	

PLUMBROOK

Pentolite Road Red Water Pond

Groundwater

Detected Hits Summary

Report Date: 09/24/98

Sample Location:			PRRP-DP02		PRRP-DP03		PRRP-DP04		PRRP-DP09		PRRP-DP11	
Associated Site:			PRRP		PRRP		PRRP		PRRP		PRRP	
Sample No:			7270		7310		7350		7550		7630	
Sample Date:			14-JUN-98		08-JUN-98		09-JUN-98		14-JUN-98		14-JUN-98	
ALKALINITY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Alkalinity		ug/L	450000		1500000		263000		476000		864000	

Sample Location:			PRRP-DP20	
Associated Site:			PRRP	
Sample No:			7990	
Sample Date:			14-JUN-98	
ALKALINITY	Fltr	Units	Result	Val Qlfr
Alkalinity		ug/L	155000	

PLUM BROOK

Surface Water - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
WATER QUALITY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Hardness		ug/L	380000		408000		400000		420000		372000	

PLUM BROOK

Surface Water - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
WATER QUALITY	Fltr	Units	Result	Val Qlfr
Hardness		ug/L	592000	

PLUM BROOK

Surface Water - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Bromomethane		ug/L	0.22	J			0.16	J	0.21	J	0.21	J

PLUM BROOK

Surface Water - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr
Bromomethane		ug/L	0.16	J

PLUM BROOK

Surface Water - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
di-n-Octyl phthalate		ug/L									7.8	J

PLUM BROOK
Surface Water - WARP
Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr
di-n-Octyl phthalate		ug/L		

PLUM BROOK
Surface Water - WARP
Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW01		WARP-SW02		WARP-SW03		WARP-SW04		WARP-SW05	
Associated Site:			WARP		WARP		WARP		WARP		WARP	
Sample No:			12100		12110		12120		12130		12140	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	631	J			300	J			13800	J
Aluminum	Y	ug/L					233				6340	
Arsenic		ug/L									20.2	
Arsenic	Y	ug/L									10.9	
Calcium		ug/L	107000		106000		106000		105000		31100	
Calcium	Y	ug/L	104000		106000		104000		103000		27600	
Chromium		ug/L									17.4	
Chromium	Y	ug/L										
Iron		ug/L	1300		126		747		646		21100	
Iron	Y	ug/L	153				484		589		8630	
Lead		ug/L									25.0	
Lead	Y	ug/L									7.2	
Magnesium		ug/L	26000		26500		26200		25800		46500	
Magnesium	Y	ug/L	25600		26500		25700		25400		44300	
Manganese		ug/L	890		30.6		261		126		1150	
Manganese	Y	ug/L	218				97.2		107		669	
Potassium		ug/L	9400		9730		9750		9910		5590	
Potassium	Y	ug/L	8870		9340		9080		9370			
Sodium		ug/L	38200		39300		38300		39000		104000	
Sodium	Y	ug/L	37400		38800		37200		37900		103000	
Vanadium		ug/L										
Zinc		ug/L	27.0								84.8	
Zinc	Y	ug/L									42.3	

PLUM BROOK
Surface Water - WARP
Detected Hits Summary

Report Date: 03/02/99

Sample Location:			WARP-SW06	
Associated Site:			WARP	
Sample No:			12150	
Sample Date:			05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr
Aluminum		ug/L	12400	J
Aluminum	Y	ug/L	11400	
Arsenic		ug/L	21.8	
Arsenic	Y	ug/L	17.2	
Calcium		ug/L	115000	
Calcium	Y	ug/L	71500	
Chromium		ug/L	23.3	J
Chromium	Y	ug/L	21.2	J
Iron		ug/L	19000	
Iron	Y	ug/L	15500	
Lead		ug/L	32.9	
Lead	Y	ug/L	20.4	J
Magnesium		ug/L	50700	
Magnesium	Y	ug/L	49100	
Manganese		ug/L	1550	
Manganese	Y	ug/L	907	
Potassium		ug/L	5180	
Potassium	Y	ug/L	5900	
Sodium		ug/L	107000	
Sodium	Y	ug/L	112000	
Vanadium		ug/L	52.2	
Zinc		ug/L	92.5	
Zinc	Y	ug/L	68.0	

PLUM BROOK

Sediment - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
WET CHEMISTRY	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total organic carbon	mg/kg	5430		3960		9650		5520		40200	

PLUM BROOK

Sediment - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		WARP-SD06	
Associated Site:		WARP	
Sample No:		11150	
Sample Date:		05-NOV-98	
Depth:		0 - .5	
WET CHEMISTRY	Units	Result	Val Qlfr
Total organic carbon	mg/kg	93400	

PLUM BROOK

Sediment - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		WARP-SD03		WARP-SD05		WARP-SD06	
Associated Site:		WARP		WARP		WARP	
Sample No:		11120		11140		11150	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
2-Butanone	ug/kg	29	J	21	J		
Acetone	ug/kg			110	J	71	J

PLUM BROOK

Sediment - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		WARP-SD01		WARP-SD04	
Associated Site:		WARP		WARP	
Sample No:		11100		11130	
Sample Date:		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr
Benzo(a)anthracene	ug/kg	51	J		
Benzo(a)pyrene	ug/kg	53	J		
Benzo(k)fluoranthene	ug/kg	52	J		
Chrysene	ug/kg	60	J		
Fluoranthene	ug/kg	110	J	47	J
Phenanthrene	ug/kg	55	J		
Pyrene	ug/kg	79	J		

PLUM BROOK

Sediment - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		WARP-SD01		WARP-SD02		WARP-SD03		WARP-SD04		WARP-SD05	
Associated Site:		WARP		WARP		WARP		WARP		WARP	
Sample No:		11100		11110		11120		11130		11140	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5		0 - .5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	3170		2450		4260		3230		6880	
Arsenic	mg/kg	5.4		3.5		7.3		8.6		4.6	
Barium	mg/kg	26.6				36.0		34.8		65.0	
Calcium	mg/kg	10800		13900		12300		16000		6710	
Chromium	mg/kg	6.7		5.3		8.1		7.4		12.6	
Cobalt	mg/kg	10.9		6.4		10.6		10.8			
Copper	mg/kg	13.7		8.8		15.0		9.8		15.2	
Iron	mg/kg	14900		9900		16500		24300		16000	
Lead	mg/kg	9.7		6.5		9.4		8.1		22.6	
Magnesium	mg/kg	2110		2720		2520		2950		3130	
Manganese	mg/kg	305		231		290		255		338	
Nickel	mg/kg	23.0		13.7		24.4		18.3		15.2	
Potassium	mg/kg					821					
Vanadium	mg/kg										
Zinc	mg/kg	48.0		35.1		58.4		45.3		54.4	

PLUM BROOK

Sediment - WARP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:	WARP-SD06
Associated Site:	WARP
Sample No:	11150
Sample Date:	05-NOV-98
Depth:	0 - .5

METALS	Units	Result	Val Qlfr
Aluminum	mg/kg	9600	
Arsenic	mg/kg	8.7	
Barium	mg/kg		
Calcium	mg/kg	74700	
Chromium	mg/kg	28.7	
Cobalt	mg/kg		
Copper	mg/kg	24.5	
Iron	mg/kg	18000	
Lead	mg/kg	32.1	
Magnesium	mg/kg	6770	
Manganese	mg/kg	726	
Nickel	mg/kg	24.5	
Potassium	mg/kg		
Vanadium	mg/kg	25.0	
Zinc	mg/kg	77.0	

PLUM BROOK

Surface Water - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
WATER QUALITY	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Hardness		ug/L	328000		284000		488000		432000	

PLUM BROOK

Surface Water - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
VOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Bromodichloromethane		ug/L	0.72	J						
Bromomethane		ug/L	0.17	J	0.11	J				
Dibromochloromethane		ug/L	0.21	J						

PLUM BROOK

Surface Water - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03	
Associated Site:			PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98	
SEMIVOLATILES	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr

PLUM BROOK

Surface Water - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:			PRRP-SW01		PRRP-SW02		PRRP-SW03		PRRP-SW04	
Associated Site:			PRRP		PRRP		PRRP		PRRP	
Sample No:			12160		12170		12180		12190	
Sample Date:			05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
METALS-W	Fltr	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum		ug/L	778	J	530	J	3040	J		
Aluminum	Y	ug/L	463		874		10200			
Barium	Y	ug/L					215			
Calcium		ug/L	74200		71700		118000		97900	
Calcium	Y	ug/L	74000		71400		179000		98100	
Chromium	Y	ug/L					17.2			
Iron		ug/L	1420		972		5790		948	
Iron	Y	ug/L	809		1260		16800		550	
Lead	Y	ug/L					8.7			
Magnesium		ug/L	16000		15800		37300		36800	
Magnesium	Y	ug/L	15700		15800		46700		36900	
Manganese		ug/L	245		261		404		67.1	
Manganese	Y	ug/L	144		249		649		34.4	
Potassium	Y	ug/L					7130			
Sodium		ug/L	24900		24700		13700		14800	
Sodium	Y	ug/L	25700		24500		15000		15300	
Vanadium	Y	ug/L					53.9			
Zinc		ug/L					58.0		20.2	
Zinc	Y	ug/L					145			

PLUM BROOK

Sediment - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
WET CHEMISTRY	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Total organic carbon	mg/kg	33000		5450		17000		12000	J

PLUM BROOK

Sediment - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		PRRP-SD01		PRRP-SD03	
Associated Site:		PRRP		PRRP	
Sample No:		11160		11180	
Sample Date:		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5	
VOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr
2-Butanone	ug/kg	11	J	10	J
Acetone	ug/kg	51	J	49	J

PLUM BROOK
Sediment - PRRP
Detected Hits Summary

Report Date: 03/02/99

Sample Location:		PRRP-SD02		PRRP-SD04	
Associated Site:		PRRP		PRRP	
Sample No:		11170		11190	
Sample Date:		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5	
SEMIVOLATILES	Units	Result	Val Qlfr	Result	Val Qlfr
Acenaphthene	ug/kg	110	J		
Anthracene	ug/kg	77	J	29	J
Benzo(a)anthracene	ug/kg			84	J
Benzo(a)pyrene	ug/kg			96	J
Benzo(b)fluoranthene	ug/kg			100	J
Benzo(ghi)perylene	ug/kg			53	J
Benzo(k)fluoranthene	ug/kg			84	J
Carbazole	ug/kg	180	J		
Chrysene	ug/kg			110	J
Dibenzofuran	ug/kg	60	J		
Fluoranthene	ug/kg	140	J	230	J
Fluorene	ug/kg	110	J		
Indeno(1,2,3-cd)pyrene	ug/kg			54	J
Phenanthrene	ug/kg	320	J	120	J
Pyrene	ug/kg	110	J	160	J

PLUM BROOK

Sediment - PRRP

Detected Hits Summary

Report Date: 03/02/99

Sample Location:		PRRP-SD01		PRRP-SD02		PRRP-SD03		PRRP-SD04	
Associated Site:		PRRP		PRRP		PRRP		PRRP	
Sample No:		11160		11170		11180		11190	
Sample Date:		05-NOV-98		05-NOV-98		05-NOV-98		05-NOV-98	
Depth:		0 - .5		0 - .5		0 - .5		0 - .5	
METALS	Units	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr	Result	Val Qlfr
Aluminum	mg/kg	6020		2830		5130		3400	
Arsenic	mg/kg	4.5		5.1		4.3		4.4	
Barium	mg/kg	53.4				48.1		30.9	
Calcium	mg/kg	96000		46300		62000		8110	
Chromium	mg/kg	11.5		6.3		10.4		6.8	
Copper	mg/kg	17.9		7.6		14.5		7.4	
Iron	mg/kg	16200		9620		13700		9330	
Lead	mg/kg	12.8		4.8		7.8		5.6	
Magnesium	mg/kg	10700		19300		13500		2710	
Manganese	mg/kg	865		421		404		104	
Nickel	mg/kg	18.6		9.5		17.9		10.4	
Potassium	mg/kg					1040			
Vanadium	mg/kg	17.4		12.9		14.2		7.9	
Zinc	mg/kg	73.3		23.2		58.4		42.1	

APPENDIX G

GEOTECHNICAL TESTING DATA

GEO·ENVIRONMENTAL
DRILLING COMPANY, INC.

July 27, 1998

Mr. Michael Stangberg
IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923-3211

RE: Geotechnical Testing Laboratory Reports
NASA Plumbrook Site
Sandusky, Ohio
GEO Project No. G98-2234
IT Project No. 7737701

Dear Mr. Stangberg:

Enclosed please find the original copy of the geotechnical testing laboratory reports for the second group of samples submitted for testing. The chain-of-custody/request-for-analysis form is attached for these samples.

If you have any questions, please contact me at your earliest convenience at (412) 371-6551.

Thank you.

Sincerely,

Geo-Environmental Drilling Company, Inc.

Deborah Ann Weible, P.G., CWD
President & General Manager

Attachments Laboratory Report
Chain-Of-Custody/Request-For-Analysis Form

82234208.LTR

GEO-ENVIRONMENTAL DRILLING COMPANY, INC. *Environmental and Geotechnical Drilling Services*
11101 Frankstown Road
Pittsburgh, PA 15235-3096
tel: 412/371-6551
fax: 412/371-1027

Relinquished by: John Vandling IT Corp 1450 / 6-16-98

Received by: JC Beal 1430 16-98 GEO-ENVIRONMENTAL

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

Reference Document No.[30] _____

Page____of ____

Project Name PBOW - PRRP

Project No. 773701.03000000

Samples Shipment Date _____

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Preservative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
W-98-PRRP-DP23-Geot-0204	Soil	6-13-98	2x15" Acetate Sleeve	2x15"	None	Moisture Content (D2216)		
W-98-PRRP-DP23-Geot-0608		6-13-98				Atterberg Limits (D4318)	FOR LAB USE ONLY	
W-98-PRRP-DP23-Geot-1012		6-13-98				Sieve Analysis		
						USCS Classification,		
W-98-PRRP-DP22-Geot-0204		6-13-98				For All Samples	FOR LAB USE ONLY	
W-98-PRRP-DP22-Geot-0608		6-13-98						
W-98-PRRP-DP22-Geot-1012		6-13-98					FOR LAB USE ONLY	
W-98-PRRP-DP21-Geot-0204		6-13-98					FOR LAB USE ONLY	
W-98-PRRP-DP21-Geot-0608		6-13-98						
W-98-PRRP-DP21-Geot-0810		6-13-98						
							FOR LAB USE ONLY	
W-98-PRRP-DP25-Geot-0204		6-13-98						
W-98-PRRP-DP25-Geot-0608		6-13-98						
W-98-PRRP-DP25-Geot-1012		6-13-98					FOR LAB USE ONLY	
W-98-PRRP-DP24-Geot-0204		6-13-98					FOR LAB USE ONLY	
W-98-PRRP-DP24-Geot-0608		6-13-98						
W-98-PRRP-DP24-Geot-1012		6-13-98						

White: To accompany samples

Yellow: Field copy

*See back of form for special instructions.

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LABORATORY TEST REPORT

July 24, 1998

Project No. 98178-01

Ms. Deb Weible
Geoenvironmental Drilling Co.
11101 Frankstown Rd.
Pgh., PA 15235

RE: Soils Testing – PBOW-WARP

RECEIVED

Transmitted herein are the results of the soils testing performed for Geoenvironmental Drilling verified on the Project Verification Form, submitted July 13, 1998. The testing was performed in accordance with the ASTM methods listed on the enclosed data sheets. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

Disclaimer

The test results are believed to be representative of the samples submitted but are indicative only of the specimens which were evaluated. Geotechnics has no direct knowledge of the origin of the samples, implies no position with regard to the disposition of the test results, i.e., pass/fail, and makes no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization of the Client and Geotechnics. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please do not hesitate to contact our office.

Respectively submitted,

David R. Backstrom
Laboratory Director

544 Braddock Avenue • East Pittsburgh, PA 15112 • Phone (412) 823-7600 • Fax (412) 823-8999

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MOISTURE CONTENT

ASTM D 2216 (SOP-S1)

Client	GEO-ENVIRONMENTAL DRILLING
Client Reference	PBOW-WARP
Project No.	98178-01

Lab ID	.001	.002	.003	.004	.005
Boring No.	PBOW-98-Warp	PBOW-98-Warp	PBOW-98-Warp	PBOW-98-Warp	PBOW-98-Warp
Depth (ft)	NA	NA	NA	NA	NA
Sample No.	DP21-geot-0204	DP21-geot-0608	DP21-geot-1012	DP22-geot-0204	DP22-geot-0608
Tare Number	573	544	560	579	700
Wt. of Tare & WS (gm)	243.29	219.45	230.99	216.09	203.38
Wt. of Tare & DS (gm)	222.77	191.8	201.5	187.28	176.63
Wt. of Tare (gm)	82.55	84.79	82.75	84	76.01
Wt. of Water (gm)	20.52	27.65	29.49	28.81	26.75
Wt. of DS (gm)	140.22	107.01	118.75	103.28	100.62
Water Content (%)	**14.6**	**25.8**	**24.8**	**27.9**	**26.6**

Lab ID	.006	.007	.008	.009	.010
Boring No.	PBOW-98-Warp	PBOW-98-Warp	PBOW-98-Warp	PBOW-98-Warp	PBOW-98-Warp
Depth (ft)	NA	NA	NA	NA	NA
Sample No.	DP22-geot-1012	DP23-geot-0204	DP23-geot-0608	DP23-geot-1012	DP24-geot-0204
Tare Number	546	1730	677	Z10	566
Wt. of Tare & WS (gm)	179.23	227.51	193.21	203.85	211
Wt. of Tare & DS (gm)	168.52	198.52	169.37	177.01	188.47
Wt. of Tare (gm)	86.17	82.02	74.51	85.91	84.79
Wt. of Water (gm)	10.71	28.99	23.84	26.84	22.53
Wt. of DS (gm)	82.35	116.5	94.86	91.1	103.68
Water Content (%)	**13.0**	**24.9**	**25.1**	**29.5**	**21.7**

Notes : *NA*

Tested By *BL* *Date* *7/14/98* *Checked By* LB *Date* 7-17-98

DCN: CT-S1 DATE 6-30-98 REVISION: 2

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MOISTURE CONTENT

ASTM D 2216 (SOP-S1)

Client	GEO-ENVIRONMENTAL DRILLING
Client Reference	PBOW-WARP
Project No.	98178-01

Lab ID	.011	.012
Boring No.	PBOW-98-Warp	PBOW-98-Warp
Depth (ft)	NA	NA
Sample No.	DP24-geot-0608	DP24-geot-1012
Tare Number	728	1723
Wt. of Tare & WS (gm)	222.86	218.25
Wt. of Tare & DS (gm)	198.75	199.53
Wt. of Tare (gm)	86.61	83.56
Wt. of Water (gm)	24.11	18.72
Wt. of DS (gm)	112.14	115.97
Water Content (%)	**21.5**	**16.1**

Notes : *NA*

Tested By *BL* *Date* *7/14/98* *Checked By* LB *Date* 7-17-98

DCN: CT-S1 DATE 6-30-98 REVISION: 2

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SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-0204
Lab ID	98178-01.001	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**

USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND (NON-PLASTIC FINES)***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[H117.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-0204
Lab ID	98178-01.001	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1662	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	528.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	464.30	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	98.36	Weight of Tare (gm)	NA
Weight of Water (gm)	63.70	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	365.94	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**17.4**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	365.94
Dry Weight - 3/4" Sample (gm)	236.1	Weight of minus #200 material (gm)	129.81
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	236.13
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.54	0.15	0.15	99.85	**99.85**
#20	0.850	3.91	1.07	1.22	98.78	**98.78**
#40	0.425	4.42	1.21	2.42	97.58	**97.58**
#60	0.250	7.65	2.09	4.51	95.49	**95.49**
#140	0.106	170.80	46.67	51.19	48.81	**48.81**
#200	0.075	48.81	13.34	64.53	35.47	**35.47**
Pan	-	129.81	35.47	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-0204
Lab ID	98178-01.001	Visual Description	**BROWN SILT**
			(MInus No. 40 sieve material, Airdried)

NON - PLASTIC MATERIAL

Tested By TO *Date* 7/22/98 *Checked By* LB *Date* 7-22-98

DCN: CT-S4B DATE: 7-11-97 REVISION : 2

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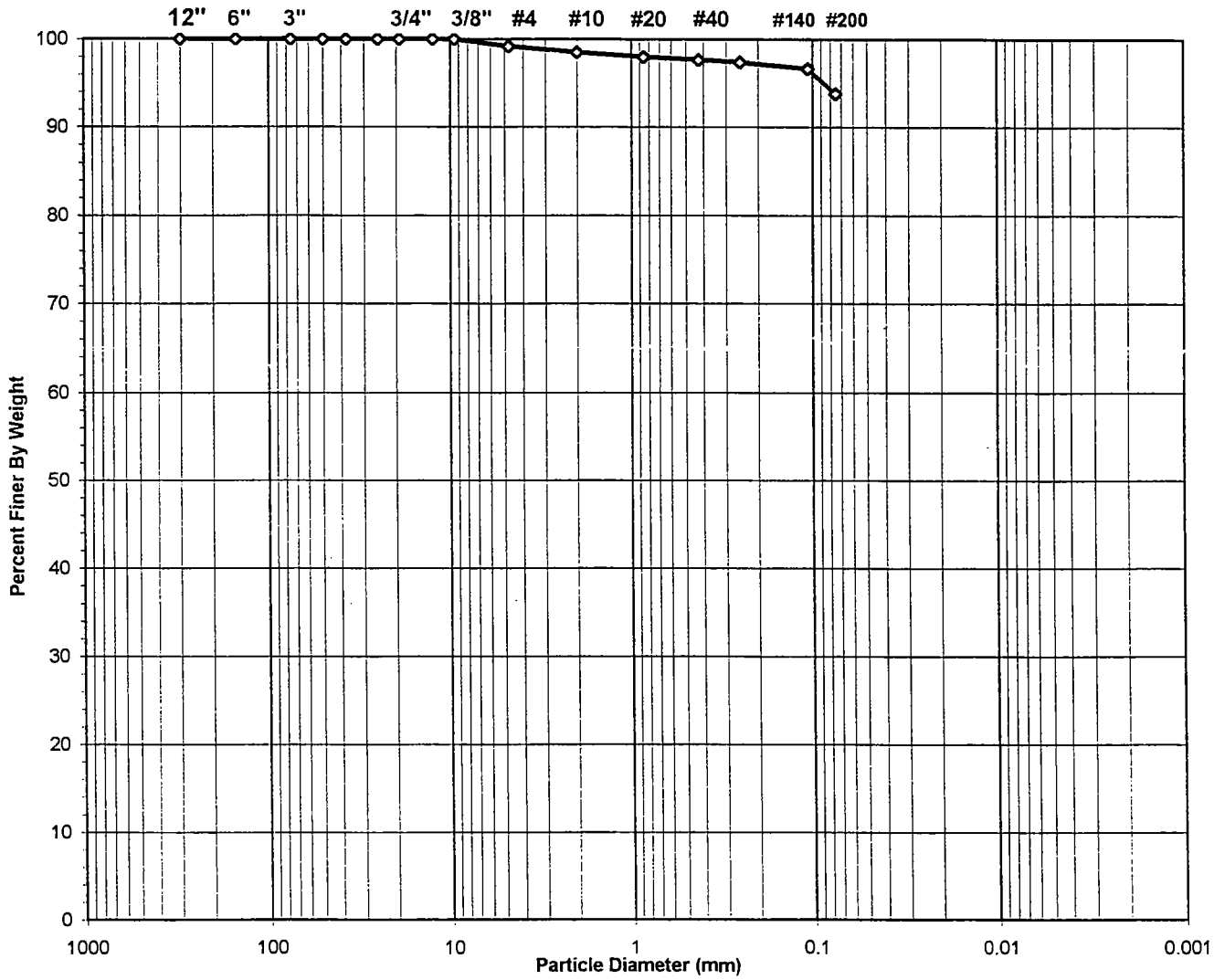
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-0608
Lab ID	98178-01.002	Soil Color	**GRAYISH BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[H118.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-0608
Lab ID	98178-01.002	Soil Color	**GRAYISH BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	846	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	611.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	514.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	103.23	Weight of Tare (gm)	NA
Weight of Water (gm)	96.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	411.67	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**23.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	411.67
Dry Weight - 3/4" Sample (gm)	25.5	Weight of minus #200 material (gm)	386.15
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	25.52
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	3.17	0.77	0.77	99.23	**99.23**
#10	2.00	2.79	0.68	1.45	98.55	**98.55**
#20	0.850	2.21	0.54	1.98	98.02	**98.02**
#40	0.425	1.32	0.32	2.31	97.69	**97.69**
#60	0.250	1.08	0.26	2.57	97.43	**97.43**
#140	0.106	3.15	0.77	3.33	96.67	**96.67**
#200	0.075	11.80	2.87	6.20	93.80	**93.80**
Pan	-	386.15	93.80	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-0608
Lab ID	98178-01.002	Soil Description	**GRAYISH BROWN LEAN CLAY**

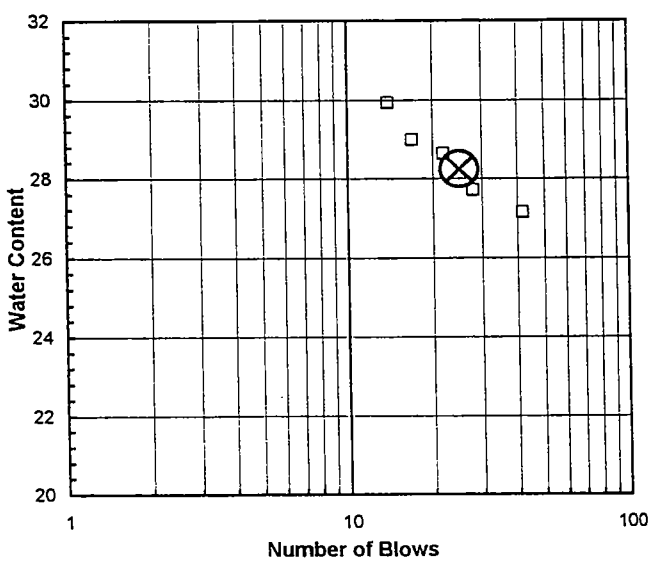
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	57	2280	2278	96	82	
Wt. of Tare & WS (gm)	39.02	35.83	39.90	38.35	42.68	
Wt. of Tare & DS (gm)	34.04	31.39	34.12	33.44	37.14	
Wt. of Tare (gm)	15.68	15.36	13.92	16.49	18.62	
Wt. of Water (gm)	4.98	4.44	5.78	4.91	5.54	
Wt. of DS (gm)	18.36	16.03	20.2	16.95	18.52	
Moisture Content (%)	**27.1**	**27.7**	**28.6**	**29.0**	**29.9**	
Number of Blows	**42**	**28**	**22**	**17**	**14**	

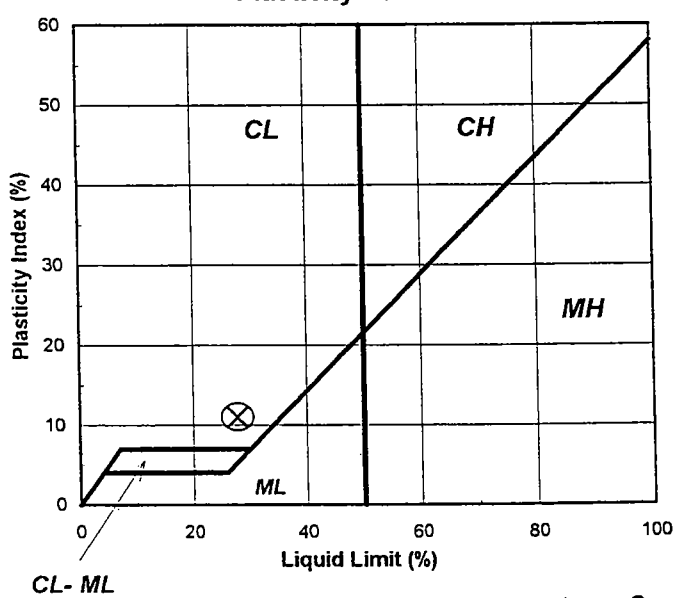
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2302	2300	2301
Wt. of Tare & WS (gm)	25.99	22.67	25.89
Wt. of Tare & DS (gm)	25.07	21.75	24.98
Wt. of Tare (gm)	19.89	16.39	19.79
Wt. of Water (gm)	0.92	0.92	0.91
Wt. of DS (gm)	5.18	5.36	5.19
Moisture Content (%)	**17.8**	**17.2**	**17.5**

Test Results	
Liquid Limit (%)	**28**
Plastic Limit (%)	**17**
Plasticity Index (%)	**11**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By TO *Date* 7/22/98 *Checked By* LB *Date* 7-24-98

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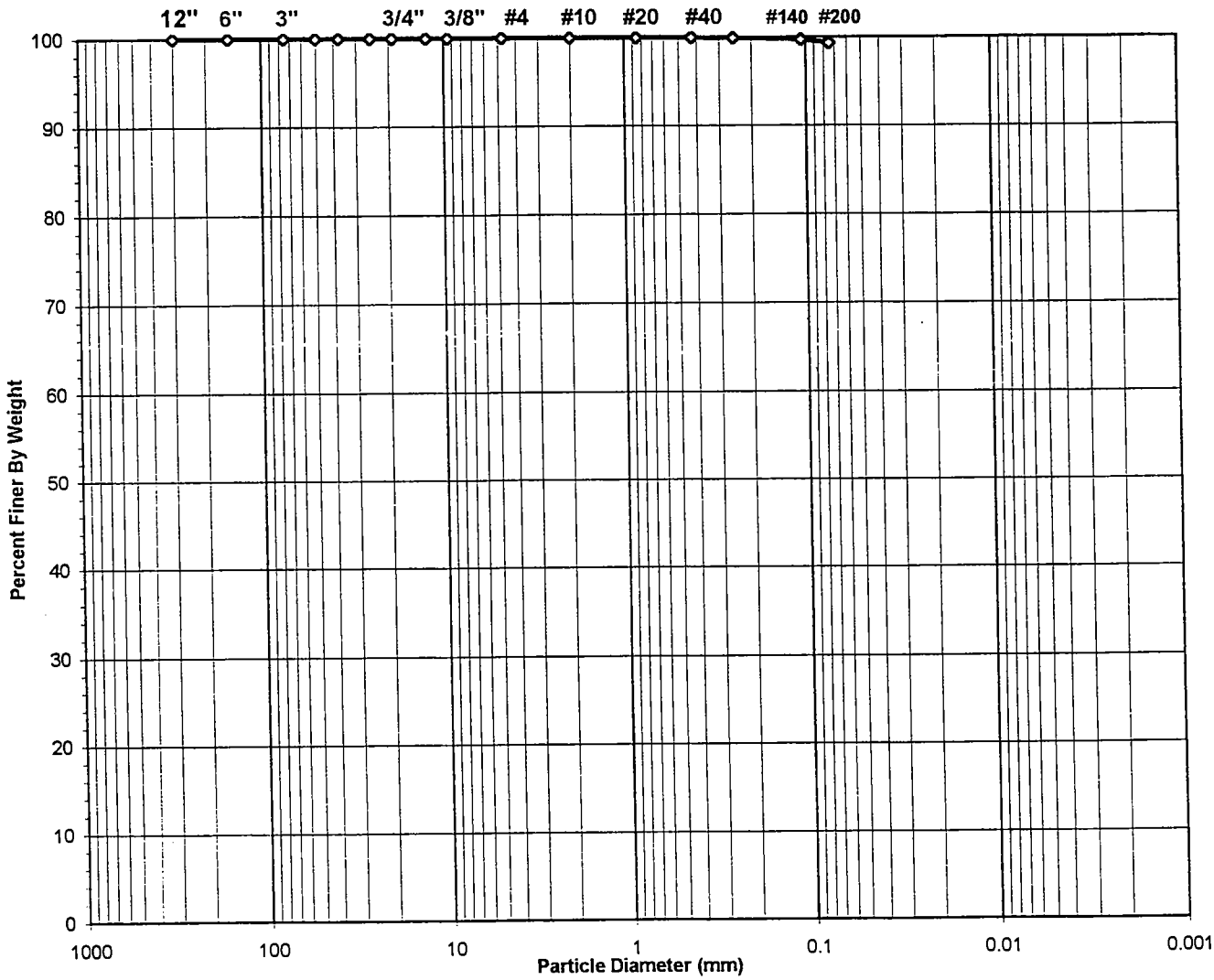
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-1012
Lab ID	98178-01.003	Soil Color	**BROWNISH GRAY**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H119.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-1012
Lab ID	98178-01.003	Soil Color	**BROWNISH GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2497	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	640.90	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	531.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	99.65	Weight of Tare (gm)	NA
Weight of Water (gm)	109.40	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	431.85	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**25.3**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	431.85
Dry Weight - 3/4" Sample (gm)	2.8	Weight of minus #200 material (gm)	429.07
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	2.78
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.00	0.00	0.00	100.00	**100.00**
#20	0.850	0.04	0.01	0.01	99.99	**99.99**
#40	0.425	0.09	0.02	0.03	99.97	**99.97**
#60	0.250	0.13	0.03	0.06	99.94	**99.94**
#140	0.106	0.99	0.23	0.29	99.71	**99.71**
#200	0.075	1.53	0.35	0.64	99.36	**99.36**
Pan	-	429.07	99.36	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP21-GEOT-1012
Lab ID	98178-01.003	Soil Description	**BROWNISH GRAY LEAN CLAY**

***Note:** The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

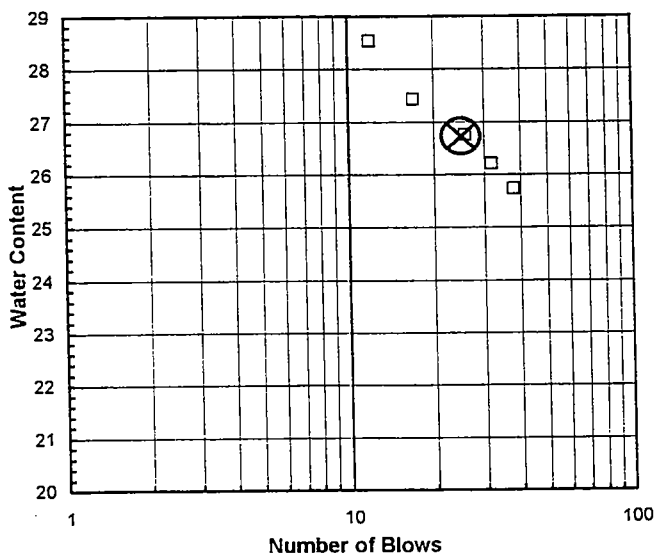
(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2032	2029	2229	2039	2033	MULTIPOINT
Wt. of Tare & WS (gm)	37.95	39.23	42.17	36.92	41.16	
Wt. of Tare & DS (gm)	33.29	34.73	37.65	32.07	36.61	
Wt. of Tare (gm)	15.17	17.55	20.75	14.38	20.66	
Wt. of Water (gm)	4.66	4.5	4.52	4.85	4.55	
Wt. of DS (gm)	18.12	17.18	16.9	17.69	15.95	
Moisture Content (%)	**25.7**	**26.2**	**26.7**	**27.4**	**28.5**	
Number of Blows	**38**	**32**	**26**	**17**	**12**	

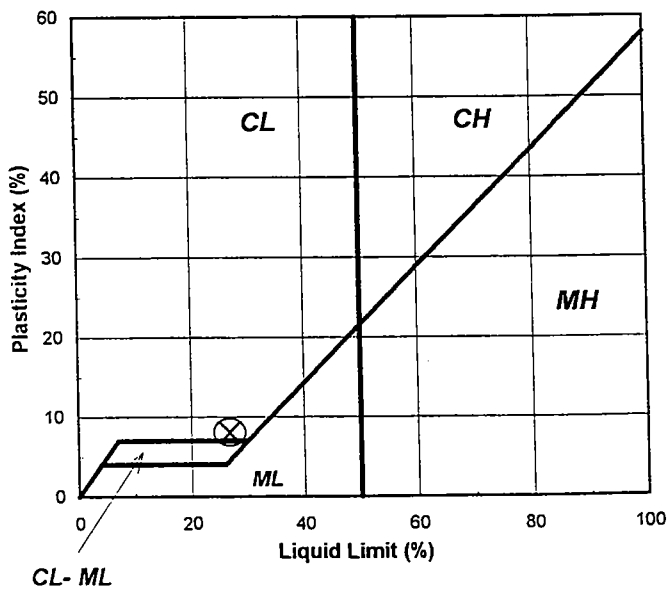
Plastic Limit Test	**1**	**2**	**3**
Tare Number	117	2280	38
Wt. of Tare & WS (gm)	22.67	22.57	25.41
Wt. of Tare & DS (gm)	21.62	21.42	24.27
Wt. of Tare (gm)	16.04	15.37	18.16
Wt. of Water (gm)	1.05	1.15	1.14
Wt. of DS (gm)	5.58	6.05	6.11
Moisture Content (%)	**18.8**	**19.0**	**18.7**

Test Results	
Liquid Limit (%)	**27**
Plastic Limit (%)	**19**
Plasticity Index (%)	**8**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By DBB *Date* 7/21/98 *Checked By* LB *Date* 7-22-98

page 1 of 1 **DCN:** CT-S4 **DATE:** 1/13/98 **REVISION:** 3 *ICE\EXCEL\PrintQ\[H59.xls]Sheet1*

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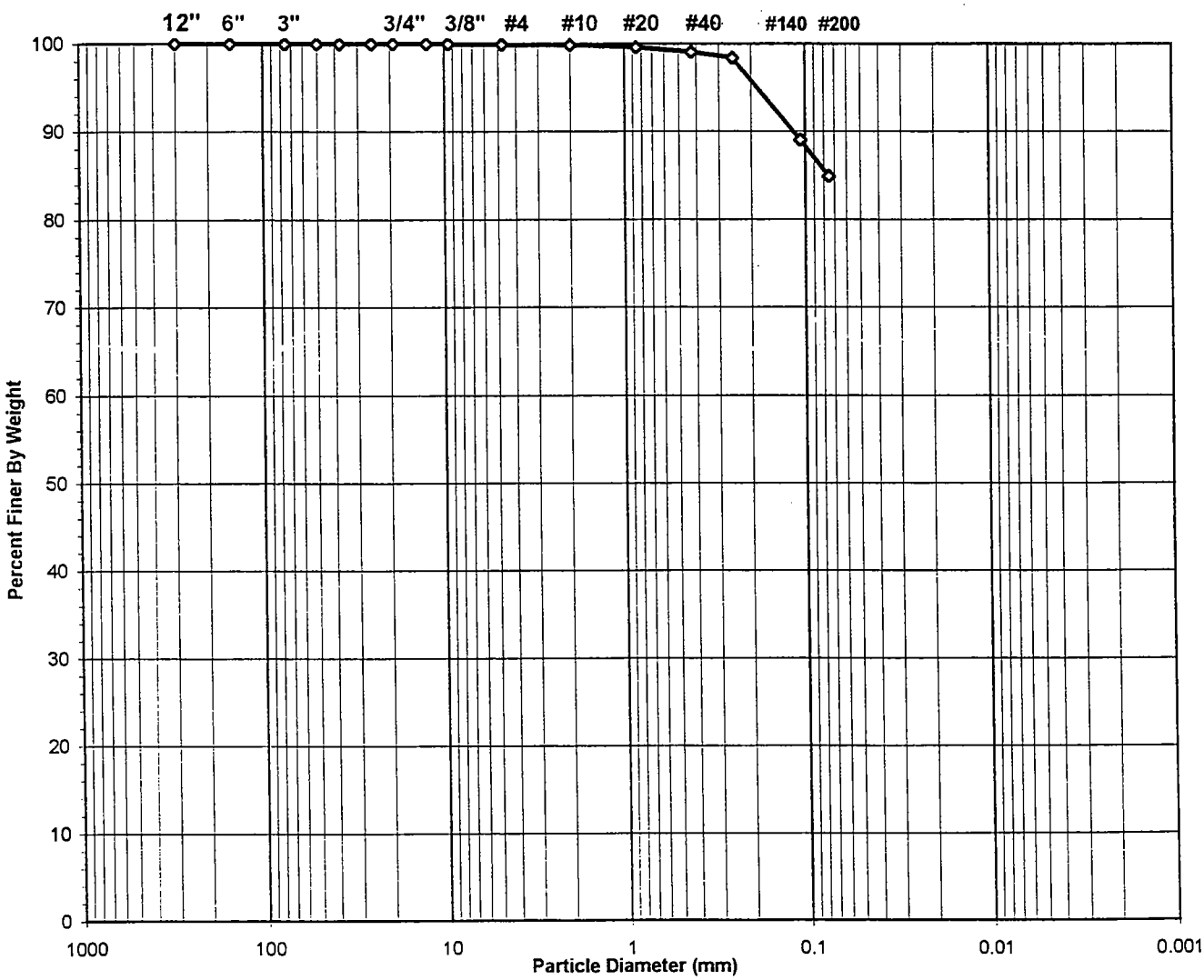
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-0204
Lab ID	98178-01.004	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H120.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-0204
Lab ID	98178-01.004	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1636	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	488.50	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	410.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	98.79	Weight of Tare (gm)	NA
Weight of Water (gm)	77.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	311.91	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**24.9**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	311.91
Dry Weight - 3/4" Sample (gm)	47.2	Weight of minus #200 material (gm)	264.76
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	47.15
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.28	0.09	0.09	99.91	**99.91**
#10	2.00	0.19	0.06	0.15	99.85	**99.85**
#20	0.850	0.81	0.26	0.41	99.59	**99.59**
#40	0.425	1.64	0.53	0.94	99.06	**99.06**
#60	0.250	1.97	0.63	1.57	98.43	**98.43**
#140	0.106	29.36	9.41	10.98	89.02	**89.02**
#200	0.075	12.90	4.14	15.12	84.88	**84.88**
Pan	-	264.76	84.88	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-0204
Lab ID	98178-01.004	Soil Description	**BROWN LEAN CLAY**

***Note:** The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

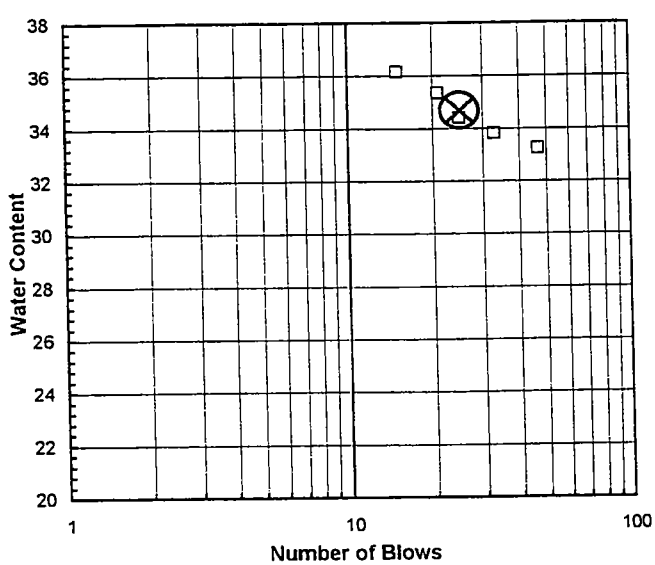
(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	70	109	112	75	35	
Wt. of Tare & WS (gm)	27.73	26.41	29.88	26.37	37.83	
Wt. of Tare & DS (gm)	24.96	23.56	26.58	23.59	32.36	
Wt. of Tare (gm)	16.62	15.13	16.98	15.72	17.22	
Wt. of Water (gm)	2.77	2.85	3.3	2.78	5.47	
Wt. of DS (gm)	8.34	8.43	9.6	7.87	15.14	
Moisture Content (%)	**33.2**	**33.8**	**34.4**	**35.3**	**36.1**	
Number of Blows	**47**	**33**	**25**	**21**	**15**	

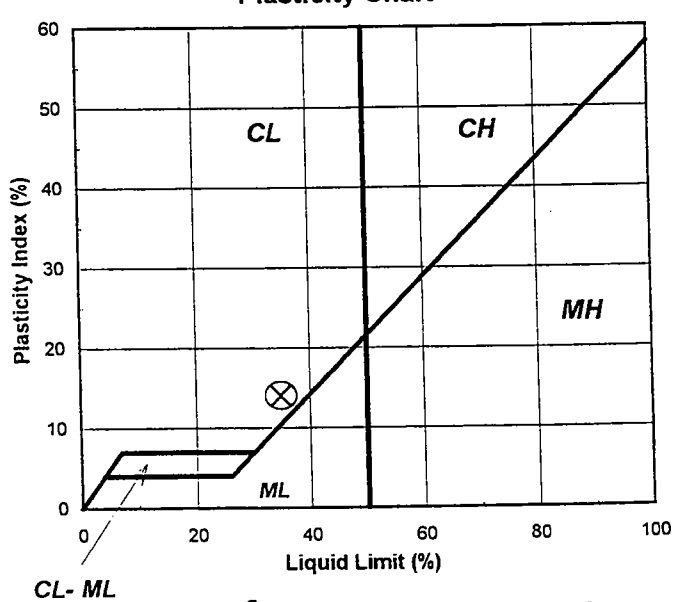
Plastic Limit Test	**1**	**2**	**3**
Tare Number	117	38	64
Wt. of Tare & WS (gm)	22.31	24.43	22.94
Wt. of Tare & DS (gm)	21.20	23.32	21.86
Wt. of Tare (gm)	16.03	18.17	16.79
Wt. of Water (gm)	1.11	1.11	1.08
Wt. of DS (gm)	5.17	5.15	5.07
Moisture Content (%)	**21.5**	**21.6**	**21.3**

Test Results	
Liquid Limit (%)	**35**
Plastic Limit (%)	**21**
Plasticity Index (%)	**14**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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page 1 of 1 **DCN:** CT-S4 **DATE:** 1/13/98 **REVISION:** 3 *CE\EXCEL\PrintQ\[H104.xls]Sheet1*

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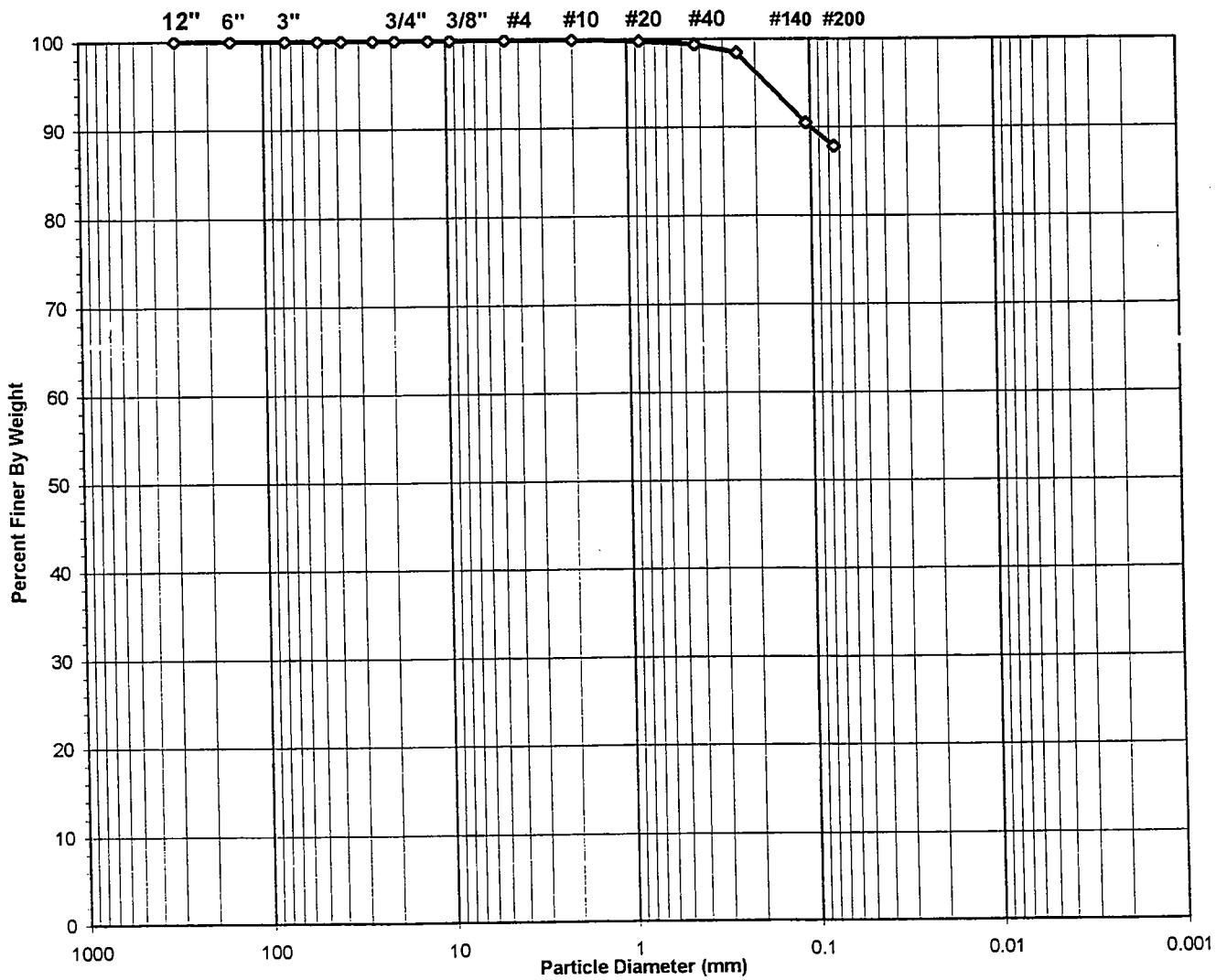
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-0608
Lab ID	98178-01.005	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H121.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-0608
Lab ID	98178-01.005	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1003	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	614.40	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	513.60	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	104.39	Weight of Tare (gm)	NA
Weight of Water (gm)	100.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	409.21	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**24.6**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	409.21
Dry Weight - 3/4" Sample (gm)	49.9	Weight of minus #200 material (gm)	359.33
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	49.88
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.13	0.03	0.03	99.97	**99.97**
#20	0.850	0.63	0.15	0.19	99.81	**99.81**
#40	0.425	1.81	0.44	0.63	99.37	**99.37**
#60	0.250	3.63	0.89	1.52	98.48	**98.48**
#140	0.106	32.59	7.96	9.48	90.52	**90.52**
#200	0.075	11.09	2.71	12.19	87.81	**87.81**
Pan	-	359.33	87.81	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-0608
Lab ID	98178-01.005	Soil Description	**BROWN LEAN CLAY**

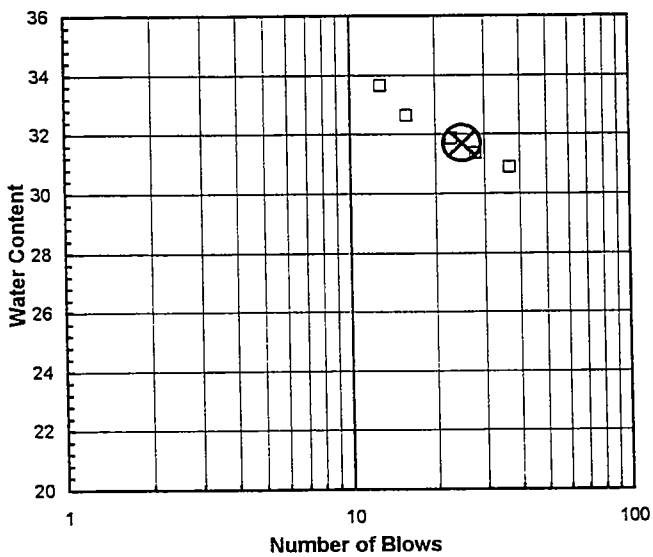
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	2234	1886	1877	2230	2297	
Wt. of Tare & WS (gm)	37.45	36.87	37.20	28.99	30.39	
Wt. of Tare & DS (gm)	32.42	31.95	31.95	26.32	28.02	
Wt. of Tare (gm)	16.12	16.25	15.46	18.13	20.97	
Wt. of Water (gm)	5.03	4.92	5.25	2.67	2.37	
Wt. of DS (gm)	16.3	15.7	16.49	8.19	7.05	
Moisture Content (%)	**30.9**	**31.3**	**31.8**	**32.6**	**33.6**	
Number of Blows	**37**	**28**	**23**	**16**	**13**	

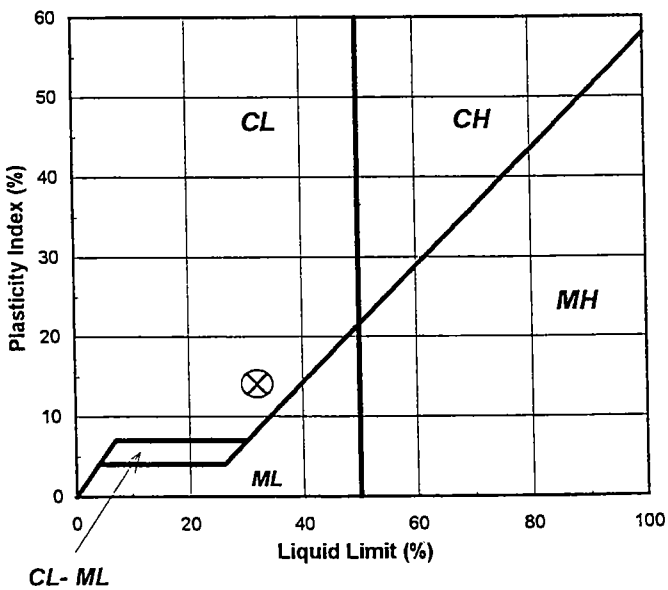
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2271	54	110
Wt. of Tare & WS (gm)	22.76	22.61	23.69
Wt. of Tare & DS (gm)	21.88	21.66	22.79
Wt. of Tare (gm)	16.71	16.51	17.69
Wt. of Water (gm)	0.88	0.95	0.9
Wt. of DS (gm)	5.17	5.15	5.1
Moisture Content (%)	**17.0**	**18.4**	**17.6**

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**18**
Plasticity Index (%)	**14**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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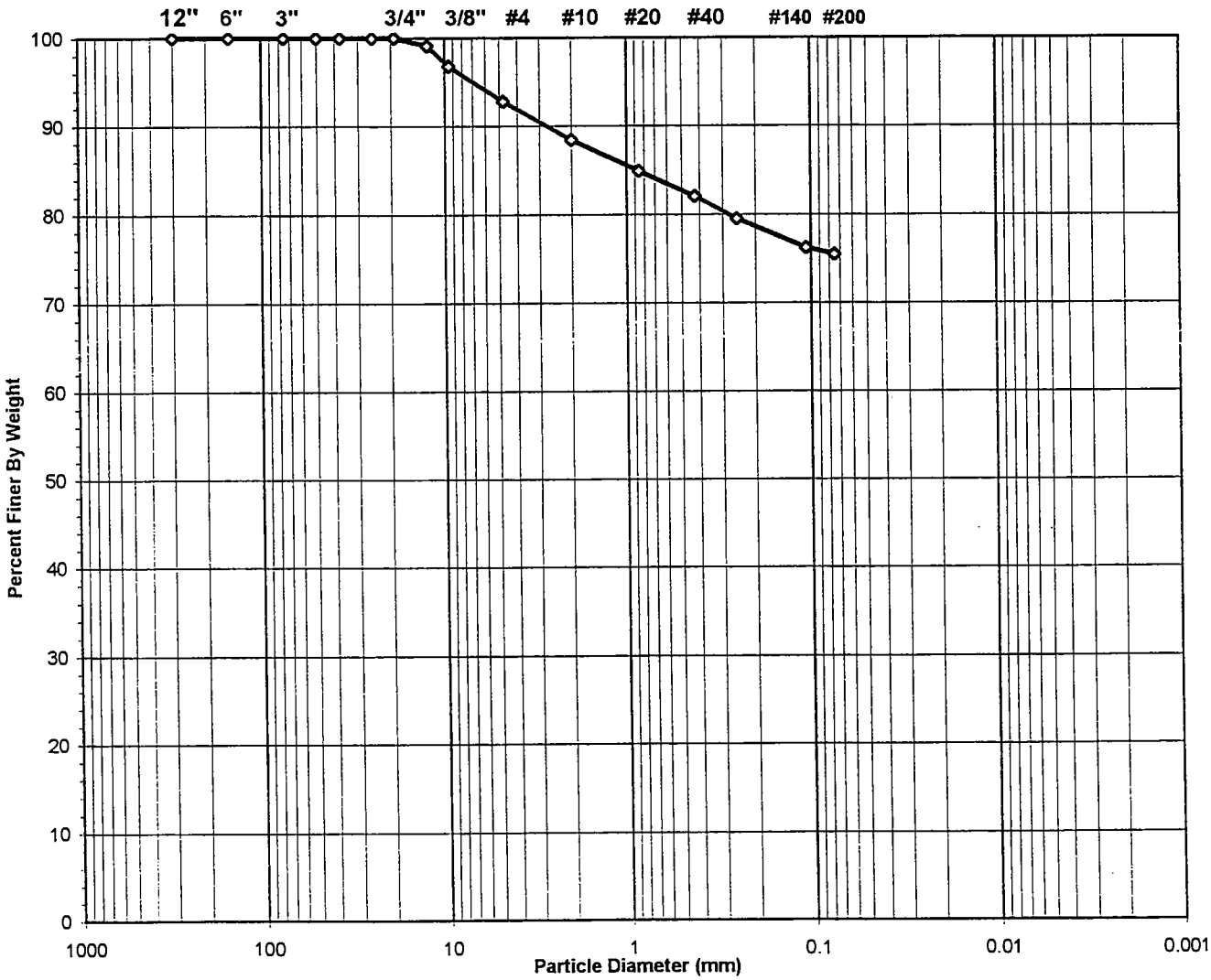
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-1012
Lab ID	98178-01.006	Soil Color	**GRAY**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

Tested By TM Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[H122.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-1012
Lab ID	98178-01.006	Soil Color	**GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2467	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	617.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	557.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	99.47	Weight of Tare (gm)	NA
Weight of Water (gm)	59.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	458.43	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**13.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	458.43
Dry Weight - 3/4" Sample (gm)	112.6	Weight of minus #200 material (gm)	345.84
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	112.59
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	4.01	0.87	0.87	99.13	**99.13**
3/8"	9.50	10.59	2.31	3.18	96.82	**96.82**
#4	4.75	18.45	4.02	7.21	92.79	**92.79**
#10	2.00	19.86	4.33	11.54	88.46	**88.46**
#20	0.850	16.43	3.58	15.13	84.87	**84.87**
#40	0.425	12.95	2.82	17.95	82.05	**82.05**
#60	0.250	11.54	2.52	20.47	79.53	**79.53**
#140	0.106	15.27	3.33	23.80	76.20	**76.20**
#200	0.075	3.49	0.76	24.56	75.44	**75.44**
Pan	-	345.84	75.44	100.00	-	-

Tested By TM Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP22-GEOT-1012
Lab ID	98178-01.006	Soil Description	**GRAY LEAN CLAY**

***Note:** The* USCS *symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

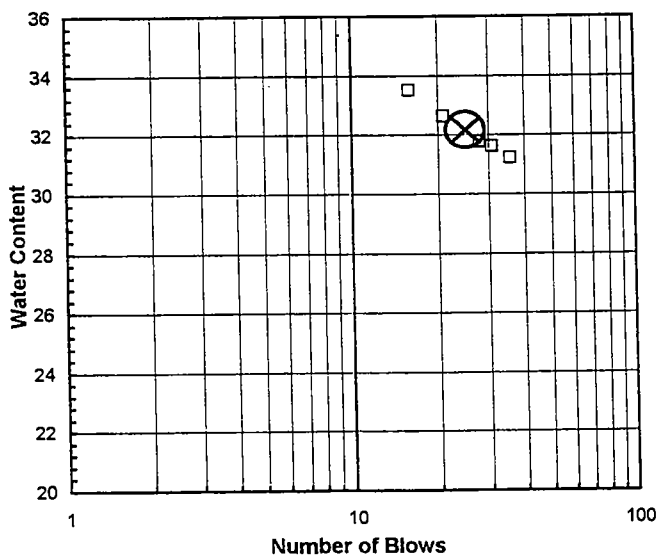
(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	2281	113	50	81	48	
Wt. of Tare & WS (gm)	38.61	38.15	41.24	41.29	41.52	
Wt. of Tare & DS (gm)	32.76	32.43	35.69	35.28	35.45	
Wt. of Tare (gm)	14.01	14.32	18.21	16.85	17.33	
Wt. of Water (gm)	5.85	5.72	5.55	6.01	6.07	
Wt. of DS (gm)	18.75	18.11	17.48	18.43	18.12	
Moisture Content (%)	**31.2**	**31.6**	**31.8**	**32.6**	**33.5**	
Number of Blows	**36**	**31**	**28**	**21**	**16**	

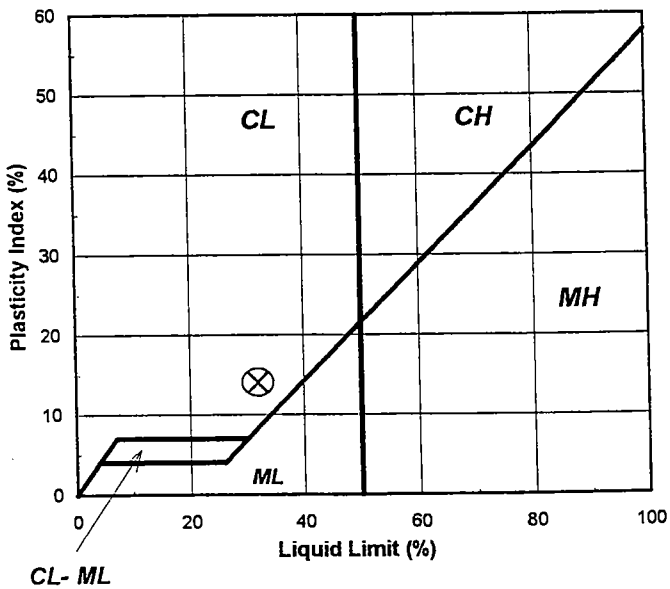
Plastic Limit Test	**1**	**2**	**3**
Tare Number	83	54	40
Wt. of Tare & WS (gm)	21.70	22.80	23.88
Wt. of Tare & DS (gm)	20.78	21.86	22.90
Wt. of Tare (gm)	15.56	16.50	17.42
Wt. of Water (gm)	0.92	0.94	0.98
Wt. of DS (gm)	5.22	5.36	5.48
Moisture Content (%)	**17.6**	**17.5**	**17.9**

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**18**
Plasticity Index (%)	**14**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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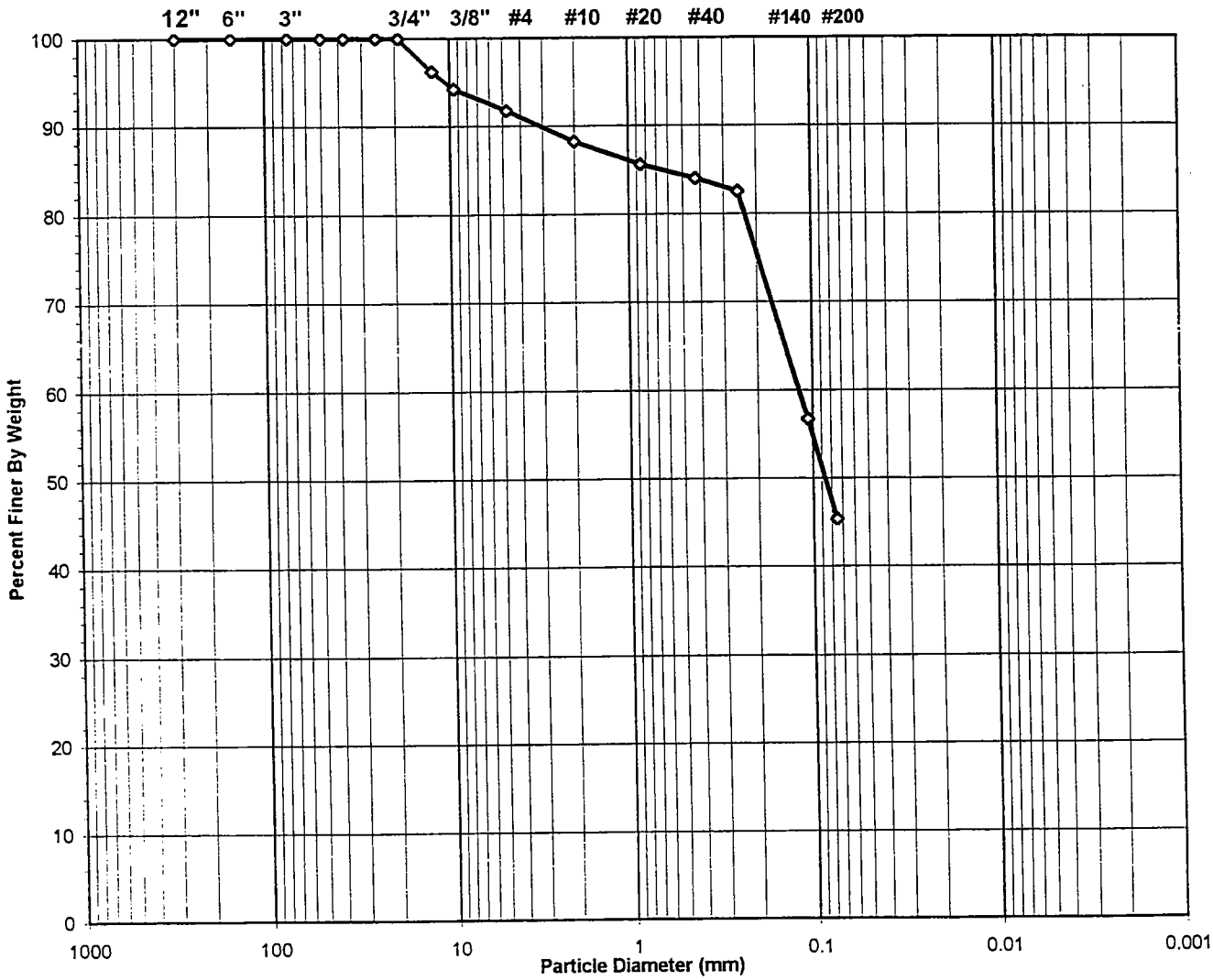
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-0204
Lab ID	98178-01.007	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SC, TESTED***

USCS Classification ***CLAYEY SAND***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H123.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-0204
Lab ID	98178-01.007	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1088	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	530.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	439.00	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	93.16	Weight of Tare (gm)	NA
Weight of Water (gm)	91.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	345.84	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**26.3**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	345.84
Dry Weight - 3/4" Sample (gm)	188.9	Weight of minus #200 material (gm)	156.91
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	188.93
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	13.16	3.81	3.81	96.19	**96.19**
3/8"	9.50	6.93	2.00	5.81	94.19	**94.19**
#4	4.75	8.44	2.44	8.25	91.75	**91.75**
#10	2.00	12.28	3.55	11.80	88.20	**88.20**
#20	0.850	9.05	2.62	14.42	85.58	**85.58**
#40	0.425	5.58	1.61	16.03	83.97	**83.97**
#60	0.250	4.97	1.44	17.47	82.53	**82.53**
#140	0.106	89.32	25.83	43.29	56.71	**56.71**
#200	0.075	39.20	11.33	54.63	45.37	**45.37**
Pan	-	156.91	45.37	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-0204
Lab ID	98178-01.007	Soil Description	**BROWN LEAN CLAY**

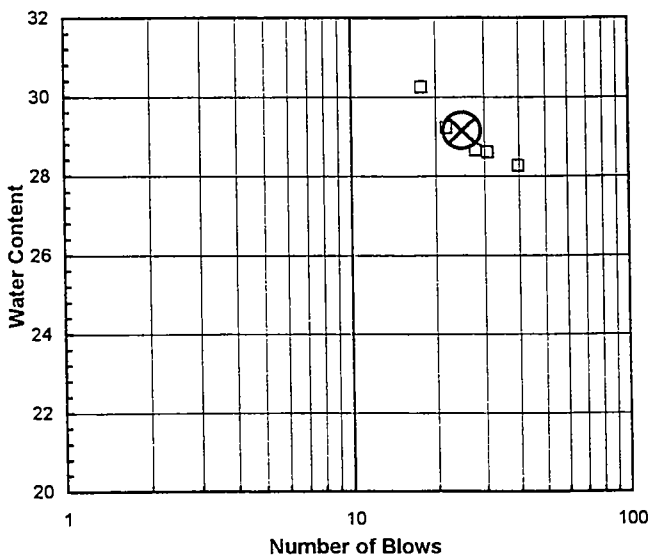
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2233	2314	2317	2252	2036	M U L T I P O I N T
Wt. of Tare & WS (gm)	38.84	42.07	37.94	39.17	42.69	
Wt. of Tare & DS (gm)	34.18	36.77	32.95	34.32	36.74	
Wt. of Tare (gm)	17.68	18.23	15.52	17.71	17.06	
Wt. of Water (gm)	4.66	5.3	4.99	4.85	5.95	
Wt. of DS (gm)	16.5	18.54	17.43	16.61	19.68	
Moisture Content (%)	**28.2**	**28.6**	**28.6**	**29.2**	**30.2**	
Number of Blows	**40**	**31**	**28**	**22**	**18**	

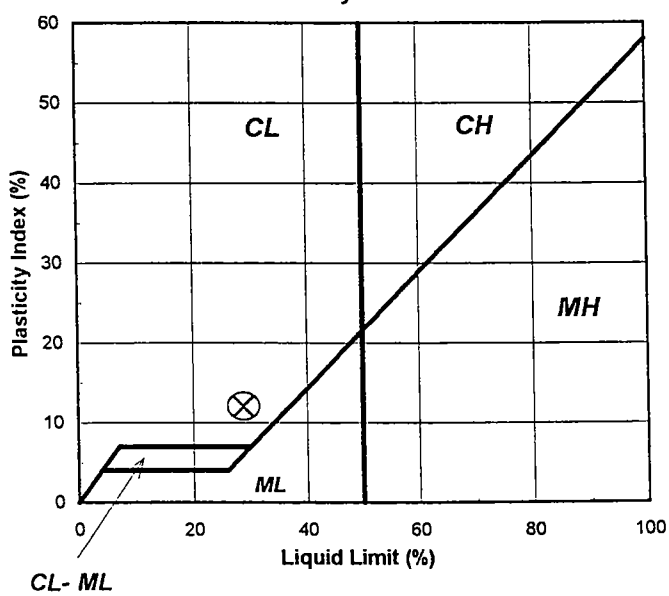
Plastic Limit Test	**1**	**2**	**3**
Tare Number	88	2285	83
Wt of Tare & WS (gm)	28.71	23.96	21.56
Wt. of Tare & DS (gm)	27.78	23.06	20.67
Wt. of Tare (gm)	22.29	17.75	15.55
Wt. of Water (gm)	0.93	0.9	0.89
Wt. of DS (gm)	5.49	5.31	5.12
Moisture Content (%)	**16.9**	**16.9**	**17.4**

Test Results	
Liquid Limit (%)	**29**
Plastic Limit (%)	**17**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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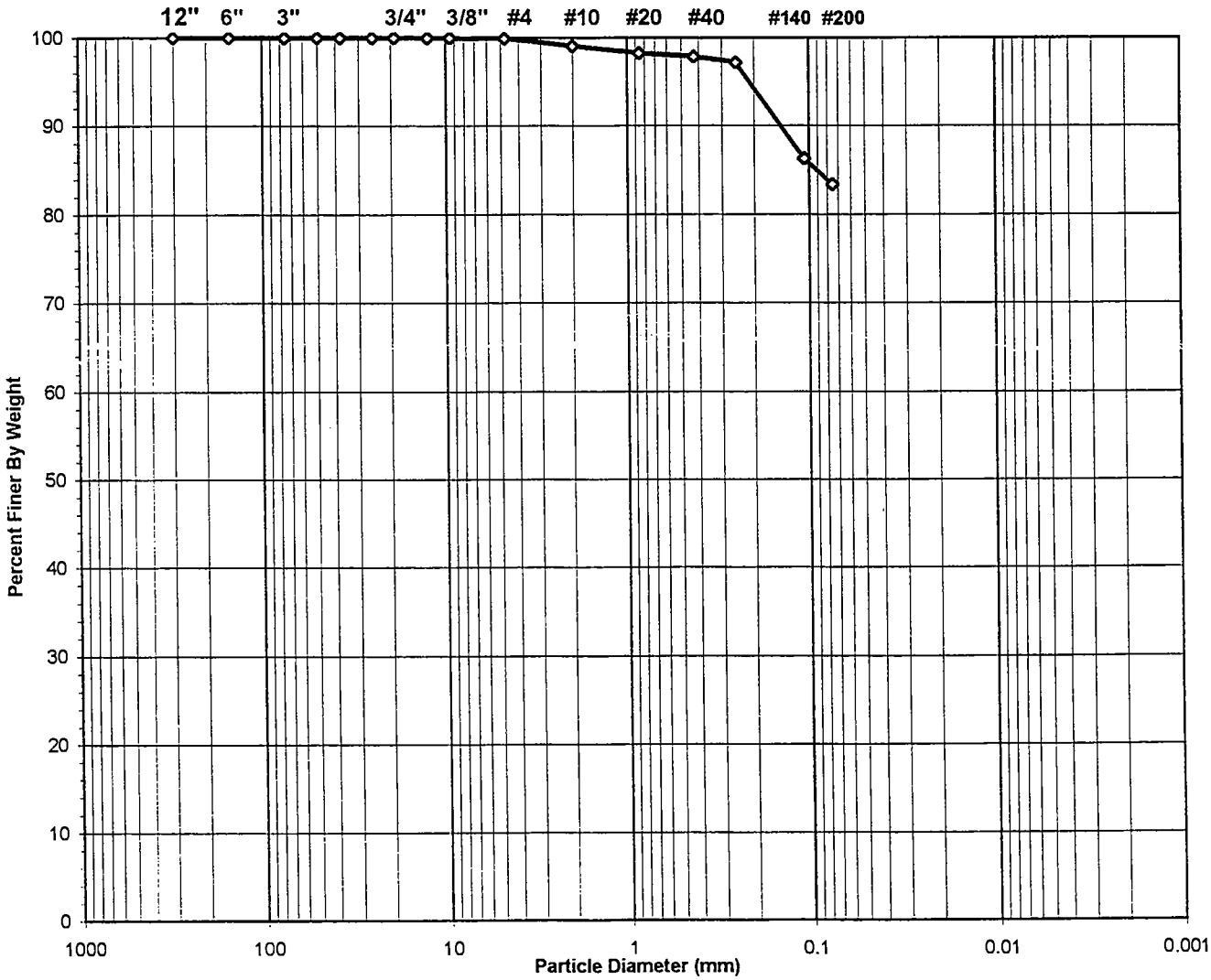
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-0608
Lab ID	98178-01.008	Soil Color	**GRAYISH BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[H124.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-0608
Lab ID	98178-01.008	Soil Color	**GRAYISH BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1919	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	771.50	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	636.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	102.39	Weight of Tare (gm)	NA
Weight of Water (gm)	134.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	534.31	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**25.2**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	534.31
Dry Weight - 3/4" Sample (gm)	88.8	Weight of minus #200 material (gm)	445.52
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	88.79
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.28	0.05	0.05	99.95	**99.95**
#10	2.00	4.56	0.85	0.91	99.09	**99.09**
#20	0.850	4.33	0.81	1.72	98.28	**98.28**
#40	0.425	2.35	0.44	2.16	97.84	**97.84**
#60	0.250	3.46	0.65	2.80	97.20	**97.20**
#140	0.106	58.35	10.92	13.72	86.28	**86.28**
#200	0.075	15.46	2.89	16.62	83.38	**83.38**
Pan	-	445.52	83.38	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-0608
Lab ID	98178-01.008	Soil Description	**GRAYISH BROWN LEAN CLAY**

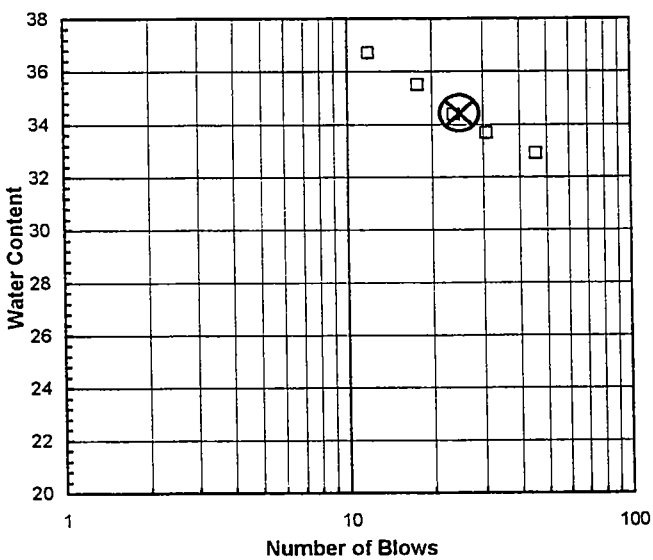
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	59	40	65	106	52	
Wt. of Tare & WS (gm)	40.76	41.66	40.99	37.80	40.85	
Wt. of Tare & DS (gm)	34.94	35.56	35.01	31.87	34.64	
Wt. of Tare (gm)	17.23	17.43	17.60	15.15	17.71	
Wt. of Water (gm)	5.82	6.1	5.98	5.93	6.21	
Wt. of DS (gm)	17.71	18.13	17.41	16.72	16.93	
Moisture Content (%)	**32.9**	**33.6**	**34.3**	**35.5**	**36.7**	
Number of Blows	**46**	**31**	**24**	**18**	**12**	

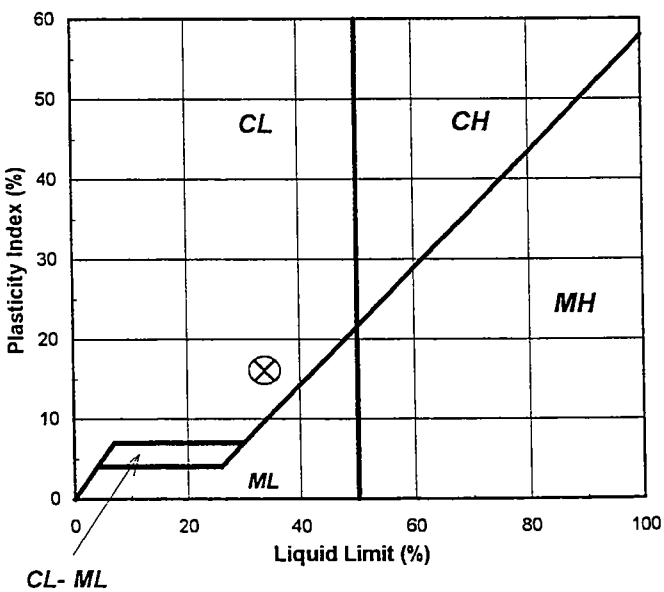
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2322	23	1859
Wt. of Tare & WS (gm)	22.57	24.13	21.65
Wt. of Tare & DS (gm)	21.58	23.17	20.70
Wt. of Tare (gm)	16.21	17.93	15.57
Wt. of Water (gm)	0.99	0.96	0.95
Wt. of DS (gm)	5.37	5.24	5.13
Moisture Content (%)	**18.4**	**18.3**	**18.5**

Test Results	
Liquid Limit (%)	**34**
Plastic Limit (%)	**18**
Plasticity Index (%)	**16**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By TO *Date* 7/22/98 *Checked By* LB *Date* 7-24-98

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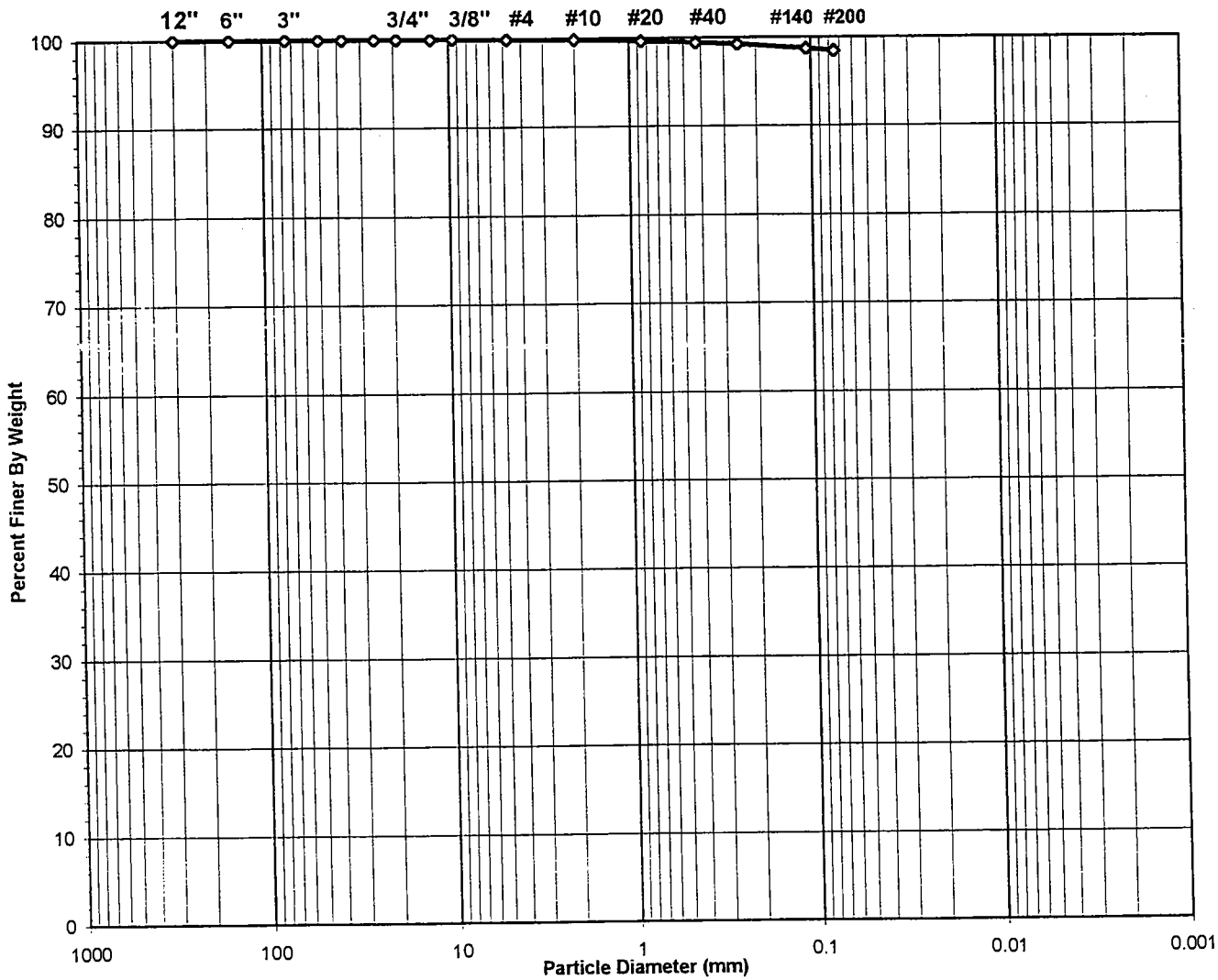
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-1012
Lab ID	98178-01.009	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By BL Date 7/14/98 Checked By UB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H125.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-1012
Lab ID	98178-01.009	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1683	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	525.50	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	429.10	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	101.08	Weight of Tare (gm)	NA
Weight of Water (gm)	96.40	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	328.02	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**29.4**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	328.02
Dry Weight - 3/4" Sample (gm)	5.1	Weight of minus #200 material (gm)	322.97
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	5.05
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.22	0.07	0.07	99.93	**99.93**
#10	2.00	0.19	0.06	0.12	99.88	**99.88**
#20	0.850	0.59	0.18	0.30	99.70	**99.70**
#40	0.425	0.73	0.22	0.53	99.47	**99.47**
#60	0.250	0.74	0.23	0.75	99.25	**99.25**
#140	0.106	1.59	0.48	1.24	98.76	**98.76**
#200	0.075	0.99	0.30	1.54	98.46	**98.46**
Pan	-	322.97	98.46	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP23-GEOT-1012
Lab ID	98178-01.009	Soil Description	**BROWN LEAN CLAY**

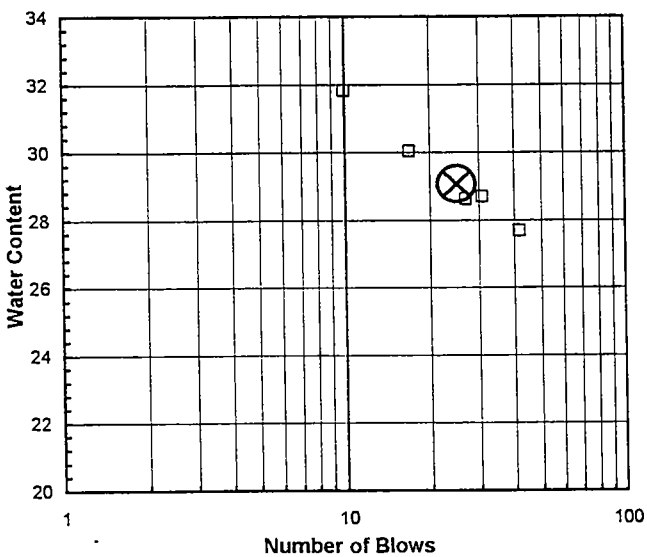
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2306	2055	2253	2245	2250	M
Wt. of Tare & WS (gm)	38.14	39.82	41.36	37.12	37.92	U
Wt. of Tare & DS (gm)	33.31	35.12	36.42	32.16	32.65	L
Wt. of Tare (gm)	15.85	18.73	19.15	15.63	16.08	T
Wt. of Water (gm)	4.83	4.7	4.94	4.96	5.27	I
Wt. of DS (gm)	17.46	16.39	17.27	16.53	16.57	P
						O
Moisture Content (%)	**27.7**	**28.7**	**28.6**	**30.0**	**31.8**	I
Number of Blows	**42**	**31**	**27**	**17**	**10**	N
						T

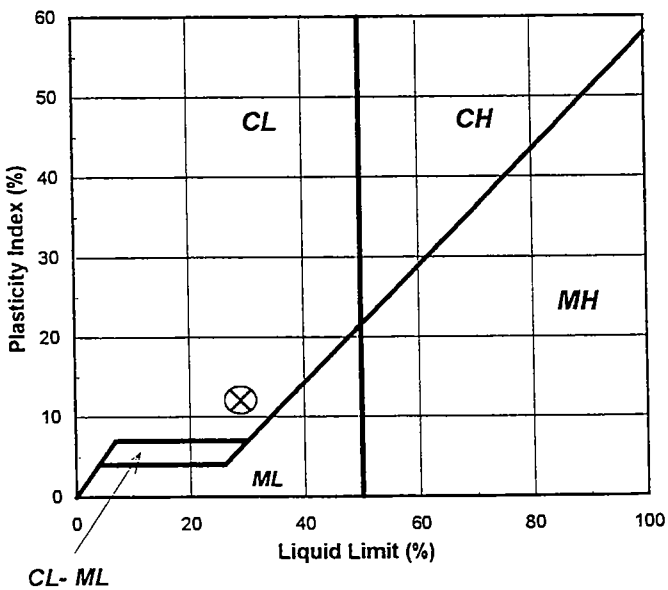
Plastic Limit Test	**1**	**2**	**3**
Tare Number	70	109	57
Wt. of Tare & WS (gm)	22.79	21.55	22.32
Wt. of Tare & DS (gm)	21.88	20.62	21.34
Wt. of Tare (gm)	16.63	15.15	15.68
Wt. of Water (gm)	0.91	0.93	0.98
Wt. of DS (gm)	5.25	5.47	5.66
Moisture Content (%)	**17.3**	**17.0**	**17.3**

Test Results	
Liquid Limit (%)	**29**
Plastic Limit (%)	**17**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By TO *Date* 7/21/98 *Checked By* LB *Date* 7-22-98

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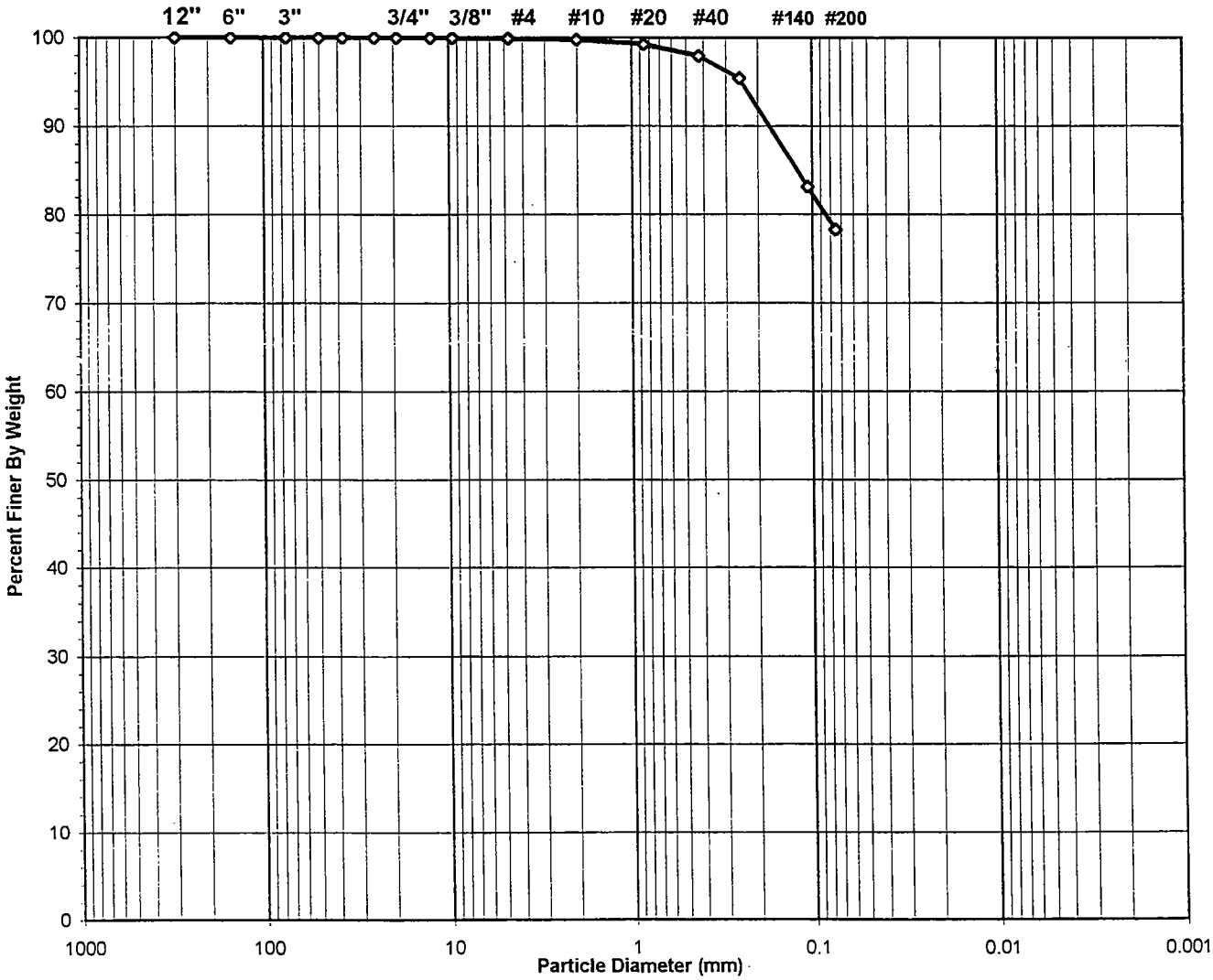
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-0204
Lab ID	98178-01.010	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

Tested By TM Date 7/14/98 Checked By UB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H126.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-0204
Lab ID	98178-01.010	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	501	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	722.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	621.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	107.17	Weight of Tare (gm)	NA
Weight of Water (gm)	100.50	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	514.33	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**19.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	514.33
Dry Weight - 3/4" Sample (gm)	111.8	Weight of minus #200 material (gm)	402.58
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	111.75
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.29	0.06	0.06	99.94	**99.94**
#10	2.00	0.81	0.16	0.21	99.79	**99.79**
#20	0.850	2.59	0.50	0.72	99.28	**99.28**
#40	0.425	6.87	1.34	2.05	97.95	**97.95**
#60	0.250	12.92	2.51	4.57	95.43	**95.43**
#140	0.106	63.29	12.31	16.87	83.13	**83.13**
#200	0.075	24.98	4.86	21.73	78.27	**78.27**
Pan	-	402.58	78.27	100.00	-	-

Tested By TM Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-0204
Lab ID	98178-01.010	Soil Description	**BROWN LEAN CLAY**

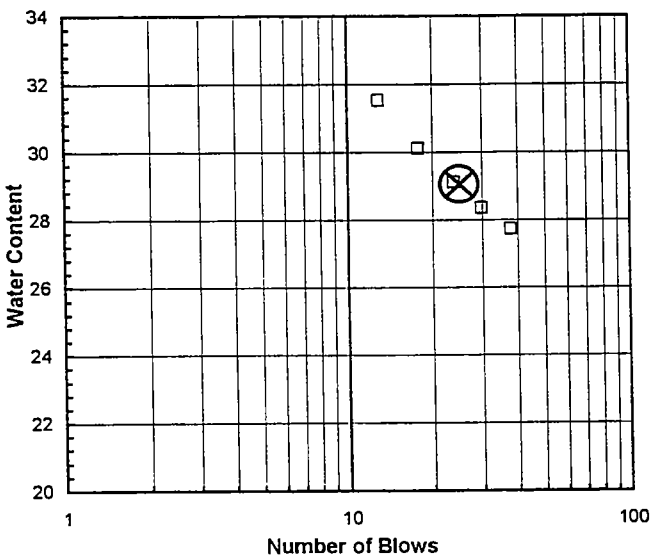
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2057	2234	2247	2248	2290	MULTIPOINT
Wt. of Tare & WS (gm)	39.43	36.23	37.46	37.69	40.41	
Wt. of Tare & DS (gm)	35.08	31.79	32.93	32.89	35.02	
Wt. of Tare (gm)	19.38	16.12	17.36	16.94	17.91	
Wt. of Water (gm)	4.35	4.44	4.53	4.8	5.39	
Wt. of DS (gm)	15.7	15.67	15.57	15.95	17.11	
Moisture Content (%)	**27.7**	**28.3**	**29.1**	**30.1**	**31.5**	
Number of Blows	**38**	**30**	**24**	**18**	**13**	

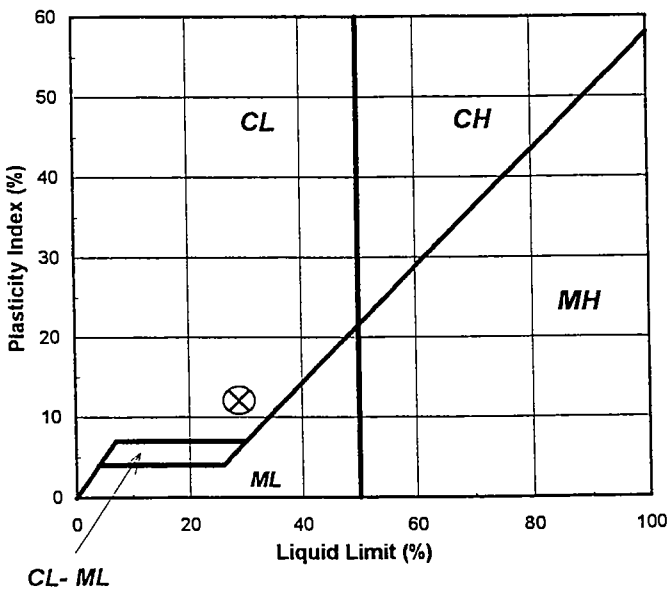
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2300	2311	2319
Wt. of Tare & WS (gm)	22.45	21.38	25.18
Wt. of Tare & DS (gm)	21.55	20.51	24.16
Wt. of Tare (gm)	16.37	15.31	18.07
Wt. of Water (gm)	0.9	0.87	1.02
Wt. of DS (gm)	5.18	5.2	6.09
Moisture Content (%)	**17.4**	**16.7**	**16.7**

Test Results	
Liquid Limit (%)	**29**
Plastic Limit (%)	**17**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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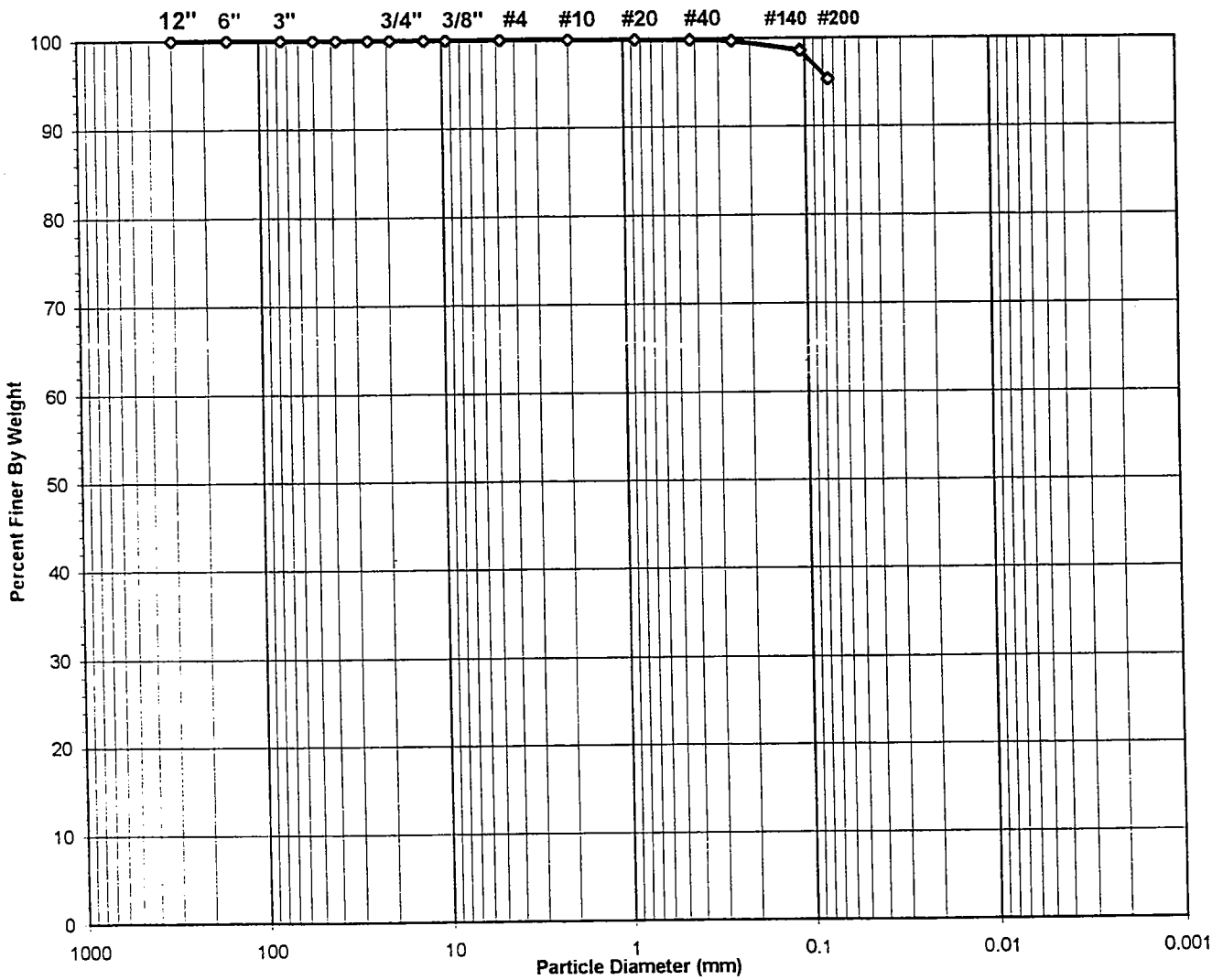
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-0608
Lab ID	98178-01.011	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[H127.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-0608
Lab ID	98178-01.011	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1018	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	536.40	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	458.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	100.51	Weight of Tare (gm)	NA
Weight of Water (gm)	77.50	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	358.39	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**21.6**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	358.39
Dry Weight - 3/4" Sample (gm)	16.8	Weight of minus #200 material (gm)	341.62
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	16.77
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.10	0.03	0.03	99.97	**99.97**
#20	0.850	0.07	0.02	0.05	99.95	**99.95**
#40	0.425	0.28	0.08	0.13	99.87	**99.87**
#60	0.250	0.41	0.11	0.24	99.76	**99.76**
#140	0.106	4.24	1.18	1.42	98.58	**98.58**
#200	0.075	11.67	3.26	4.68	95.32	**95.32**
Pan	-	341.62	95.32	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-0608
Lab ID	98178-01.011	Soil Description	**BROWN LEAN CLAY**

***Note:** The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

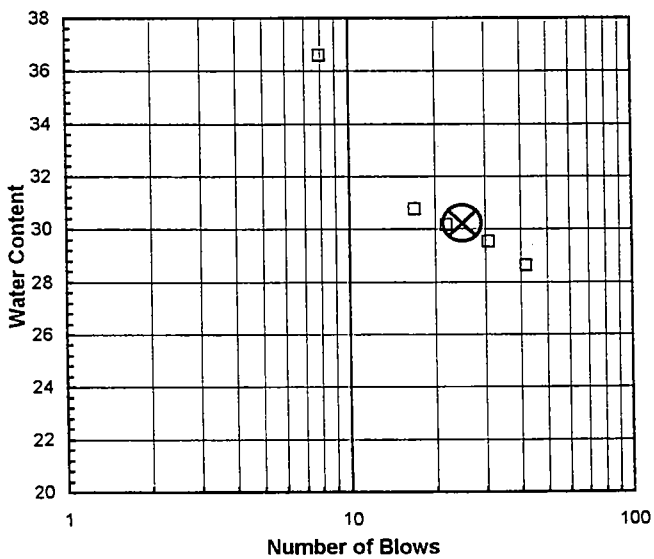
(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2225	2045	2040	2047	1881	MULTIPOINT
Wt. of Tare & WS (gm)	40.71	41.08	36.91	36.46	35.66	
Wt. of Tare & DS (gm)	36.17	36.06	31.93	31.55	30.25	
Wt. of Tare (gm)	20.30	19.04	15.40	15.57	15.46	
Wt. of Water (gm)	4.54	5.02	4.98	4.91	5.41	
Wt. of DS (gm)	15.87	17.02	16.53	15.98	14.79	
Moisture Content (%)	**28.6**	**29.5**	**30.1**	**30.7**	**36.6**	
Number of Blows	**42**	**31**	**22**	**17**	**8**	

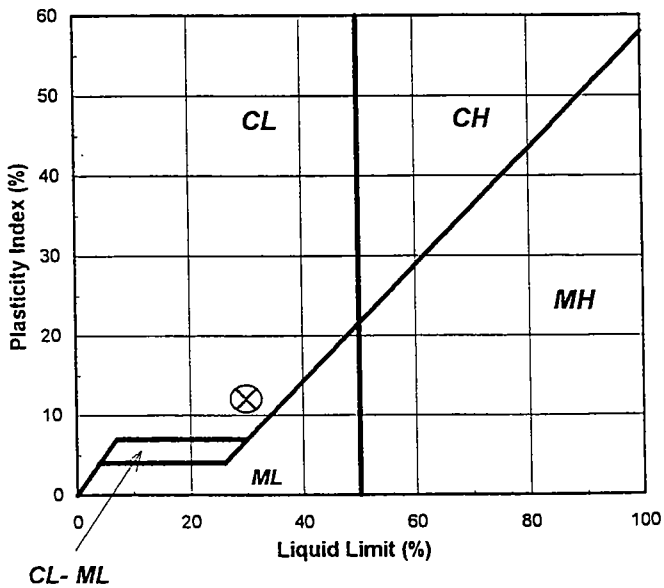
Plastic Limit Test	**1**	**2**	**3**
Tare Number	35	2278	75
Wt. of Tare & WS (gm)	23.66	20.18	22.03
Wt. of Tare & DS (gm)	22.70	19.24	21.09
Wt. of Tare (gm)	17.24	13.92	15.73
Wt. of Water (gm)	0.96	0.94	0.94
Wt. of DS (gm)	5.46	5.32	5.36
Moisture Content (%)	**17.6**	**17.7**	**17.5**

Test Results	
Liquid Limit (%)	**30**
Plastic Limit (%)	**18**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By DBB *Date* 7/21/98 *Checked By* LB *Date* 7-22-98

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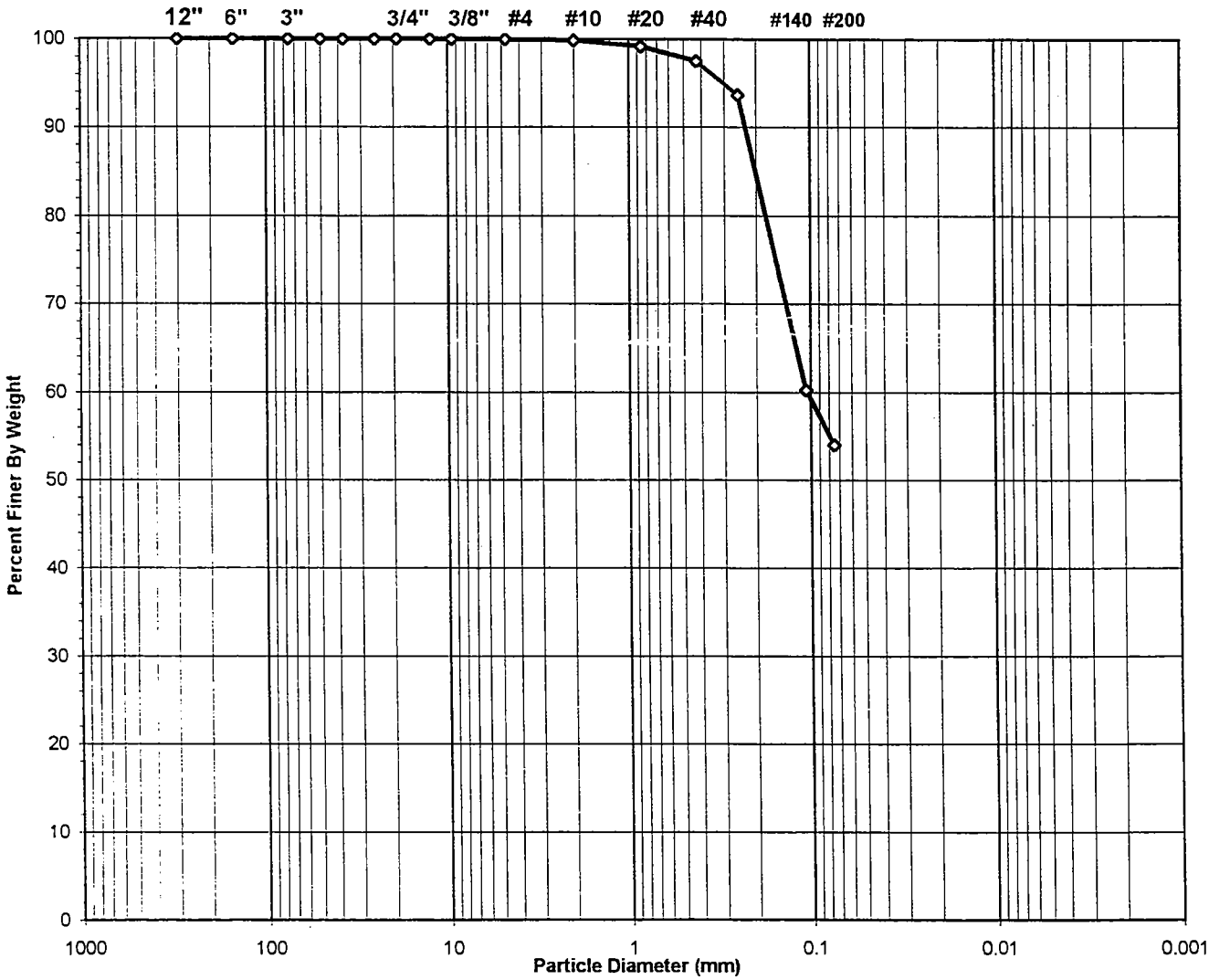
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-1012
Lab ID	98178-01.012	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***SANDY LEAN CLAY***

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[H128.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-1012
Lab ID	98178-01.012	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	864	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	630.30	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	560.60	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	99.04	Weight of Tare (gm)	NA
Weight of Water (gm)	69.70	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	461.56	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**15.1**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	461.56
Dry Weight - 3/4" Sample (gm)	212.3	Weight of minus #200 material (gm)	249.24
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	212.32
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.74	0.16	0.16	99.84	**99.84**
#20	0.850	2.82	0.61	0.77	99.23	**99.23**
#40	0.425	7.72	1.67	2.44	97.56	**97.56**
#60	0.250	17.93	3.88	6.33	93.67	**93.67**
#140	0.106	154.43	33.46	39.79	60.21	**60.21**
#200	0.075	28.68	6.21	46.00	54.00	**54.00**
Pan	-	249.24	54.00	100.00	-	-

Tested By BL Date 7/14/98 Checked By LB Date 7-24-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-WARP
Client Reference	PBOW-WARP	Depth (ft)	NA
Project No.	98178-01	Sample No.	DP24-GEOT-1012
Lab ID	98178-01.012	Soil Description	**BROWN LEAN CLAY**

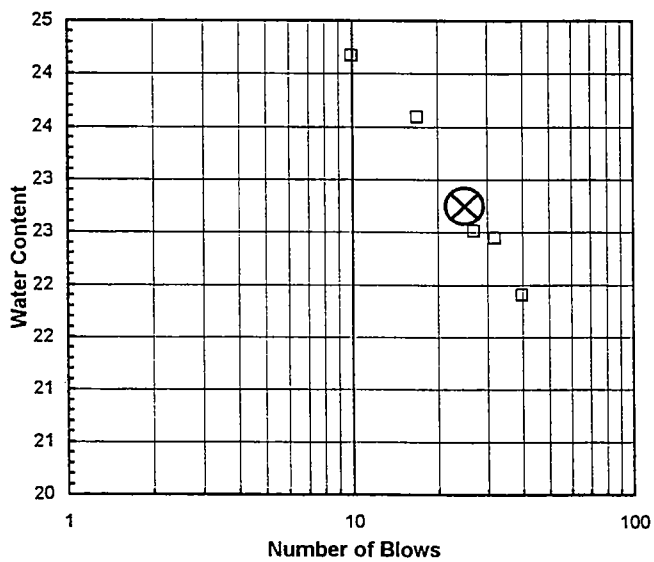
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2023	1797	2042	2315	1898	MULTIPOINT
Wt. of Tare & WS (gm)	37.46	38.30	37.97	39.04	38.99	
Wt. of Tare & DS (gm)	33.82	34.33	34.20	34.95	34.79	
Wt. of Tare (gm)	17.20	16.64	17.45	17.61	17.41	
Wt. of Water (gm)	3.64	3.97	3.77	4.09	4.2	
Wt. of DS (gm)	16.62	17.69	16.75	17.34	17.38	
Moisture Content (%)	**21.9**	**22.4**	**22.5**	**23.6**	**24.2**	
Number of Blows	**40**	**32**	**27**	**17**	**10**	

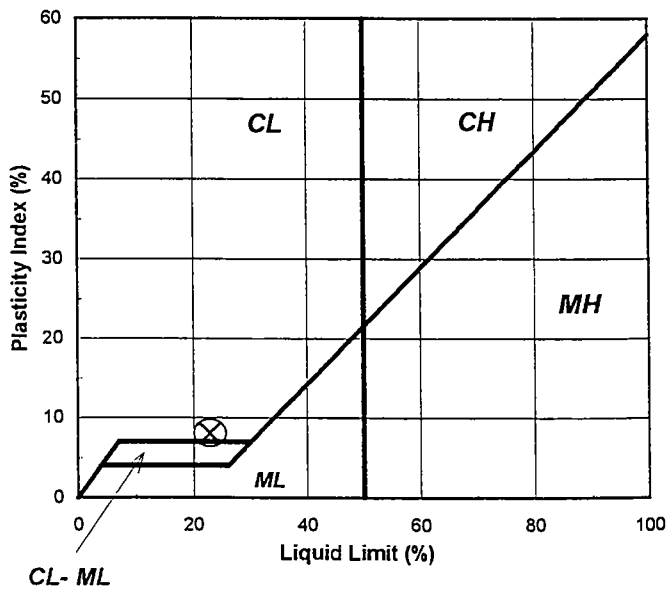
Plastic Limit Test	**1**	**2**	**3**
Tare Number	112	96	82
Wt. of Tare & WS (gm)	23.50	23.04	25.71
Wt. of Tare & DS (gm)	22.63	22.17	24.77
Wt. of Tare (gm)	16.99	16.50	18.62
Wt. of Water (gm)	0.87	0.87	0.94
Wt. of DS (gm)	5.64	5.67	6.15
Moisture Content (%)	**15.4**	**15.3**	**15.3**

Test Results	
Liquid Limit (%)	**23**
Plastic Limit (%)	**15**
Plasticity Index (%)	**8**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By DBB *Date* 7/21/98 *Checked By* LB *Date* 7-22-98

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GEO·ENVIRONMENTAL
DRILLING COMPANY, INC.

July 12, 1998

Mr. Michael Stangberg
IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923-3211

RE: Geotechnical Testing Laboratory Reports
NASA Plumbrook Site
Sandusky, Ohio
GEO Project No. G98-2234
IT Project No. 7737701

Dear Mr. Stangberg:

Enclosed please find the original copy of the geotechnical testing laboratory reports for the first group of samples submitted for testing. The chain-of-custody/request-for-analysis form is attached for these samples. The testing results for the second group of samples will follow shortly.

If you have any questions, please contact me at your earliest convenience at (412) 371-6551.

Thank you.

Sincerely,

Geo-Environmental Drilling Company, Inc.

Deborah Ann Weible, P.G., CWD
President & General Manager

Attaxhments Laboratory Report
Chain-Of-Custody/Request-For-Analysis Form

82234194.LTR

GEO-ENVIRONMENTAL DRILLING COMPANY, INC. *Environmental and Geotechnical Drilling Services*
11101 Frankstown Road
Pittsburgh, PA 15235-3096
tel: 412/ 371-6551
fax: 412/ 371-1027

[redacted]

Chain o Custody Record

Quanter

QUA-4124

Client	Project Manager: Mike Spangberg	Date	Chain Of Custody Number: 30091
Address	Telephone Number (Area Code)/Fax Number: (423) 690-3211	Lab Number	Page 1 of 2
City / State / Zip Code	Site Contact: Mike Spangberg - IT Corp.		
Project Name: PBOW-WARP	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: Moisture Content	Atterberg Limits	Sieve Analysis	USCS Classification
PBOW-98-WARP-DP21-GEOT-0204	6-23-98		Soil		Acetate Liner	1	None		✓	✓	✓	✓
PBOW-98-WARP-DP21-GEOT-0608	↓		↓	↓	↓	↓	↓		✓	✓	✓	✓
PBOW-98-WARP-DP21-GEOT-1012									✓	✓	✓	✓
PBOW-98-WARP-DP22-GEOT-0204	6-25-98								✓	✓	✓	✓
PBOW-98-WARP-DP22-GEOT-0608	↓								✓	✓	✓	✓
PBOW-98-WARP-DP22-GEOT-1012									✓	✓	✓	✓
PBOW-98-WARP-DP23-GEOT-0204	6-13-98								✓	✓	✓	✓
PBOW-98-WARP-DP23-GEOT-0608	↓								✓	✓	✓	✓
PBOW-98-WARP-DP23-GEOT-1012									✓	✓	✓	✓
PBOW-98-WARP-DP24-GEOT-0204	6-24-98								✓	✓	✓	✓
PBOW-98-WARP-DP24-GEOT-0608									✓	✓	✓	✓
PBOW-98-WARP-DP24-GEOT-1012	↓		↓		↓	↓	↓		✓	✓	✓	✓

[redacted]

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months

Project Specific (Specify): Call Proj Mngr. if uncertain

Turn Around Time Required: ☒ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

	Date	Time		Date	Time
1. Relinquished By: John Vogeding / IT Corp.	6-26-98	1700	1. Received By: Scott Beal	6-26-98	1200
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Geotechnics

LABORATORY TEST REPORT

July 8, 1998

Project No. 98167-01

RECEIVED JUL 10

Ms. Deb Weible
Geoenvironmental Drilling Co.
11101 Frankstown Rd.
Pgh., PA 15235

RE: Soils Testing – PBOW-PRRP

Transmitted herein are the results of the soils testing performed for Geoenvironmental Drilling verified on the Project Verification Form, submitted June 26, 1998. The testing was performed in accordance with the ASTM methods listed on the enclosed data sheets. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

Disclaimer

The test results are believed to be representative of the samples submitted but are indicative only of the specimens which were evaluated. Geotechnics has no direct knowledge of the origin of the samples, implies no position with regard to the disposition of the test results, i.e., pass/fail, and makes no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization of the Client and Geotechnics. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please do not hesitate to contact our office.

Respectively submitted,

David R. Backstrom
Laboratory Director

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MOISTURE CONTENT

ASTM D 2216 (SOP-S1)

Client	GEO-ENVIRONMENTAL DRILLING
Client Reference	PBOW-PRRP
Project No.	98167-01

Lab ID	.001	.002	.003	.004	.005
Boring No.	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP
Depth (ft)	NA	NA	NA	NA	NA
Sample No.	DP23-Geot-0204	DP23-Geot-0608	DP23-GeoT-1012	DP22-Geot-0204	DP22-Geot-0608
Tare Number	551	1740	563	1735	1709
Wt. of Tare & WS (gm)	152.17	168.17	171.29	198.94	188.6
Wt. of Tare & DS (gm)	142.78	153.72	153.61	176.27	167.31
Wt. of Tare (gm)	84.51	83.54	82.61	82.17	83.24
Wt. of Water (gm)	9.39	14.45	17.68	22.67	21.29
Wt. of DS (gm)	58.27	70.18	71	94.1	84.07
Water Content (%)	**16.1**	**20.6**	**24.9**	**24.1**	**25.3**

Lab ID	.006	.007	.008	.009	.010
Boring No.	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP
Depth (ft)	NA	NA	NA	NA	NA
Sample No.	DP22-Geot-1012	DP21-Geot-0204	DP21-Geot-0608	DP21-Geot-0810	DP25-Geot-0204
Tare Number	1724	1722	1691	1698	565
Wt. of Tare & WS (gm)	167.17	187.6	183.85	189.52	167.31
Wt. of Tare & DS (gm)	151.07	170.95	166.02	169.54	149.13
Wt. of Tare (gm)	83.03	81.65	83.56	81.37	83.07
Wt. of Water (gm)	16.1	16.65	17.83	19.98	18.18
Wt. of DS (gm)	68.04	89.3	82.46	88.17	66.06
Water Content (%)	**23.7**	**18.6**	**21.6**	**22.7**	**27.5**

Notes : *NA*

Tested By *MV* *Date* *6/30/98* *Checked By* LB *Date* 7-1-98

DCN: CT-S1 DATE 6-30-98 REVISION: 2

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MOISTURE CONTENT

ASTM D 2216 (SOP-S1)

Client	GEO-ENVIRONMENTAL DRILLING
Client Reference	PBOW-PRRP
Project No.	98167-01

Lab ID	.011	.012	.013	.014	.015
Boring No.	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP	PBOW-98-PRRP
Depth (ft)	NA	NA	NA	NA	NA
Sample No.	DP25-Geot-0608	DP25-Geot-1012	DP24-GeoT-0204	DP24-Geot-0608	DP24-Geot-1012
Tare Number	1128	564	577	1718	729
Wt. of Tare & WS (gm)	180.2	185.75	167.88	176.11	187.6
Wt. of Tare & DS (gm)	160.79	164.19	151.3	158.2	167.79
Wt. of Tare (gm)	84.27	82.49	84.58	82.31	86.58
Wt. of Water (gm)	19.41	21.56	16.58	17.91	19.81
Wt. of DS (gm)	76.52	81.7	66.72	75.89	81.21
Water Content (%)	**25.4**	**26.4**	**24.9**	**23.6**	**24.4**

Notes : *NA*

Tested By *MV* *Date* *6/30/98* *Checked By* LB *Date* 7-1-98

DCN: CT-S1 DATE 6-30-98 REVISION: 2

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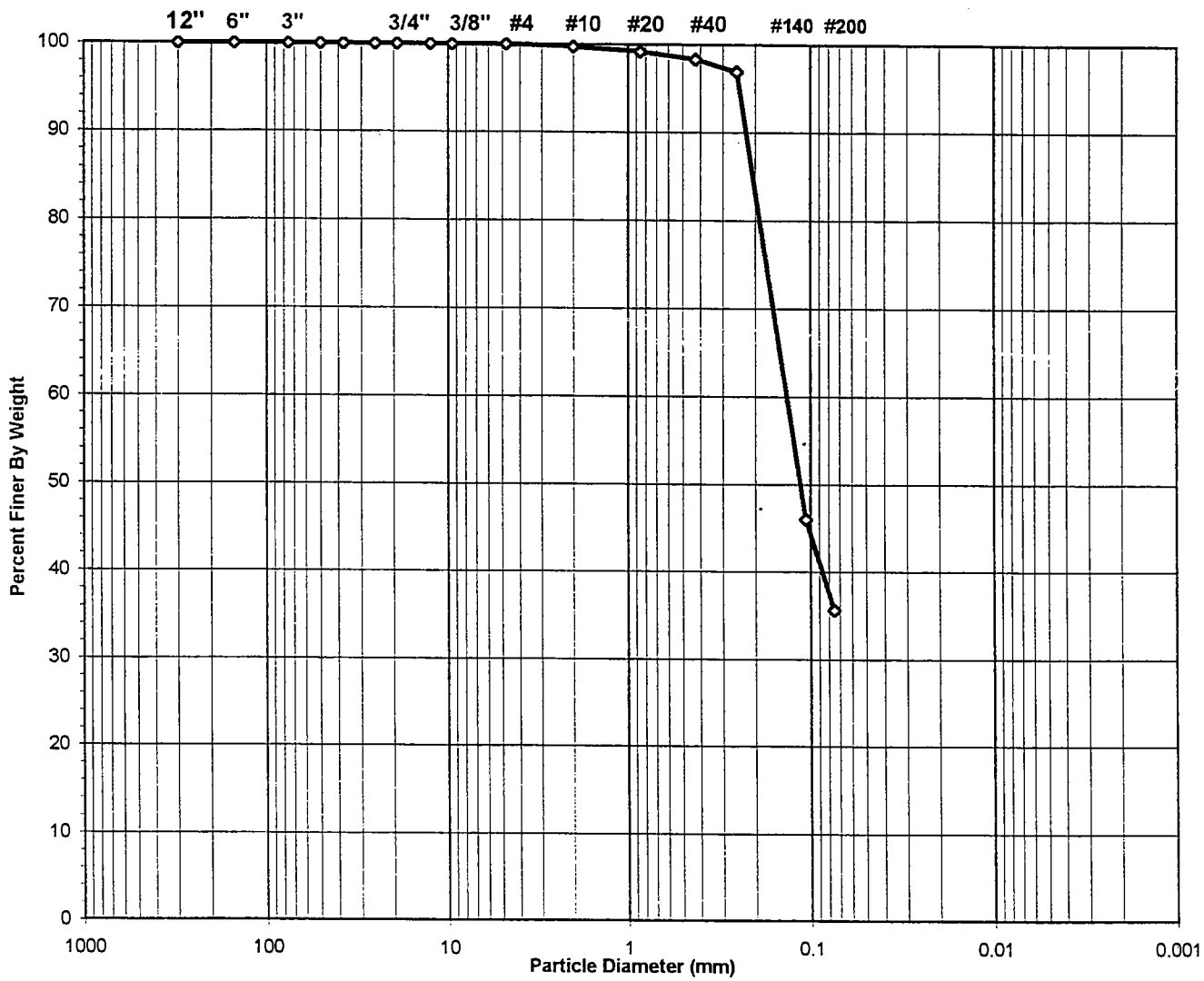
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-0204
Lab ID	98167-01.001	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND (NON-PLASTIC FINES)***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-0204
Lab ID	98167-01.001	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2479	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	517.60	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	461.70	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	101.47	Weight of Tare (gm)	NA
Weight of Water (gm)	55.90	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	360.23	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**15.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	360.23
Dry Weight - 3/4" Sample (gm)	231.9	Weight of minus #200 material (gm)	128.37
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	231.86
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	1.05	0.29	0.29	99.71	**99.71**
#20	0.850	1.80	0.50	0.79	99.21	**99.21**
#40	0.425	3.23	0.90	1.69	98.31	**98.31**
#60	0.250	5.03	1.40	3.08	96.92	**96.92**
#140	0.106	183.35	50.90	53.98	46.02	**46.02**
#200	0.075	37.40	10.38	64.36	35.64	**35.64**
Pan	-	128.37	35.64	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-0204
Lab ID	98167-01.001	Visual Description	**BROWN SILT**
			(MInus No. 40 sieve material, Airdried)

NON - PLASTIC MATERIAL

Tested By BS *Date* 7/6/98 *Checked By* LB *Date* 7-8-98

DCN: CT-S4B DATE: 7-11-97 REVISION : 2

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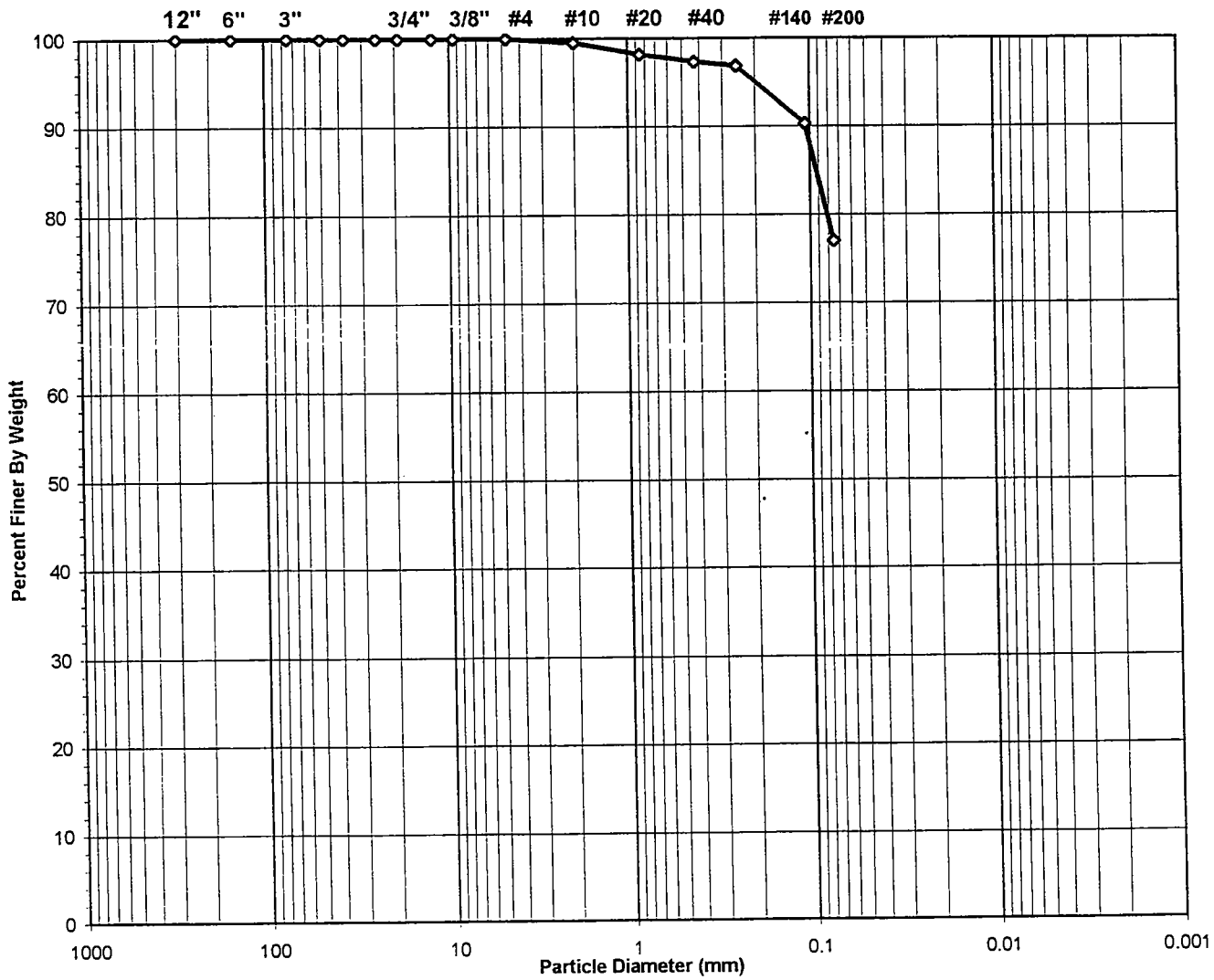
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-0608
Lab ID	98167-01.002	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

Tested By MV Date 6/30/98 Checked By CB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[F130.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-0608
Lab ID	98167-01.002	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2489	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	512.40	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	443.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	99.92	Weight of Tare (gm)	NA
Weight of Water (gm)	68.50	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	343.98	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**19.9**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	343.98
Dry Weight - 3/4" Sample (gm)	79.2	Weight of minus #200 material (gm)	264.79
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	79.19
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	1.51	0.44	0.44	99.56	**99.56**
#20	0.850	4.70	1.37	1.81	98.19	**98.19**
#40	0.425	2.97	0.86	2.67	97.33	**97.33**
#60	0.250	1.56	0.45	3.12	96.88	**96.88**
#140	0.106	22.68	6.59	9.72	90.28	**90.28**
#200	0.075	45.77	13.31	23.02	76.98	**76.98**
Pan	-	264.79	76.98	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-0608
Lab ID	98167-01.002	Soil Description	**BROWN LEAN CLAY**

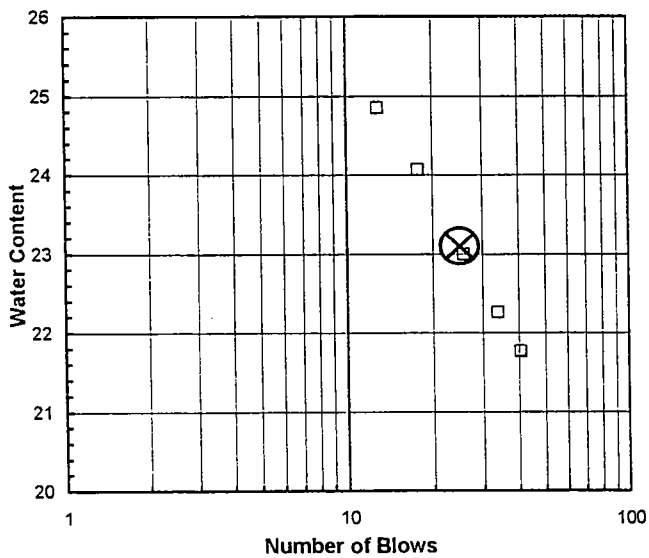
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	1886	2023	2039	2062	2293	M
Wt. of Tare & WS (gm)	41.10	39.01	38.23	42.41	45.43	U
Wt. of Tare & DS (gm)	36.66	35.04	33.77	37.87	40.21	L
Wt. of Tare (gm)	16.25	17.20	14.37	19.00	19.20	T
Wt. of Water (gm)	4.44	3.97	4.46	4.54	5.22	I
Wt. of DS (gm)	20.41	17.84	19.4	18.87	21.01	P
						O
Moisture Content (%)	**21.8**	**22.3**	**23.0**	**24.1**	**24.8**	I
Number of Blows	**41**	**34**	**26**	**18**	**13**	N T

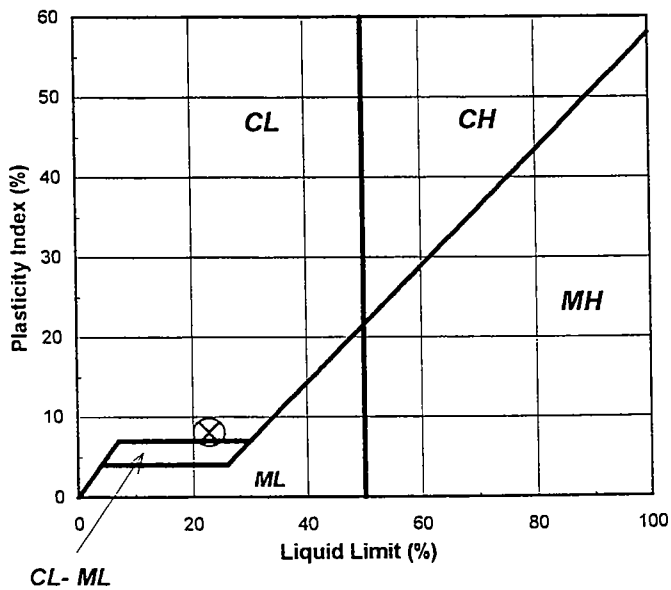
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2302	2316	2320
Wt. of Tare & WS (gm)	26.04	25.62	23.92
Wt. of Tare & DS (gm)	25.23	24.80	23.03
Wt. of Tare (gm)	19.88	19.52	17.21
Wt. of Water (gm)	0.81	0.82	0.89
Wt. of DS (gm)	5.35	5.28	5.82
Moisture Content (%)	**15.1**	**15.5**	**15.3**

Test Results	
Liquid Limit (%)	**23**
Plastic Limit (%)	**15**
Plasticity Index (%)	**8**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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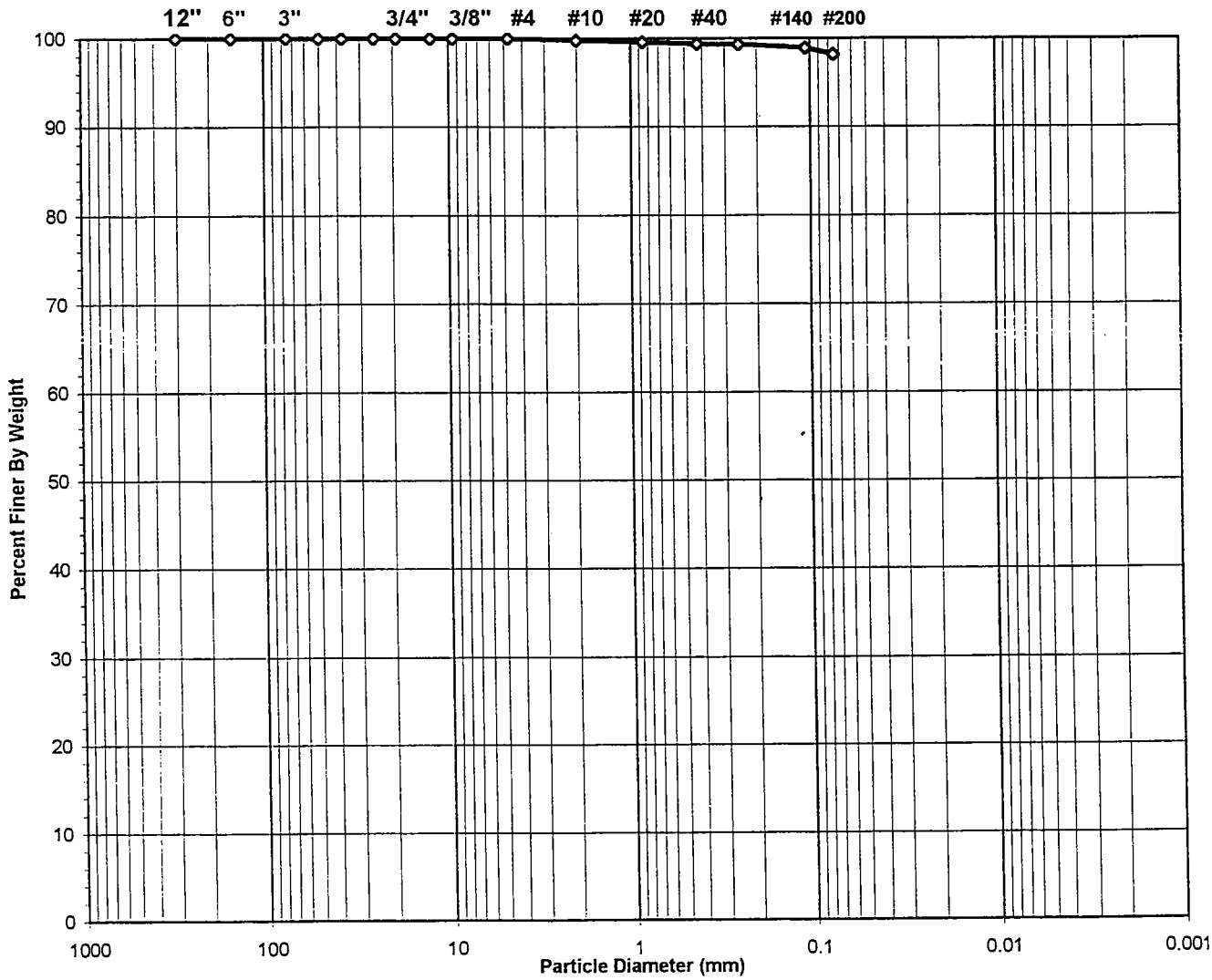
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-1012
Lab ID	98167-01.003	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F131.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-1012
Lab ID	98167-01.003	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	525	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	546.20	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	457.40	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	101.57	Weight of Tare (gm)	NA
Weight of Water (gm)	88.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	355.83	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**25.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	355.83
Dry Weight - 3/4" Sample (gm)	6.5	Weight of minus #200 material (gm)	349.33
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	6.50
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.74	0.21	0.21	99.79	**99.79**
#20	0.850	0.78	0.22	0.43	99.57	**99.57**
#40	0.425	0.51	0.14	0.57	99.43	**99.43**
#60	0.250	0.41	0.12	0.69	99.31	**99.31**
#140	0.106	1.41	0.40	1.08	98.92	**98.92**
#200	0.075	2.65	0.74	1.83	98.17	**98.17**
Pan	-	349.33	98.17	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP23-GEOT-1012
Lab ID	98167-01.003	Soil Description	**BROWN LEAN CLAY**

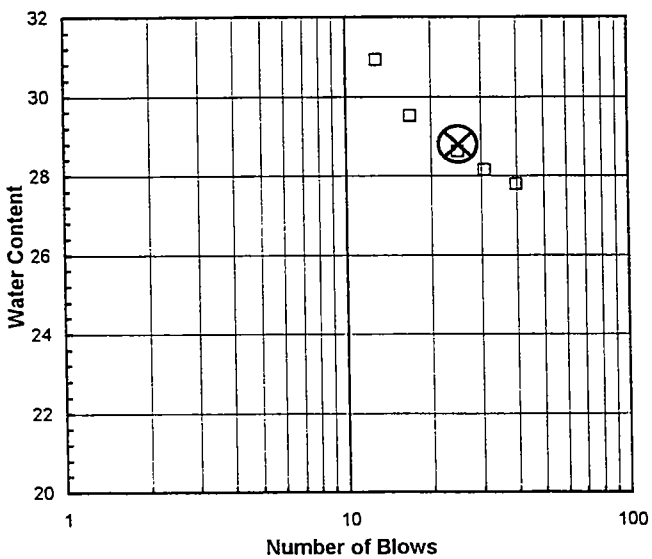
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2025	2032	2053	2063	2226	M
Wt. of Tare & WS (gm)	35.55	35.38	39.50	34.56	37.58	U
Wt. of Tare & DS (gm)	31.05	30.94	34.76	29.73	32.81	L
Wt. of Tare (gm)	14.85	15.16	18.19	13.35	17.38	T
Wt. of Water (gm)	4.5	4.44	4.74	4.83	4.77	I
Wt. of DS (gm)	16.2	15.78	16.57	16.38	15.43	P
						O
Moisture Content (%)	**27.8**	**28.1**	**28.6**	**29.5**	**30.9**	I
Number of Blows	**40**	**31**	**25**	**17**	**13**	N T

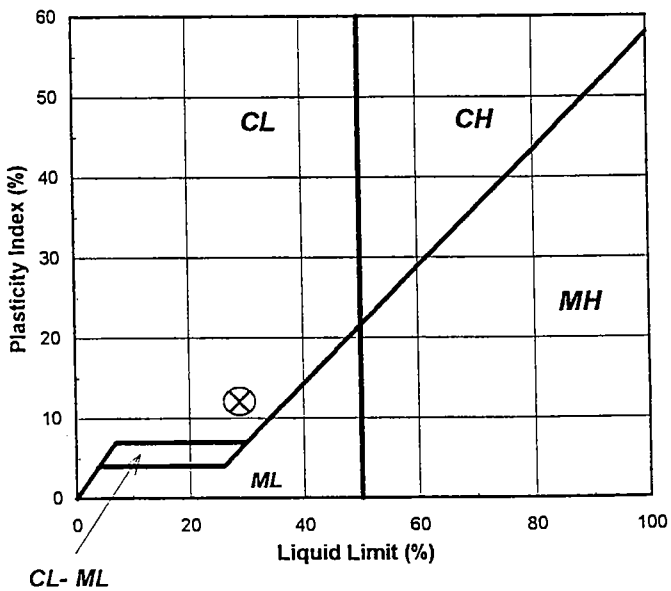
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2230	2233	2247
Wt. of Tare & WS (gm)	24.58	23.78	23.71
Wt. of Tare & DS (gm)	23.67	22.91	22.80
Wt. of Tare (gm)	18.13	17.69	17.34
Wt. of Water (gm)	0.91	0.87	0.91
Wt. of DS (gm)	5.54	5.22	5.46
Moisture Content (%)	**16.4**	**16.7**	**16.7**

Test Results	
Liquid Limit (%)	**29**
Plastic Limit (%)	**17**
Plasticity Index (%)	**12**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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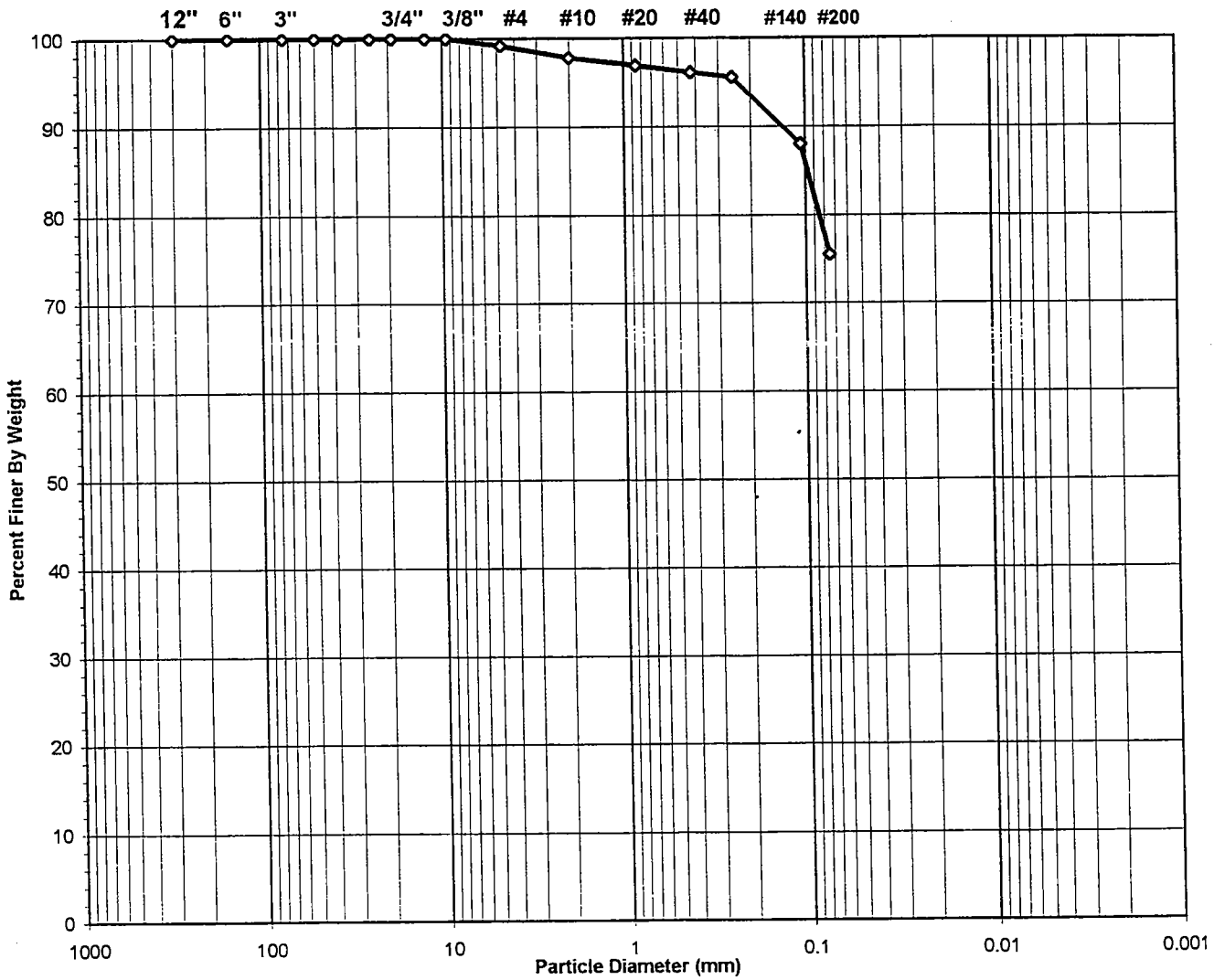
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-0204
Lab ID	98167-01.004	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL-ML, TESTED***

USCS Classification ***SILTY CLAY WITH SAND***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[F132.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-0204
Lab ID	98167-01.004	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1642	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	446.80	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	379.08	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	101.26	Weight of Tare (gm)	NA
Weight of Water (gm)	67.72	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	277.82	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**24.4**	**Moisture Content (%)**	NA

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	277.82
Dry Weight - 3/4" Sample (gm)	68.0	Weight of minus #200 material (gm)	209.79
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	68.03
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	2.29	0.82	0.82	99.18	**99.18**
#10	2.00	3.86	1.39	2.21	97.79	**97.79**
#20	0.850	2.39	0.86	3.07	96.93	**96.93**
#40	0.425	2.09	0.75	3.83	96.17	**96.17**
#60	0.250	1.56	0.56	4.39	95.61	**95.61**
#140	0.106	21.10	7.59	11.98	88.02	**88.02**
#200	0.075	34.74	12.50	24.49	75.51	**75.51**
Pan	-	209.79	75.51	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-0204
Lab ID	98167-01.004	Soil Description	**BROWN SILTY CLAY**

***Note:** The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

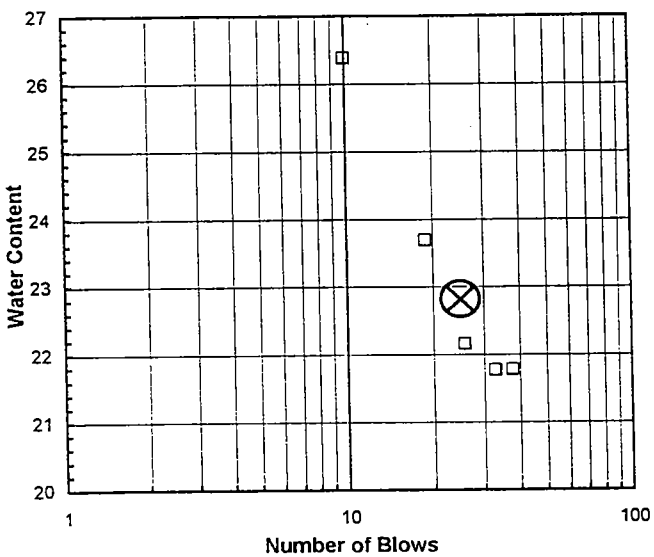
(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	1797	1877	1882	1888	2034	
Wt. of Tare & WS (gm)	42.97	39.85	45.87	39.36	41.93	
Wt. of Tare & DS (gm)	38.26	35.49	41.04	35.25	37.37	
Wt. of Tare (gm)	16.63	15.46	19.24	17.90	20.08	
Wt. of Water (gm)	4.71	4.36	4.83	4.11	4.56	
Wt. of DS (gm)	21.63	20.03	21.8	17.35	17.29	
Moisture Content (%)	**21.8**	**21.8**	**22.2**	**23.7**	**26.4**	
Number of Blows	**38**	**33**	**26**	**19**	**10**	

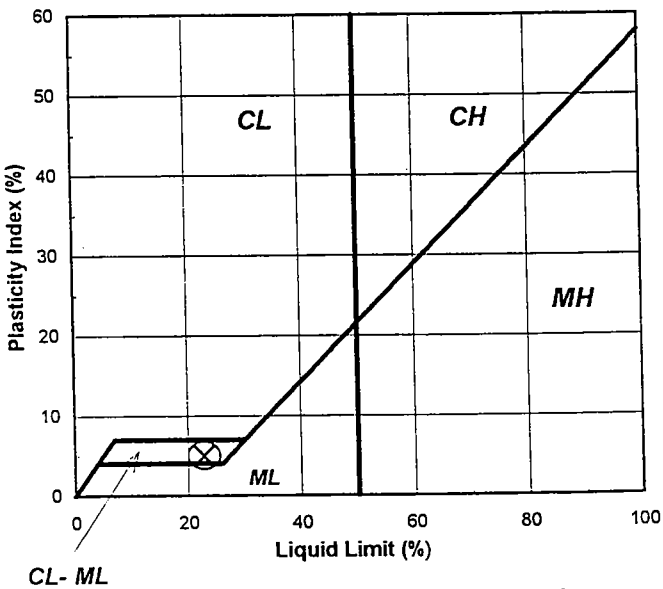
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2036	2045	2052
Wt. of Tare & WS (gm)	23.33	25.01	22.45
Wt. of Tare & DS (gm)	22.39	24.11	21.50
Wt. of Tare (gm)	17.06	19.01	16.26
Wt. of Water (gm)	0.94	0.9	0.95
Wt. of DS (gm)	5.33	5.1	5.24
Moisture Content (%)	**17.6**	**17.6**	**18.1**

Test Results	
Liquid Limit (%)	**23**
Plastic Limit (%)	**18**
Plasticity Index (%)	**5**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



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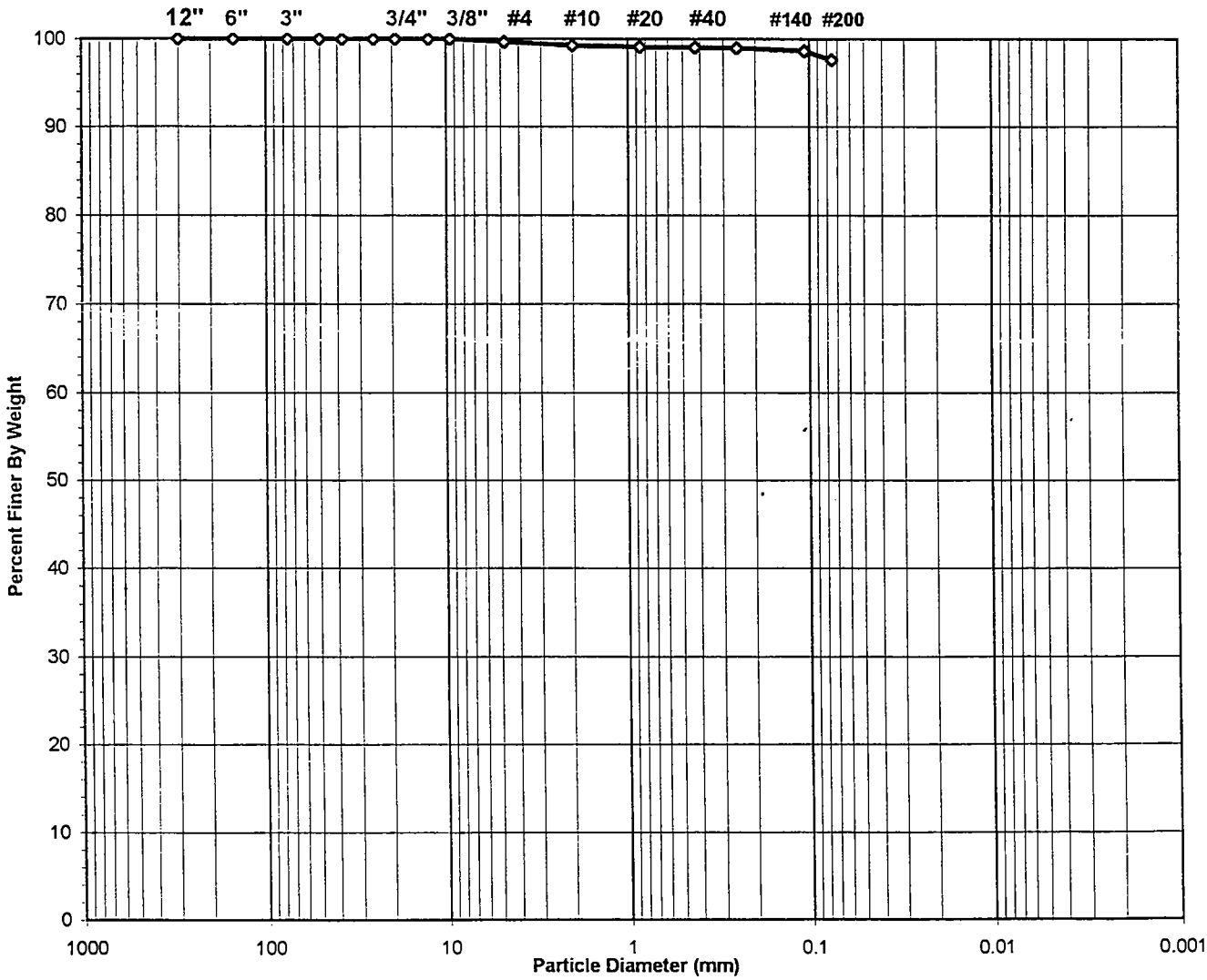
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-0608
Lab ID	98167-01.005	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F133.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-0608
Lab ID	98167-01.005	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2461	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	546.90	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	459.50	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	101.12	Weight of Tare (gm)	NA
Weight of Water (gm)	87.40	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	358.38	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**24.4**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	358.38
Dry Weight - 3/4" Sample (gm)	8.4	Weight of minus #200 material (gm)	349.99
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	8.39
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	1.08	0.30	0.30	99.70	**99.70**
#10	2.00	1.63	0.45	0.76	99.24	**99.24**
#20	0.850	0.43	0.12	0.88	99.12	**99.12**
#40	0.425	0.19	0.05	0.93	99.07	**99.07**
#60	0.250	0.16	0.04	0.97	99.03	**99.03**
#140	0.106	1.22	0.34	1.31	98.69	**98.69**
#200	0.075	3.68	1.03	2.34	97.66	**97.66**
Pan	-	349.99	97.66	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-0608
Lab ID	98167-01.005	Soil Description	**BROWN LEAN CLAY**

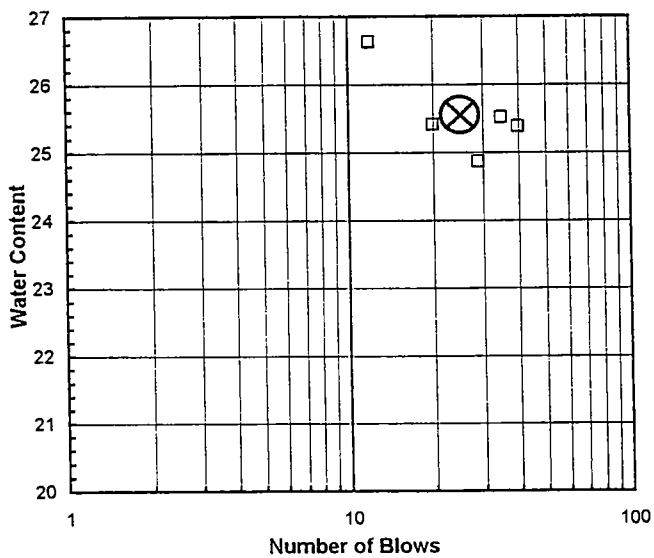
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2047	2052	2035	2042	2037	M
Wt. of Tare & WS (gm)	37.39	36.44	34.48	28.56	28.88	U
Wt. of Tare & DS (gm)	32.80	32.35	30.30	26.30	26.51	L
Wt. of Tare (gm)	15.56	16.25	13.48	17.44	17.17	T
Wt. of Water (gm)	4.59	4.09	4.18	2.26	2.37	I
Wt. of DS (gm)	17.24	16.1	16.82	8.86	9.34	P
						O
Moisture Content (%)	**26.6**	**25.4**	**24.9**	**25.5**	**25.4**	I
Number of Blows	**12**	**20**	**29**	**35**	**40**	N
						T

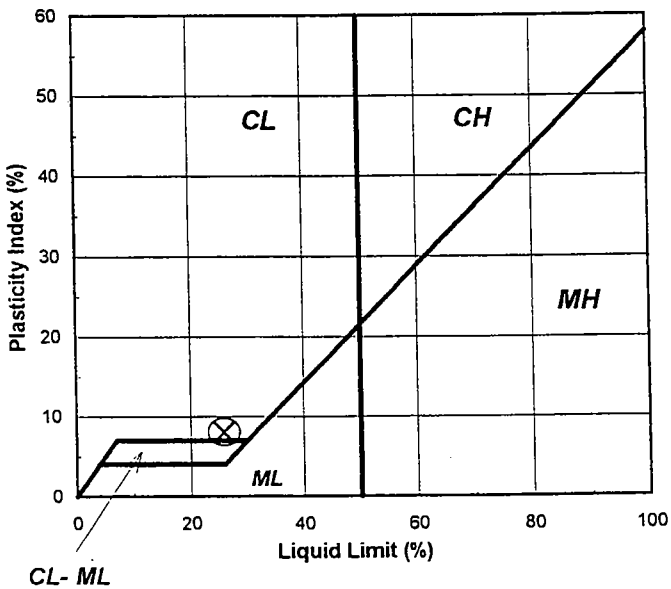
Plastic Limit Test	**1**	**2**	**3**
Tare Number	1881	2036	2055
Wt. of Tare & WS (gm)	21.38	23.48	24.83
Wt. of Tare & DS (gm)	20.92	22.50	23.89
Wt. of Tare (gm)	15.45	17.06	18.73
Wt. of Water (gm)	0.96	0.98	0.94
Wt. of DS (gm)	5.47	5.44	5.16
Moisture Content (%)	**17.6**	**18.0**	**18.2**

Test Results	
Liquid Limit (%)	**26**
Plastic Limit (%)	**18**
Plasticity Index (%)	**8**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By *RO* *Date* *7/7/98* *Checked By* LB *Date* 7-8-98

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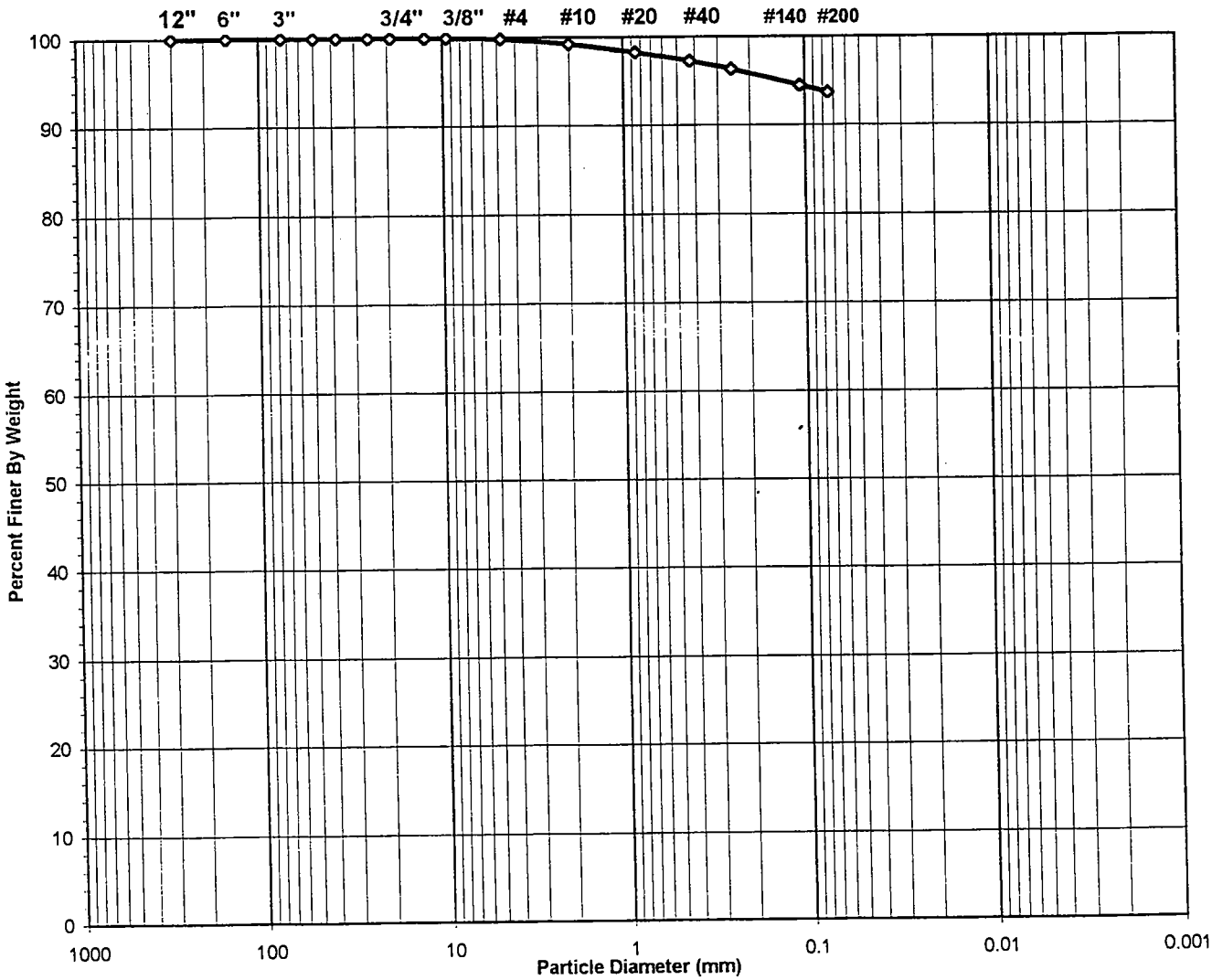
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-1012
Lab ID	98167-01.006	Soil Color	**GRAY**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F134.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-1012
Lab ID	98167-01.006	Soil Color	**GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2443	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	578.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	482.20	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	100.01	Weight of Tare (gm)	NA
Weight of Water (gm)	95.80	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	382.19	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**25.1**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	382.19
Dry Weight - 3/4" Sample (gm)	24.1	Weight of minus #200 material (gm)	358.08
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	24.11
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.45	0.12	0.12	99.88	**99.88**
#10	2.00	2.32	0.61	0.72	99.28	**99.28**
#20	0.850	3.85	1.01	1.73	98.27	**98.27**
#40	0.425	3.87	1.01	2.74	97.26	**97.26**
#60	0.250	3.59	0.94	3.68	96.32	**96.32**
#140	0.106	7.13	1.87	5.55	94.45	**94.45**
#200	0.075	2.90	0.76	6.31	93.69	**93.69**
Pan	-	358.08	93.69	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP22-GEOT-1012
Lab ID	98167-01.006	Soil Description	**GRAY LEAN CLAY**

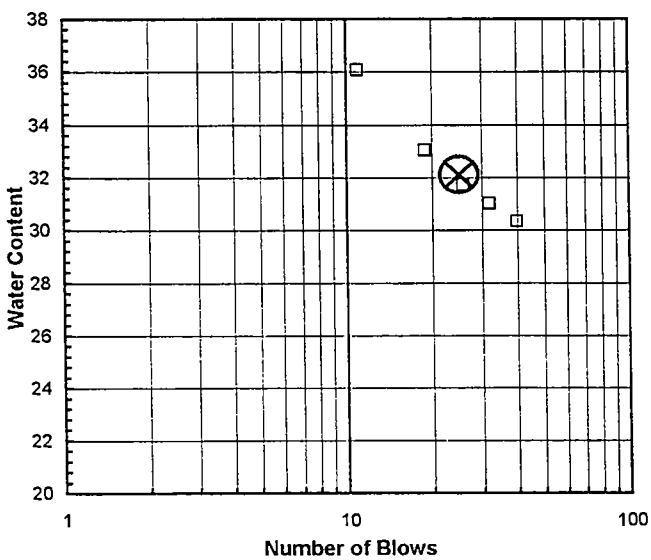
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	1792	2026	2031	2040	2232	MULTIPOINT
Wt. of Tare & WS (gm)	36.04	41.29	38.25	35.58	38.48	
Wt. of Tare & DS (gm)	31.16	36.38	33.28	30.57	32.90	
Wt. of Tare (gm)	15.07	20.54	17.60	15.40	17.42	
Wt. of Water (gm)	4.88	4.91	4.97	5.01	5.58	
Wt. of DS (gm)	16.09	15.84	15.68	15.17	15.48	
Moisture Content (%)	**30.3**	**31.0**	**31.7**	**33.0**	**36.0**	
Number of Blows	**40**	**32**	**26**	**19**	**11**	

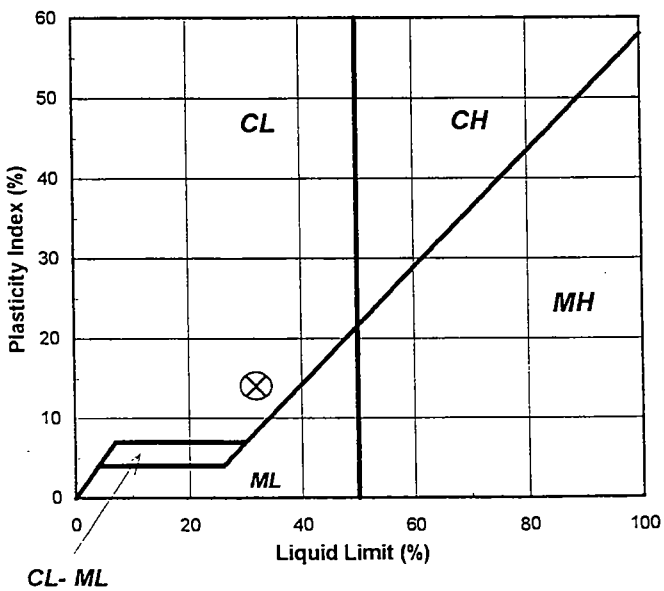
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2250	2296	2299
Wt. of Tare & WS (gm)	21.09	25.17	22.91
Wt. of Tare & DS (gm)	20.29	24.22	21.94
Wt. of Tare (gm)	16.07	19.06	16.52
Wt. of Water (gm)	0.8	0.95	0.97
Wt. of DS (gm)	4.22	5.16	5.42
Moisture Content (%)	**19.0**	**18.4**	**17.9**

Test Results	
Liquid Limit (%)	**32**
Plastic Limit (%)	**18**
Plasticity Index (%)	**14**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By BS *Date* 7/6/98 *Checked By* LB *Date* 7-8-98

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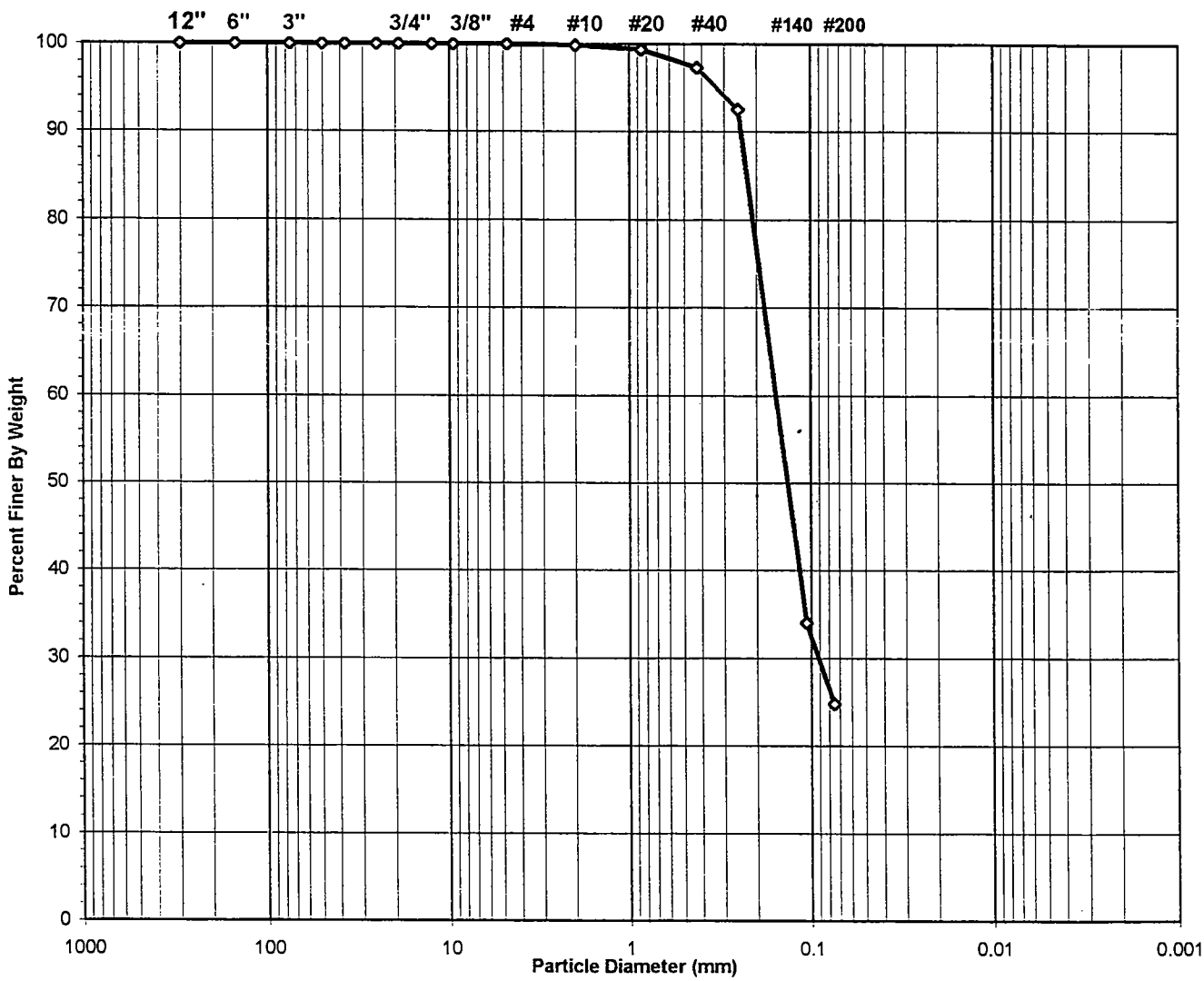
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0204
Lab ID	98167-01.007	Soil Color	**BROWN**

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



USCS Symbol ***SM, TESTED***

USCS Classification ***SILTY SAND (NON-PLASTIC FINES)***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0204
Lab ID	98167-01.007	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1646	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	499.80	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	439.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	98.66	Weight of Tare (gm)	NA
Weight of Water (gm)	59.90	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	341.24	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**17.6**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	341.24
Dry Weight - 3/4" Sample (gm)	256.6	Weight of minus #200 material (gm)	84.61
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	256.63
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.42	0.12	0.12	99.88	**99.88**
#20	0.850	1.69	0.50	0.62	99.38	**99.38**
#40	0.425	7.03	2.06	2.68	97.32	**97.32**
#60	0.250	16.30	4.78	7.46	92.54	**92.54**
#140	0.106	199.62	58.50	65.95	34.05	**34.05**
#200	0.075	31.57	9.25	75.21	24.79	**24.79**
Pan	-	84.61	24.79	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0204
Lab ID	98167-01.007	Visual Description	**BROWN SILT**
			(Minus No. 40 sieve material, Airdried)

NON - PLASTIC MATERIAL

Tested By TO *Date* 7/7/98 *Checked By* LB *Date* 7-8-98

page 1 of 1 DCN: CT-S4B DATE: 7-11-97 REVISION : 2 *C:\MSOFFICE\EXCEL\PrintQ\[G5.xls]Sheet1*

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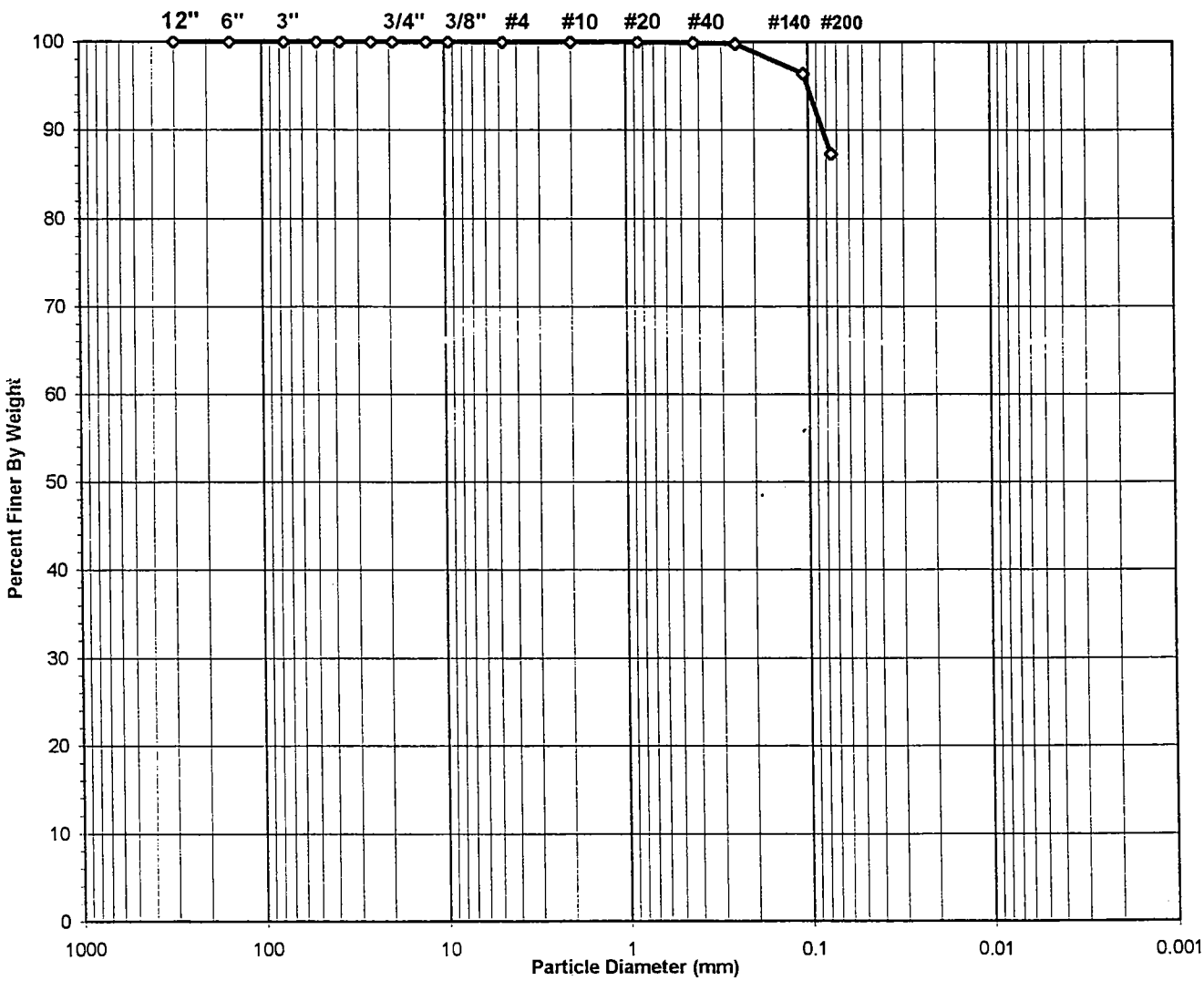
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0608
Lab ID	98167-01.008	Soil Color	**GRAYISH BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL-ML, TESTED***

USCS Classification ***SILTY CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[F136.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0608
Lab ID	98167-01.008	Soil Color	**GRAYISH BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	502	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	512.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	441.40	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	104.77	Weight of Tare (gm)	NA
Weight of Water (gm)	70.60	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	336.63	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**21.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	336.63
Dry Weight - 3/4" Sample (gm)	42.8	Weight of minus #200 material (gm)	293.87
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	42.76
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.00	0.00	0.00	100.00	**100.00**
#20	0.850	0.07	0.02	0.02	99.98	**99.98**
#40	0.425	0.14	0.04	0.06	99.94	**99.94**
#60	0.250	0.36	0.11	0.17	99.83	**99.83**
#140	0.106	11.51	3.42	3.59	96.41	**96.41**
#200	0.075	30.68	9.11	12.70	87.30	**87.30**
Pan	-	293.87	87.30	100.00	-	-

Tested By MV Date 6/30/98 Checked By UB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0608
Lab ID	98167-01.008	Soil Description	**GRAYISH BROWN SILTY CLAY**

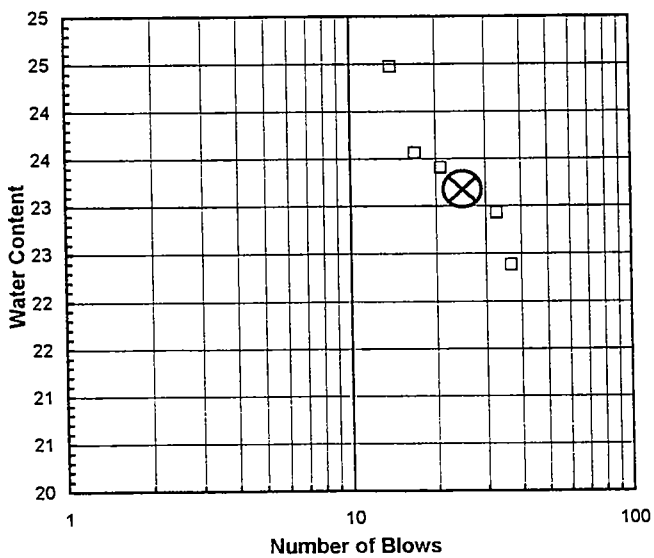
***Note:** The* USCS *symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.* (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	40	26	48	93	91	MULTIPOINT
Wt. of Tare & WS (gm)	39.09	41.38	42.81	38.66	41.47	
Wt. of Tare & DS (gm)	35.13	36.72	37.98	34.66	36.45	
Wt. of Tare (gm)	17.43	16.39	17.34	17.68	15.93	
Wt. of Water (gm)	3.96	4.66	4.83	4	5.02	
Wt. of DS (gm)	17.7	20.33	20.64	16.98	20.52	
Moisture Content (%)	**22.4**	**22.9**	**23.4**	**23.6**	**24.5**	
Number of Blows	**37**	**33**	**21**	**17**	**14**	

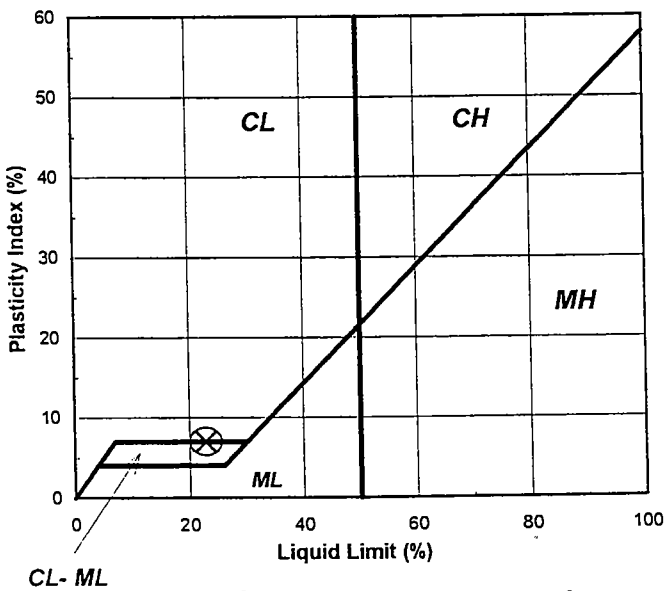
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2316	2317	2252
Wt. of Tare & WS (gm)	25.88	22.55	24.17
Wt. of Tare & DS (gm)	25.03	21.61	23.30
Wt. of Tare (gm)	19.52	15.54	17.72
Wt. of Water (gm)	0.85	0.94	0.87
Wt. of DS (gm)	5.51	6.07	5.58
Moisture Content (%)	**15.4**	**15.5**	**15.6**

Test Results	
Liquid Limit (%)	**23**
Plastic Limit (%)	**16**
Plasticity Index (%)	**7**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



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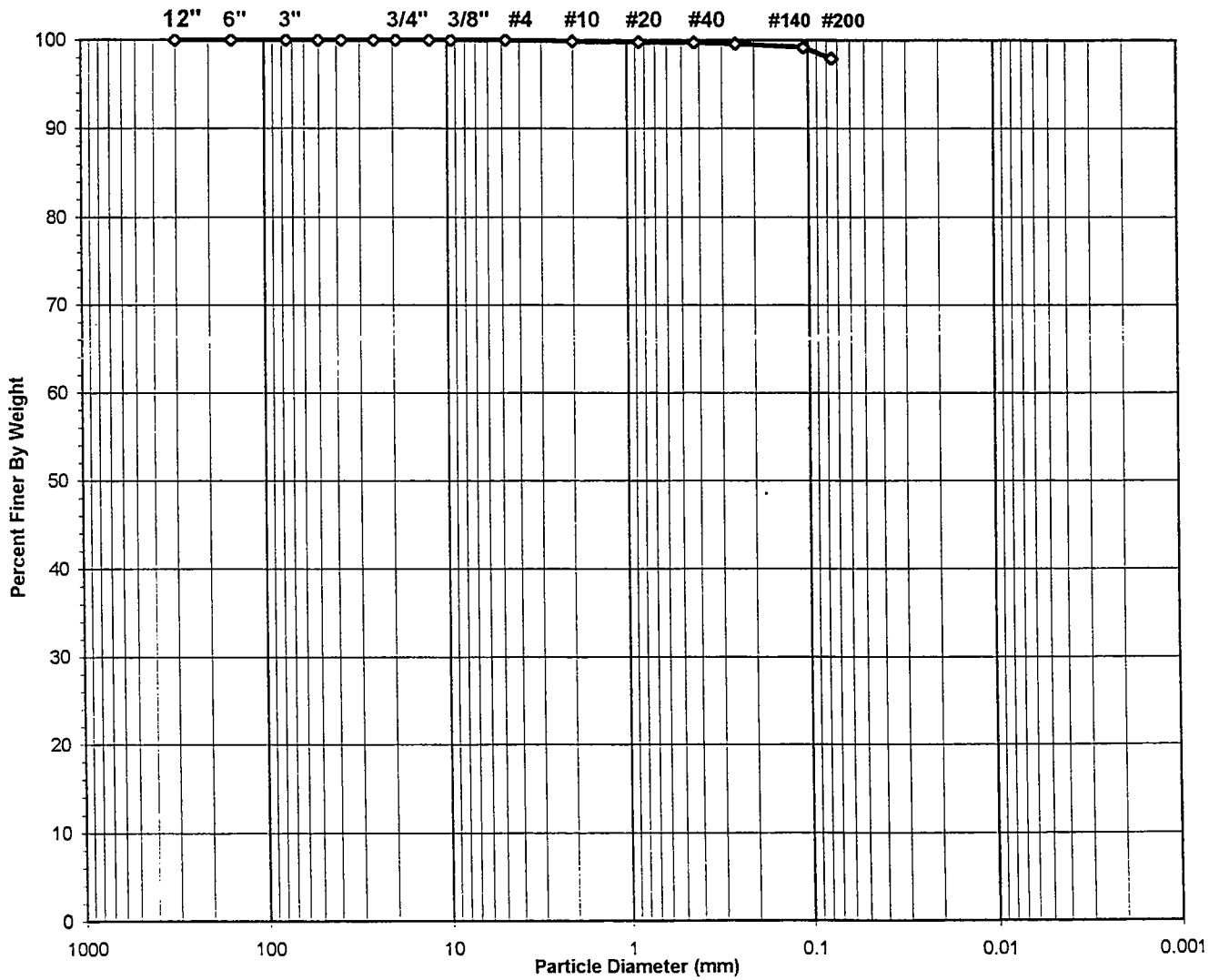
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0810
Lab ID	98167-01.009	Soil Color	**GRAY**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F137.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0810
Lab ID	98167-01.009	Soil Color	**GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1658	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	574.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	485.30	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	92.06	Weight of Tare (gm)	NA
Weight of Water (gm)	89.40	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	393.24	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**22.7**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	393.24
Dry Weight - 3/4" Sample (gm)	8.0	Weight of minus #200 material (gm)	385.22
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	8.02
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.46	0.12	0.12	99.88	**99.88**
#20	0.850	0.41	0.10	0.22	99.78	**99.78**
#40	0.425	0.28	0.07	0.29	99.71	**99.71**
#60	0.250	0.34	0.09	0.38	99.62	**99.62**
#140	0.106	1.77	0.45	0.83	99.17	**99.17**
#200	0.075	4.76	1.21	2.04	97.96	**97.96**
Pan	-	385.22	97.96	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP21-GEOT-0810
Lab ID	98167-01.009	Soil Description	**GRAY LEAN CLAY**

***Note:** The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.*

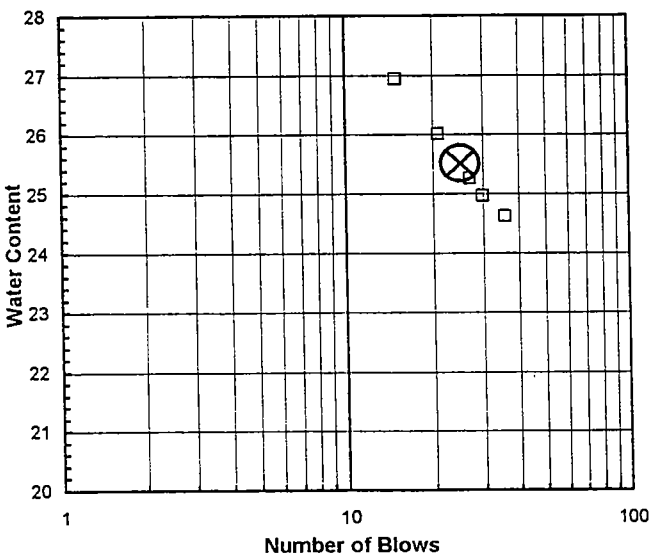
(Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	71	436	103	110	88	MULTIPOINT
Wt. of Tare & WS (gm)	39.17	38.45	38.84	40.65	40.03	
Wt. of Tare & DS (gm)	35.03	34.12	34.25	35.91	34.48	
Wt. of Tare (gm)	18.21	16.77	16.07	17.68	13.87	
Wt. of Water (gm)	4.14	4.33	4.59	4.74	5.55	
Wt. of DS (gm)	16.82	17.35	18.18	18.23	20.61	
Moisture Content (%)	**24.6**	**25.0**	**25.2**	**26.0**	**26.9**	
Number of Blows	**36**	**30**	**27**	**21**	**15**	

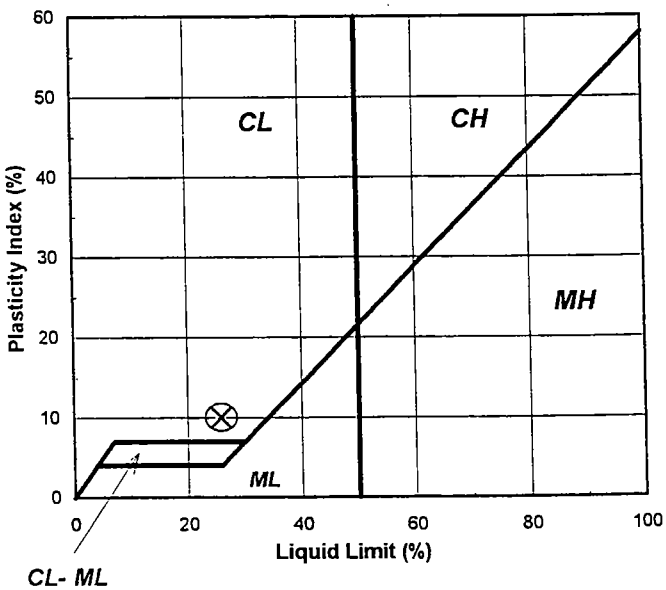
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2319	2299	2291
Wt. of Tare & WS (gm)	24.21	22.83	23.66
Wt. of Tare & DS (gm)	23.36	21.94	22.81
Wt. of Tare (gm)	18.07	16.53	17.46
Wt. of Water (gm)	0.85	0.89	0.85
Wt. of DS (gm)	5.29	5.41	5.35
Moisture Content (%)	**16.1**	**16.5**	**15.9**

Test Results	
Liquid Limit (%)	**26**
Plastic Limit (%)	**16**
Plasticity Index (%)	**10**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



Tested By TO *Date* 7/7/98 *Checked By* LB *Date* 7-8-98

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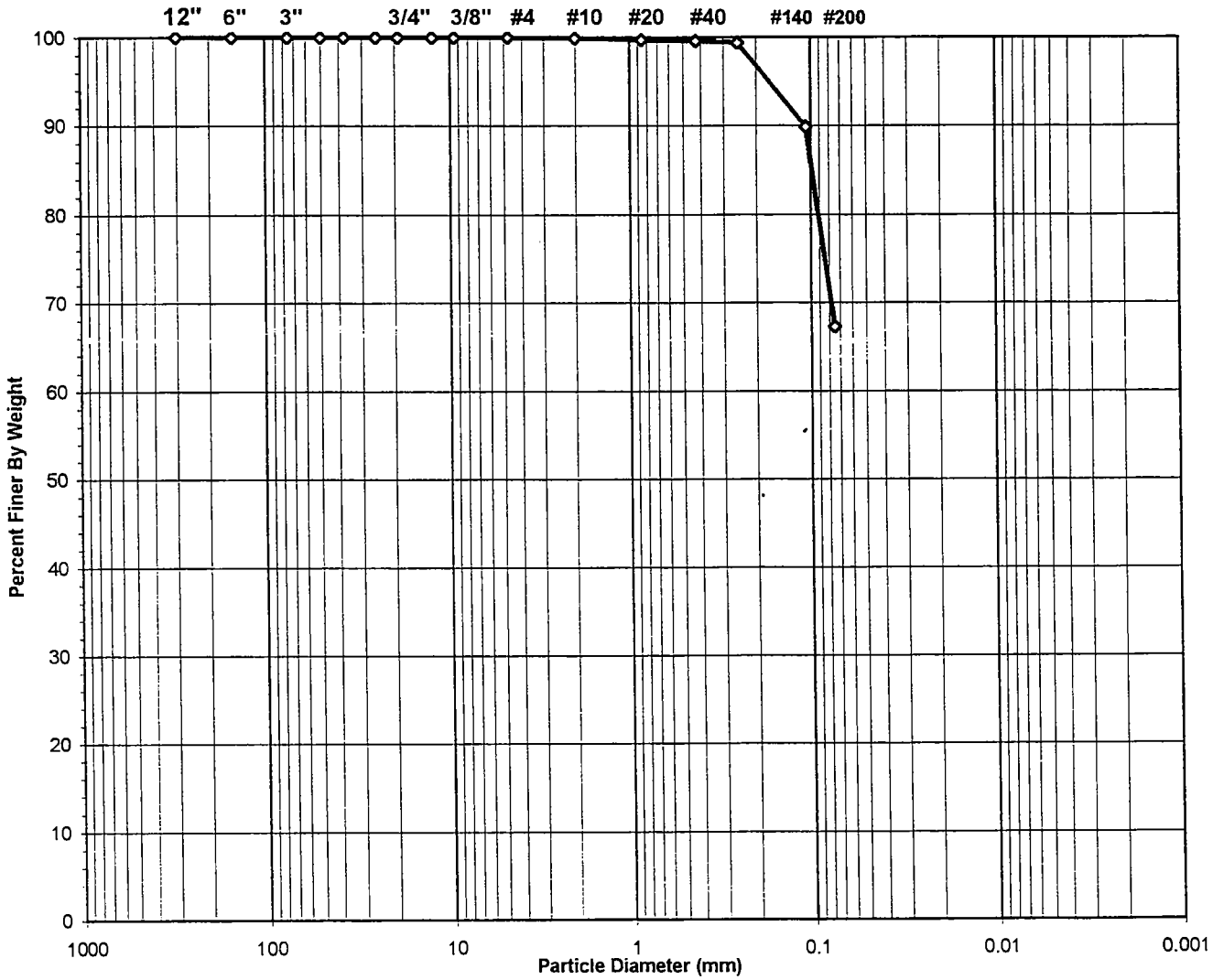
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-0204
Lab ID	98167-01.010	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***ML, TESTED***

USCS Classification ***SANDY SILT (NON-PLASTIC FINES)***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-0204
Lab ID	98167-01.010	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2447	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	545.30	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	455.30	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	100.21	Weight of Tare (gm)	NA
Weight of Water (gm)	90.00	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	355.09	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**25.3**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	355.09
Dry Weight - 3/4" Sample (gm)	116.2	Weight of minus #200 material (gm)	238.88
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	116.21
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.20	0.06	0.06	99.94	**99.94**
#20	0.850	0.66	0.19	0.24	99.76	**99.76**
#40	0.425	0.57	0.16	0.40	99.60	**99.60**
#60	0.250	0.58	0.16	0.57	99.43	**99.43**
#140	0.106	33.96	9.56	10.13	89.87	**89.87**
#200	0.075	80.24	22.60	32.73	67.27	**67.27**
Pan	-	238.88	67.27	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-0204
Lab ID	98167-01.010	Visual Description	**BROWN SILT**
			(MInus No. 40 sieve material, Airdried)

NON - PLASTIC MATERIAL

Tested By BS *Date* 7/6/98 *Checked By* LB *Date* 7-8-98

DCN: CT-S4B DATE: 7-11-97 REVISION : 2

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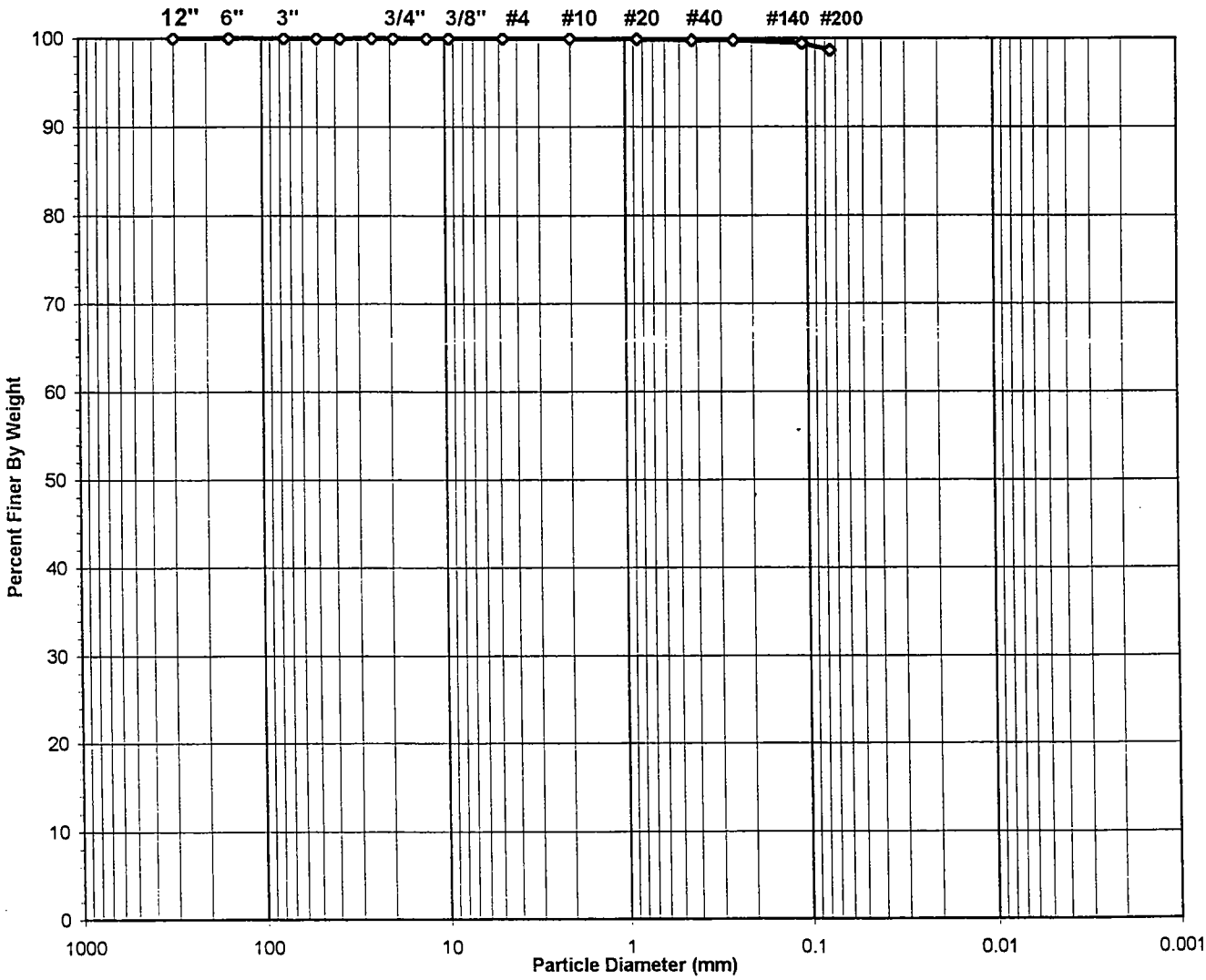
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-0608
Lab ID	98167-01.011	Soil Color	**GRAY**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	**gravel**	**sand**	**silt and clay**



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\F139.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-0608
Lab ID	98167-01.011	Soil Color	**GRAY**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2460	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	569.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	477.20	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	101.15	Weight of Tare (gm)	NA
Weight of Water (gm)	92.50	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	376.05	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**24.6**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	376.05
Dry Weight - 3/4" Sample (gm)	5.1	Weight of minus #200 material (gm)	370.96
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	5.09
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.11	0.03	0.03	99.97	**99.97**
#20	0.850	0.25	0.07	0.10	99.90	**99.90**
#40	0.425	0.28	0.07	0.17	99.83	**99.83**
#60	0.250	0.20	0.05	0.22	99.78	**99.78**
#140	0.106	1.16	0.31	0.53	99.47	**99.47**
#200	0.075	3.09	0.82	1.35	98.65	**98.65**
Pan	-	370.96	98.65	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-0608
Lab ID	98167-01.011	Soil Description	**GRAY LEAN CLAY**

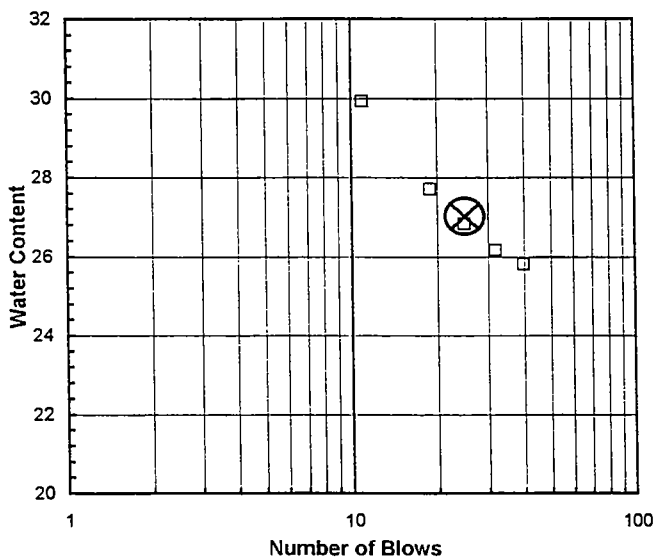
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	2225	2228	2235	2236	2238	MULTIPOINT
Wt. of Tare & WS (gm)	40.48	37.91	38.58	34.82	42.14	
Wt. of Tare & DS (gm)	36.34	33.59	34.04	30.44	36.59	
Wt. of Tare (gm)	20.29	17.07	17.11	14.62	18.03	
Wt. of Water (gm)	4.14	4.32	4.54	4.38	5.55	
Wt. of DS (gm)	16.05	16.52	16.93	15.82	18.56	
Moisture Content (%)	**25.8**	**26.2**	**26.8**	**27.7**	**29.9**	
Number of Blows	**40**	**32**	**25**	**19**	**11**	

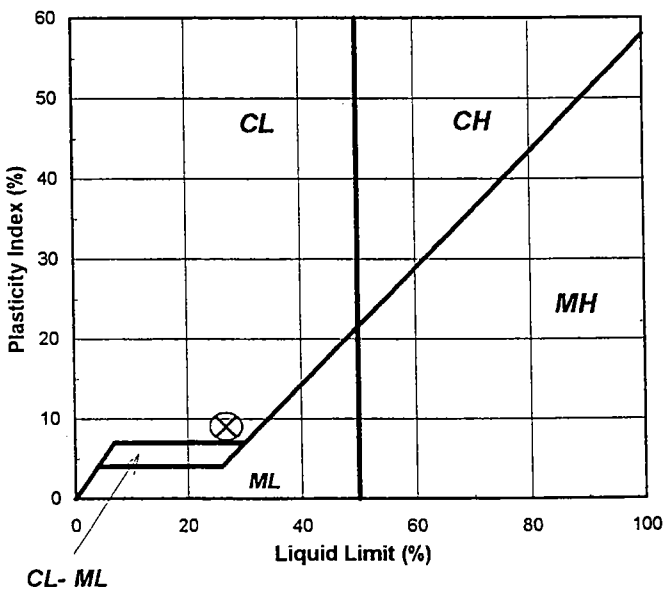
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2247	2301	2302
Wt. of Tare & WS (gm)	23.99	26.11	27.02
Wt. of Tare & DS (gm)	22.98	25.15	25.95
Wt. of Tare (gm)	17.34	19.80	19.87
Wt. of Water (gm)	1.01	0.96	1.07
Wt. of DS (gm)	5.64	5.35	6.08
Moisture Content (%)	**17.9**	**17.9**	**17.6**

Test Results	
Liquid Limit (%)	**27**
Plastic Limit (%)	**18**
Plasticity Index (%)	**9**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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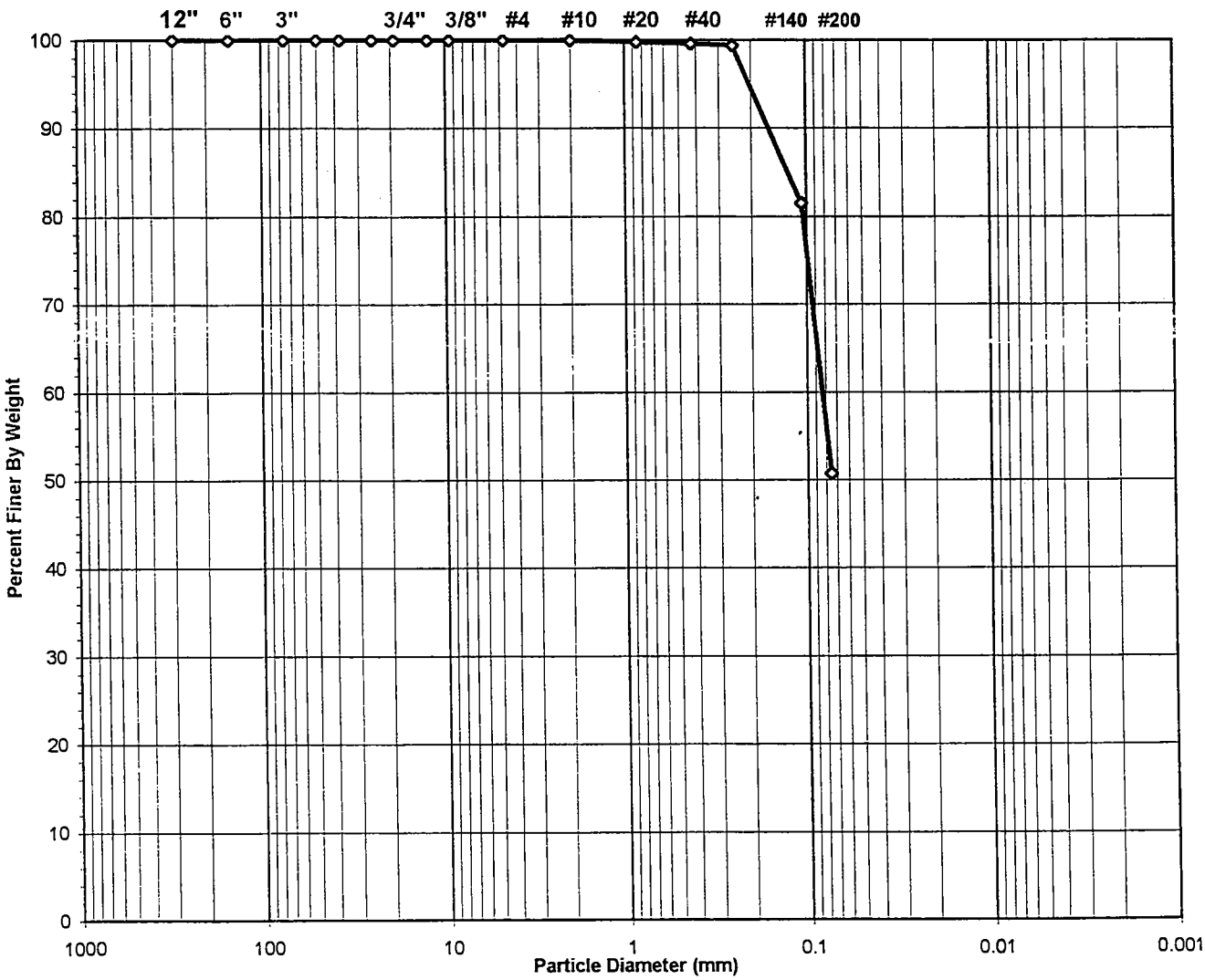
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-1012
Lab ID	98167-01.012	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***ML, TESTED***

USCS Classification ***SANDY SILT (NON-PLASTIC FINES)***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F140.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-1012
Lab ID	98167-01.012	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1653	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	401.00	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	337.81	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	99.39	Weight of Tare (gm)	NA
Weight of Water (gm)	63.19	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	238.42	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**26.5**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	238.42
Dry Weight - 3/4" Sample (gm)	117.5	Weight of minus #200 material (gm)	120.88
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	117.54
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.04	0.02	0.02	99.98	**99.98**
#20	0.850	0.36	0.15	0.17	99.83	**99.83**
#40	0.425	0.53	0.22	0.39	99.61	**99.61**
#60	0.250	0.44	0.18	0.57	99.43	**99.43**
#140	0.106	42.69	17.91	18.48	81.52	**81.52**
#200	0.075	73.48	30.82	49.30	50.70	**50.70**
Pan	-	120.88	50.70	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP25-GEOT-1012
Lab ID	98167-01.012	Visual Description	**BROWN SILT**
			(Minus No. 40 sieve material, Airdried)

NON - PLASTIC MATERIAL

Tested By BS *Date* 7/7/98 *Checked By* LB *Date* 7-8-98

page 1 of 1 DCN: CT-S4B DATE: 7-11-97 REVISION : 2 *C:\MSOFFICE\EXCEL\PrintQ\[G7.xls]Sheet1*

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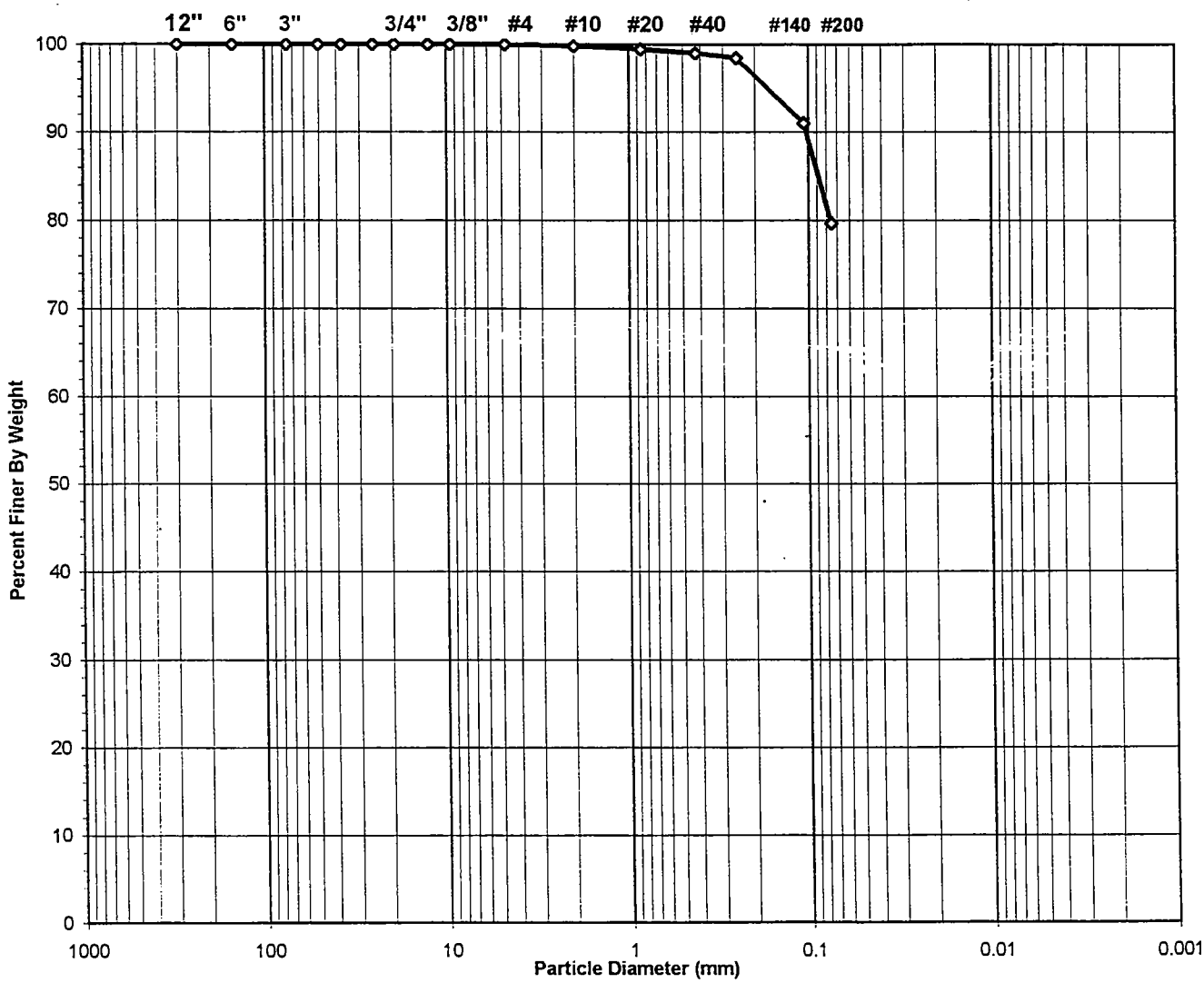
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-0204
Lab ID	98167-01.013	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY WITH SAND***

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 C:\MSOFFICE\EXCEL\PrintQ\[F141.xls]Sheet1

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-0204
Lab ID	98167-01.013	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	2491	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	577.70	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	485.30	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	100.03	Weight of Tare (gm)	NA
Weight of Water (gm)	92.40	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	385.27	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**24.0**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	385.27
Dry Weight - 3/4" Sample (gm)	78.5	Weight of minus #200 material (gm)	306.77
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	78.50
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated **Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.67	0.17	0.17	99.83	**99.83**
#20	0.850	1.26	0.33	0.50	99.50	**99.50**
#40	0.425	1.98	0.51	1.01	98.99	**98.99**
#60	0.250	1.93	0.50	1.52	98.48	**98.48**
#140	0.106	28.87	7.49	9.01	90.99	**90.99**
#200	0.075	43.79	11.37	20.38	79.62	**79.62**
Pan	-	306.77	79.62	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-3-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-0204
Lab ID	98167-01.013	Soil Description	**BROWN LEAN CLAY**

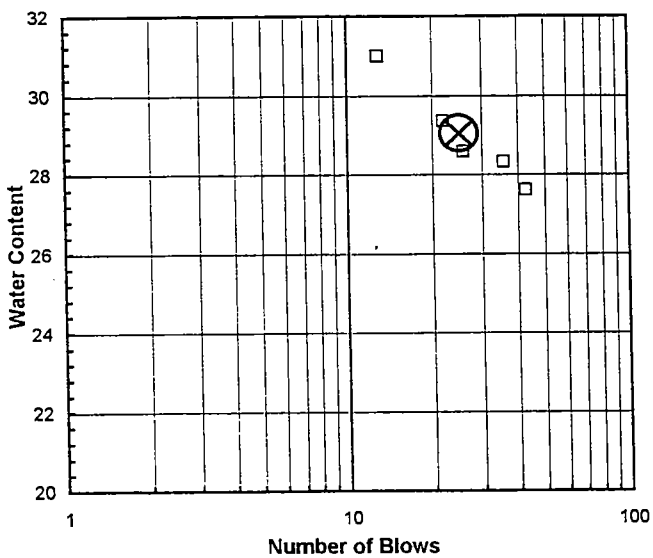
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	2032	1901	2023	2292	2050	
Wt. of Tare & WS (gm)	37.30	42.79	39.95	40.05	41.02	
Wt. of Tare & DS (gm)	32.51	37.80	34.89	34.77	36.06	
Wt. of Tare (gm)	15.15	20.17	17.18	16.78	20.05	
Wt. of Water (gm)	4.79	4.99	5.06	5.28	4.96	
Wt. of DS (gm)	17.36	17.63	17.71	17.99	16.01	
Moisture Content (%)	**27.6**	**28.3**	**28.6**	**29.3**	**31.0**	
Number of Blows	**43**	**36**	**26**	**22**	**13**	

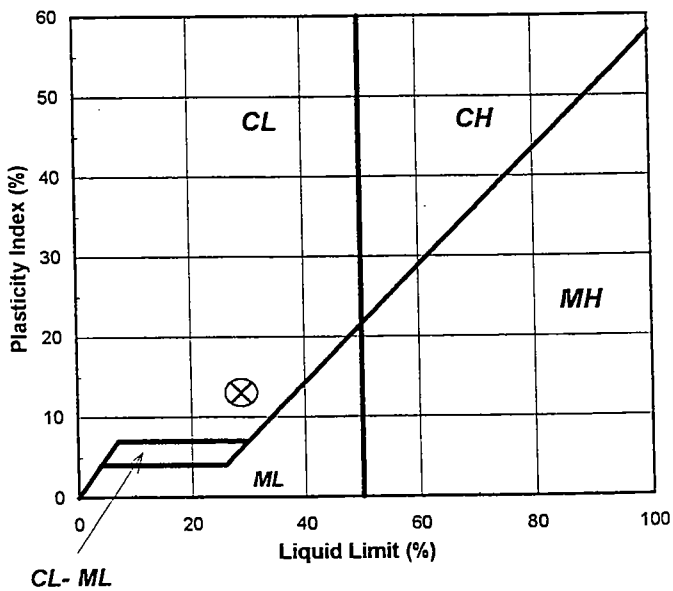
Plastic Limit Test	**1**	**2**	**3**
Tare Number	109	94	82
Wt. of Tare & WS (gm)	21.31	26.95	24.28
Wt. of Tare & DS (gm)	20.48	26.12	23.42
Wt. of Tare (gm)	15.14	20.81	17.95
Wt. of Water (gm)	0.83	0.83	0.86
Wt. of DS (gm)	5.34	5.31	5.47
Moisture Content (%)	**15.5**	**15.6**	**15.7**

Test Results	
Liquid Limit (%)	**29**
Plastic Limit (%)	**16**
Plasticity Index (%)	**13**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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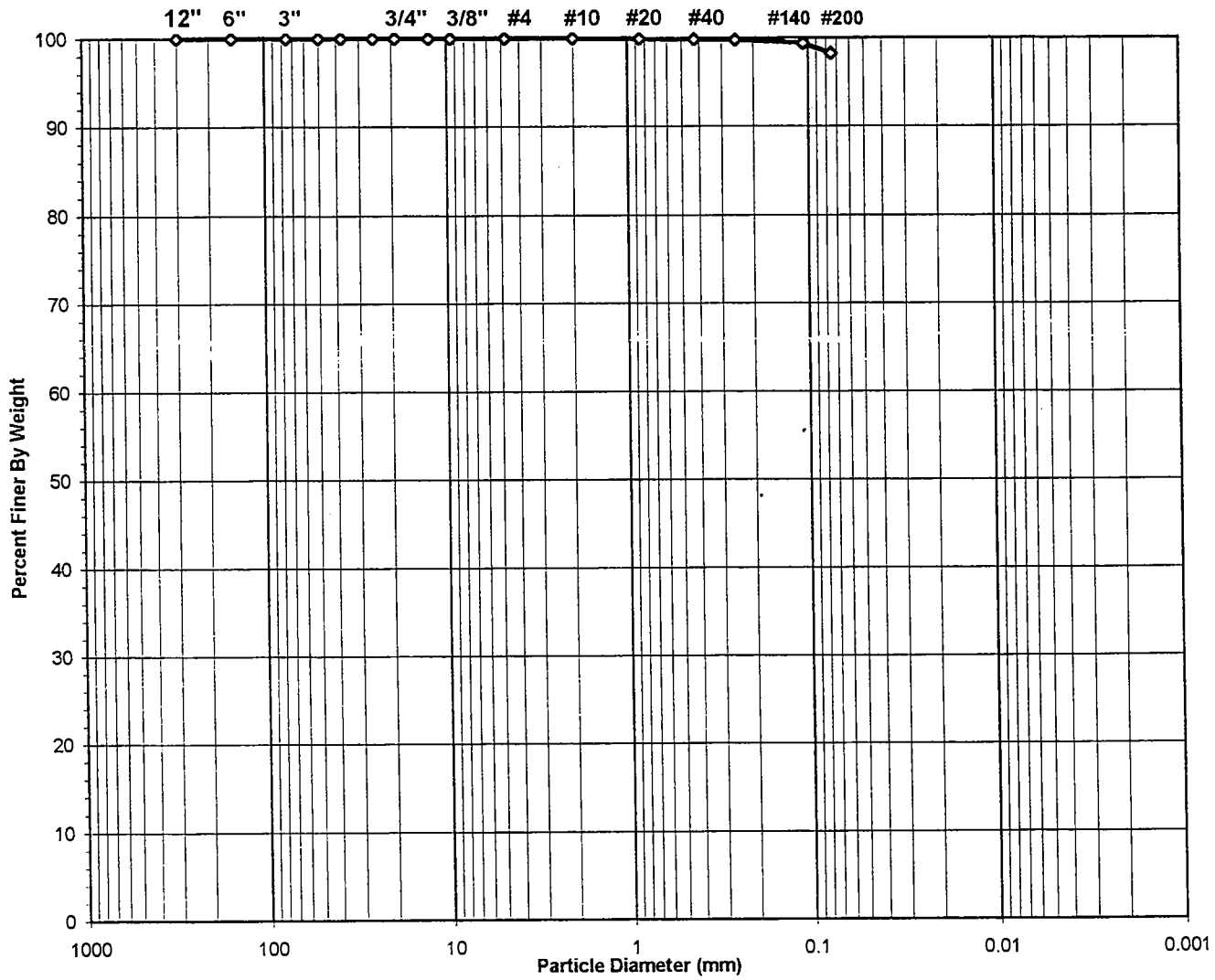
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-0608
Lab ID	98167-01.014	Soil Color	**BROWN**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL-ML, TESTED***

USCS Classification ***SILTY CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F142.xls]Sheet1*

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WASH SIEVE ANALYSIS

ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-0608
Lab ID	98167-01.014	Soil Color	**BROWN**

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1053	Tare No.	NA
Wgt.Tare + Wet Specimen (gm)	664.80	Wgt.Tare + Wet Specimen (gm)	NA
Wgt.Tare + Dry Specimen (gm)	557.90	Wgt.Tare + Dry Specimen (gm)	NA
Weight of Tare (gm)	104.36	Weight of Tare (gm)	NA
Weight of Water (gm)	106.90	Weight of Water (gm)	NA
Weight of Dry Soil (gm)	453.54	Weight of Dry Soil (gm)	NA
Moisture Content (%)	**23.6**	**Moisture Content (%)**	**NA**

Wet Weight -3/4" Sample (gm)	NA	Weight of the Dry Specimen (gm)	453.54
Dry Weight - 3/4" Sample (gm)	7.7	Weight of minus #200 material (gm)	445.80
Wet Weight +3/4" Sample (gm)	NA	Weight of plus #200 material (gm)	7.74
Dry Weight + 3/4" Sample (gm)	0.00		
Total Dry Weight Sample (gm)	NA		

Sieve Size	Sieve Opening (mm)	Wgt.of Soil Retained (gm)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	**Accumulated Percent Finer (%)**
12"	300	0.00	0.00	0.00	100.00	**100.00**
6"	150	0.00	0.00	0.00	100.00	**100.00**
3"	75	0.00	0.00	0.00	100.00	**100.00**
2"	50	0.00	0.00	0.00	100.00	**100.00**
1 1/2"	37.5	0.00	0.00	0.00	100.00	**100.00**
1"	25.0	0.00	0.00	0.00	100.00	**100.00**
3/4"	19.0	0.00	0.00	0.00	100.00	**100.00**
1/2"	12.50	0.00	0.00	0.00	100.00	**100.00**
3/8"	9.50	0.00	0.00	0.00	100.00	**100.00**
#4	4.75	0.00	0.00	0.00	100.00	**100.00**
#10	2.00	0.07	0.02	0.02	99.98	**99.98**
#20	0.850	0.27	0.06	0.07	99.93	**99.93**
#40	0.425	0.28	0.06	0.14	99.86	**99.86**
#60	0.250	0.34	0.07	0.21	99.79	**99.79**
#140	0.106	1.88	0.41	0.63	99.37	**99.37**
#200	0.075	4.90	1.08	1.71	98.29	**98.29**
Pan	-	445.80	98.29	100.00	-	-

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

DCN: CT-S3A DATE 6-25-98 REVISION: 2

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-0608
Lab ID	98167-01.014	Soil Description	**BROWN SILTY CLAY**

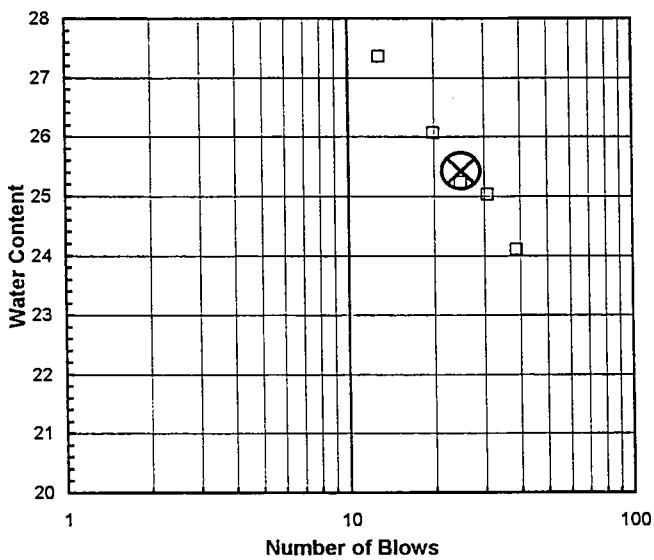
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	
Tare Number	1792	1859	1886	2026	2034	M U L T I P O I N T
Wt. of Tare & WS (gm)	37.55	40.06	40.87	41.09	45.65	
Wt. of Tare & DS (gm)	33.19	35.16	35.91	36.84	40.16	
Wt. of Tare (gm)	15.09	15.58	16.25	20.53	20.09	
Wt. of Water (gm)	4.36	4.9	4.96	4.25	5.49	
Wt. of DS (gm)	18.1	19.58	19.66	16.31	20.07	
Moisture Content (%)	**24.1**	**25.0**	**25.2**	**26.1**	**27.4**	
Number of Blows	**39**	**31**	**25**	**20**	**13**	

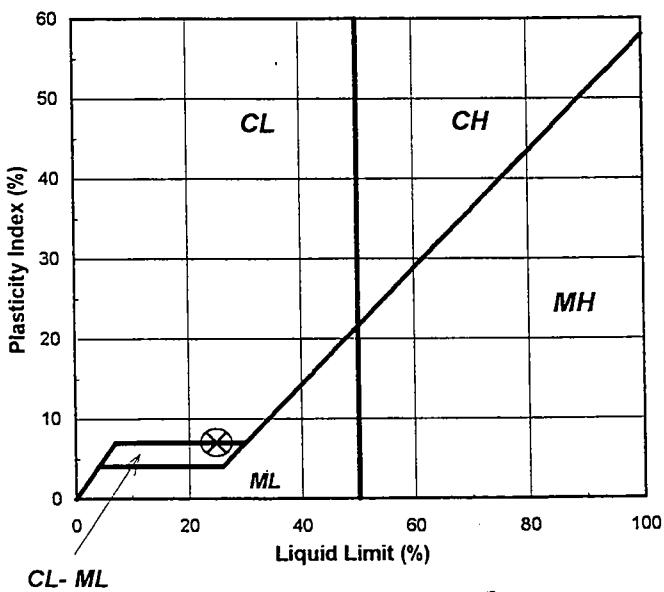
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2040	2053	2062
Wt. of Tare & WS (gm)	21.70	24.36	25.03
Wt. of Tare & DS (gm)	20.75	23.41	24.10
Wt. of Tare (gm)	15.39	18.19	19.00
Wt. of Water (gm)	0.95	0.95	0.93
Wt. of DS (gm)	5.36	5.22	5.1
Moisture Content (%)	**17.7**	**18.2**	**18.2**

Test Results	
Liquid Limit (%)	**25**
Plastic Limit (%)	**18**
Plasticity Index (%)	**7**
USCS Symbol	**CL-ML**

Flow Curve



Plasticity Chart



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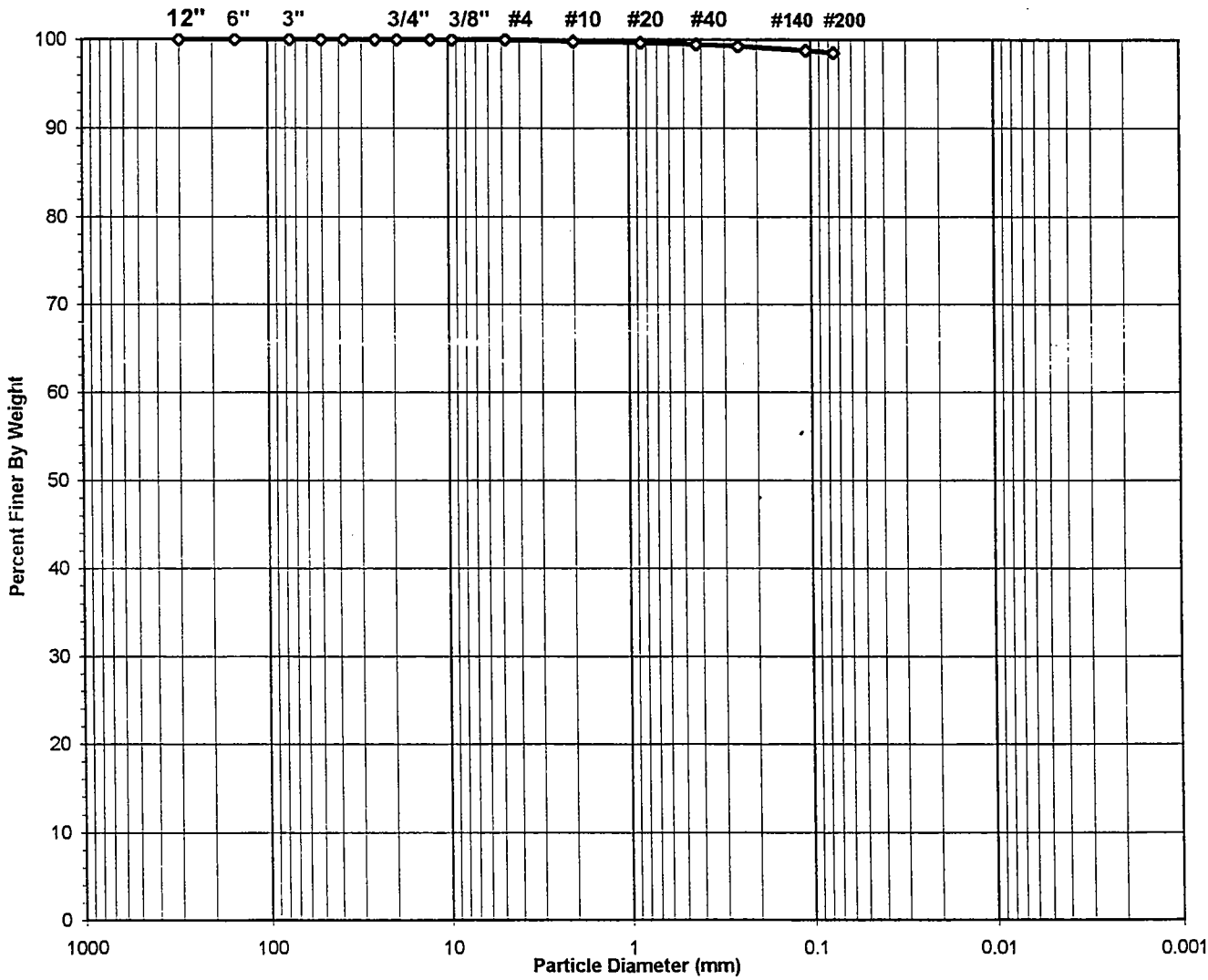
SIEVE ANALYSIS
ASTM D 422-63 (SOP-S3)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-1012
Lab ID	98167-01.015	Soil Color	**GRAY**

	SIEVE ANALYSIS		*HYDROMETER*
USCS	gravel	sand	silt and clay



USCS Symbol ***CL, TESTED***

USCS Classification ***LEAN CLAY***

Tested By MV Date 6/30/98 Checked By LB Date 7-8-98

 DCN: CT-S3A DATE 6-25-98 REVISION: 2 *C:\MSOFFICE\EXCEL\PrintQ\[F143.xls]Sheet1*

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ATTERBERG LIMIT

ASTM D 4318-96 (SOP - S4)

Client	GEO-ENVIRONMENTAL DRILLING	Boring No.	PBOW-98-PRRP
Client Reference	PBOW-PRRP	Depth (ft)	NA
Project No.	98167-01	Sample No.	DP24-GEOT-1012
Lab ID	98167-01.015	Soil Description	**GRAY LEAN CLAY**

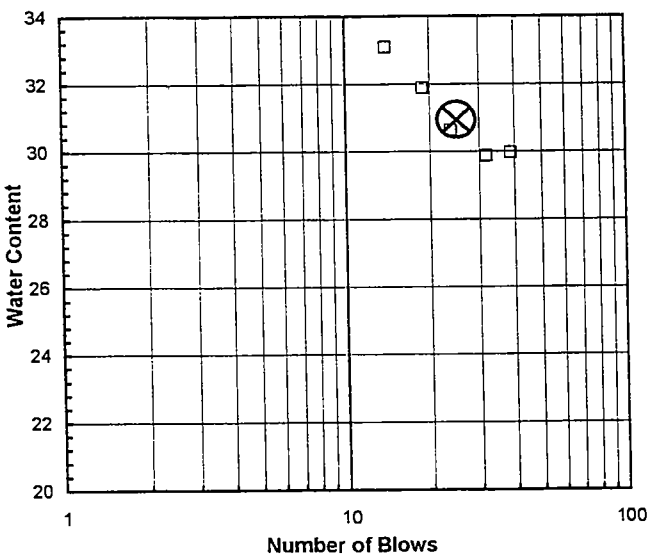
Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description. (Minus No. 40 sieve material, Airdried)

Liquid Limit Test	**1**	**2**	**3**	**4**	**5**	MULTIPOINT
Tare Number	1882	1883	1898	2024	2025	
Wt. of Tare & WS (gm)	40.07	34.87	38.14	35.16	40.01	
Wt. of Tare & DS (gm)	35.27	29.59	33.28	29.68	33.76	
Wt. of Tare (gm)	19.24	11.90	17.40	12.48	14.86	
Wt. of Water (gm)	4.8	5.28	4.86	5.48	6.25	
Wt. of DS (gm)	16.03	17.69	15.88	17.2	18.9	
Moisture Content (%)	**29.9**	**29.8**	**30.6**	**31.9**	**33.1**	
Number of Blows	**39**	**32**	**24**	**19**	**14**	

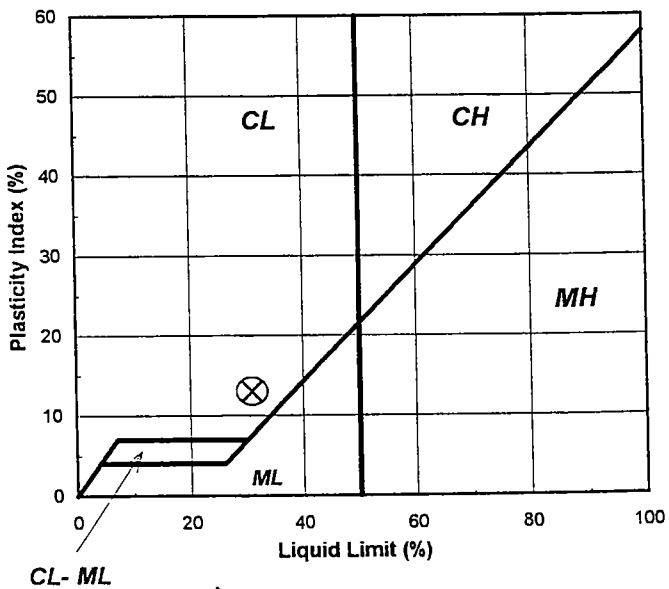
Plastic Limit Test	**1**	**2**	**3**
Tare Number	2031	2063	2320
Wt. of Tare & WS (gm)	23.74	19.48	23.66
Wt. of Tare & DS (gm)	22.81	18.55	22.67
Wt. of Tare (gm)	17.61	13.35	17.21
Wt. of Water (gm)	0.93	0.93	0.99
Wt. of DS (gm)	5.2	5.2	5.46
Moisture Content (%)	**17.9**	**17.9**	**18.1**

Test Results	
Liquid Limit (%)	**31**
Plastic Limit (%)	**18**
Plasticity Index (%)	**13**
USCS Symbol	**CL**

Flow Curve



Plasticity Chart



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APPENDIX H

ADDITIONAL HUMAN HEALTH RISK ASSESSMENT INFORMATION

APPENDIX H.1

CALCULATION OF PRG CONCENTRATIONS FOR CHEMICALS WITHOUT VALUES TABULATED BY EPA REGION 9

Appendix H.1

Calculation of PRG Concentrations for Chemicals Without Values Tabulated by EPA Region 9

Preliminary remedial goals (PRG) are not available in the U.S. Environmental Protection Agency (EPA) (1999) Region 9 PRG tables for all of the chemicals identified in various media at the RWP Areas. PRGs can be derived using the EPA (1999) Region IX methodology and chemical-specific variable values (such as toxicity values) from approved sources. The chemicals, their chemical-specific values and their documentation, and the derived PRGs are as follows.

Chemical	RfDo (mg/kg-day)	RfDi (mg/kg-day)	PEF (m^3/kg)	VFs (m^3/kg)	Soil PRG (mg/kd)	Tap water PRG (µg/L)	Ambient Air PRG (µg/m^3)
2-Amino-4,6-dinitrotoluene	6E-5[a]	6E-5[b]	1.32E+9[c]	NA[d]	3.7E+0 nc	2.2E+0 nc	NA
4-Amino-2,6-dinitrotoluene	6E-5[a]	6E-5[b]	1.32E+9[c]	NA[d]	3.7E+0 nc	2.2E+0 nc	NA
3-Nitroaniline	3E-4[e]	3E-4[b]	1.32E+9[c]	NA[d]	1.8E+1 nc	1.1E+1 nc	NA
Benzo(g,h,i)perlyene	3E-2[f]	3E-2[b]	1.32E+9[c]	NA[d]	2.3E+3 nc	1.8E+2 nc	NA
Phenanthrene	3E-2[f]	3E-2[b]	1.32E+9[c]	NA[d]	2.3E+3 nc	1.8E+2 nc	NA
Acenaphthylene	6E-2[g]	6E-2[b]	1.32E+9[c]	NA[g]	3.7E+3 nc	3.7E+2 nc	2.2E+2 nc[g]

RfDo = oral reference dose; RfDi = inhalation reference dose; PEF = particulate emission factor; VFs = volatilization-from-soil factor; PRG = preliminary remediation goal calculated by the EPA (1999) methodology; NA = not applicable; nc = based on a noncancer hazard index of 1.0.

[a]U.S. Environmental Protection Agency (EPA), 1993, ***Risk Assessment Issue Paper for: Derivation of Oral RfD for 2-Amino-4,6-Dinitrotoluene (CASRN 35572-78-2) and 4-Amino-2,6-Dinitrotoluene (CASRN 19406-51-0) By Analogy to 2,4,6-Trinitrotoluene, Systemic Toxicity Assessment***, National Center for Environmental Assessment, Cincinnati, OH, 23 February.
[b]The oral RfD is adopted for inhalation exposure for organic, but not inorganic, chemicals (U.S. Environmental Protection Agency (EPA), 1999, ***Region 9 Preliminary Remediation Goals (PRGs) 1999***, online, 1 October).
[c]Default from EPA (1999).
[d]VFs is evaluated only for readily volatile organic compounds; the compound of interest is assumed to be semivolatile or a non-volatile metal.
[e]Please see toxicity profile for nitroanilines (Appendix H.3).
[f]The verified RfDo for pyrene was used as a surrogate RfDo for this chemical.
[g]Acenaphthene was used as a surrogate for this chemical.

APPENDIX H.2

WEST AREA RED WATER PONDS, CHROMIUM IN SURFACE SOIL COMPARED WITH CHROMIUM IN BACKGROUND SOIL

Appendix H.2

West Area Red Water Ponds
Chromium in Surface Soil Compared to Chromium in Background Soil

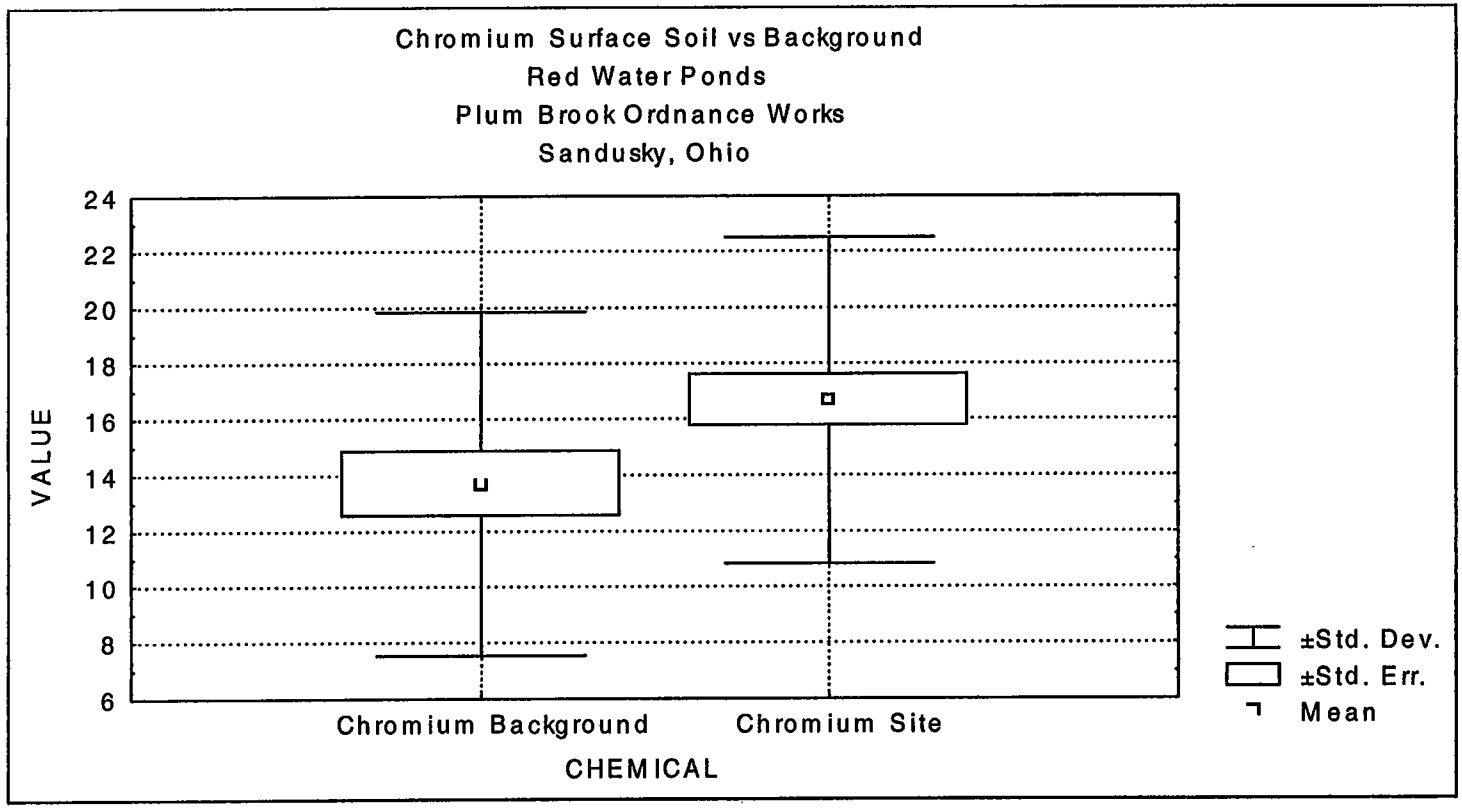
STAT. Mann-Whitney U Test (bkgdtest2.sta)
NONPAR By variable CHEMICAL
STATS Group 1: 100-Chromium Group 2: 101-Chromiu1

variable	Rank Sum Crbkg	Rank Sum Crsite	U	Z	p-level	Z adjusted	p-level	Valid N Crbkg	Valid N Crsite
VALUE	707.5000	1503.500	356.5000	-2.14563	.031910	-2.14726	.031780	26	40

STAT. Mann-Whitney U Test (bkgdtest2.sta)
NONPAR By variable CHEMICAL
STATS Group 1: 100-Chromium Group 2: 101-Chromiu1

variable	2*1sided exact p
VALUE	.031212

Chromium concentrations in site data do not appear to be drawn from same population as chromium in background data set.


Chromium Surface Soil vs Background
Red Water Ponds
Plum Brook Ordnance Works
Sandusky, Ohio
VALUE
24
22
20
18
16
14
12
10
8
6
Chromium Background
Chromium Site
CHEMICAL
±Std. Dev.
±Std. Err.
Mean

APPENDIX H.3

TOXICOLOGICAL PROFILES FOR THE CHEMICALS OF POTENTIAL CONCERN, RED WATER PONDS AREA

Appendix H.3

Toxicological Profiles for the Chemicals of Potential Concern Red Water Ponds Areas

INTRODUCTION

Toxicological profiles are presented for each chemical for which documentation of chemical-specific values is required. The doubly hyphenated number in parentheses following the chemical name is its unique Chemical Abstract Service (CAS) registration number. The CAS number may be located in the profile title, or, in the case of multiple isomers or members of a chemical class, in the introductory text or the table that provides the physical properties.

Toxicological profiles contain brief descriptions of the nature of the adverse effects associated with the chemical. It is important to note that a discussion of adverse effects without a discussion of dose is incomplete and potentially misleading, because virtually any chemical may be toxic at some dose, and many chemicals (e.g., nutritionally required minerals, vitamins, amino acids, etc.) enhance human health at some low dose. An ever growing and compelling body of evidence suggests that many environmental contaminants also enhance health at low doses (Hart and Frame, 1996).

When sufficient data are available, the EPA Integrated Risk Information System (IRIS) presents the EPA's verified chronic toxicity values for threshold, or noncancer, effects, and for cancer risk (EPA, 2000). The toxicity values for noncancer effects include a reference dose (RfD) expressed in milligrams per kilogram per day (mg/kg-day) for chronic oral exposure, and a reference concentration (RfC), in milligrams per cubic meter (mg/m^3), for chronic inhalation exposure. The inhalation RfC in units of mg/m^3 may be converted to an equivalent inhalation RfD by assuming continuous chronic exposure of humans with a body weight of 70 kg and an inhalation rate of 20 m^3/day. In other words, the RfC expressed as mg/m^3 is multiplied by the inhalation rate of 20 m^3/day, and the result is divided by the body weight of 70 kg to yield an inhalation RfD expressed as mg/kg-day.

RfDs and RfCs are usually derived from empirical benchmark doses (BMD) or concentrations called no-observed-effect levels (NOEL) or no-observed-adverse-effect levels (NOAEL) from animal toxicity or human epidemiology studies. If the data do not permit identifying a NOEL or NOAEL, a lowest-observed-adverse-effect level (LOAEL) or lowest-effect level (LEL) may be used. A frank-effect level (FEL), e.g., mortality, shortened life span or serious physiologic, neurologic or behavioral disturbances, is generally considered an inappropriate benchmark from which to develop an RfD or RfC. Some RfD and RfC derivations employ a BMD that is a statistically estimated dose for humans at which some low proportion of the population may experience some minimally adverse effect. A BMD at which 10 percent of the population may be expected to respond is expressed as BMD_{10}. The RfD or RfC is derived by dividing the

benchmark level (e.g., NOAEL or BMD_{10}) by a series of uncertainty and modifying factors, which collectively are designated the uncertainty factor (UF).

For cancer effects, IRIS presents a verified EPA cancer weight-of-evidence group classification that reflects qualitatively the likelihood that the chemical is carcinogenic to humans. IRIS also presents a slope factor (SF) for oral exposure, expressed as the risk per mg/kg-day ingested dose, and a unit risk factor (URF) for inhalation exposure, expressed as the risk per microgram per cubic meter ($\mu g/m^3$) in ambient air. These quantitative estimates are generally provided for chemicals in EPA weight-of-evidence Groups A and B and C, if the data are adequate. The SF or URF is usually estimated as an upper bound on the slope of the dose- or concentration-response curve from animal toxicity or human epidemiology studies. The inhalation URF in units of risk per $\mu g/m^3$ may be converted to an equivalent inhalation SF in units of risk per mg/kg-day by assuming continuous lifetime exposure of humans with a body weight to 70 kg and an inhalation rate of 20 m^3/day. In other words, the URF expressed as risk per $\mu g/m^3$ is divided by the inhalation rate of 20 m^3/day, and multiplied by the assumed body weight of 70 kg and a conversion factor of 1000 $\mu g/mg$.

Toxicity values are not estimated for acute toxicity and acute exposure is not evaluated in the risk assessment. Nonetheless, the levels associated with acute lethality and data regarding the effects of acute exposure to levels higher than ordinarily observed in chronic environmental exposure provide additional perspective regarding the toxicity of the chemical. Therefore, information regarding acute toxicity, when available, is included in the profiles. Lethality data for laboratory animals are generally expressed as the oral dose associated with lethality of 50 percent of an exposed population (LD_{50}) or the concentration in air associated with lethality of 50 percent of an exposed population (LC_{50}). Occasionally the dose associated with lethality in a low percentage of an exposed population (LD_{LO}) is presented.

The toxicity profiles also provide documentation for physical constants that are important for chemical transport modeling, such as molecular weight (MW) in grams per mole (g/mole), the log of the octanol/water partition coefficient (log K_{ow}), Henry's law constant (H) in atmosphere-cubic meter/mole (atm-m^3/mole), the soil/water partition coefficient (K_d) in liters per kilogram (L/kg) for metals, the log of the soil/organic carbon partition coefficient (log K_{oc}) (unitless) for organic chemicals, diffusivity in air (D_a) in square centimeters per second (cm^2/s), diffusivity in water (D_w) in cm^2/s, vapor pressure (VP) in atmospheres (atm), and solubility in water (S) in milligrams per liter (mg/L). In addition, organic chemicals are designated as volatile organic compounds (VOC) or semivolatile organic compounds (SVOC) based on their propensity to volatilize from environmental media. Chemicals designated as VOCs generally have a MW less than 200 g/mole and H greater than 1E-5 atm-m^3/mole (EPA, 1991).

The physical constants generally are taken from the most reliable source (i.e., the source that provides the highest level of documentation). Values for interrelated properties are usually taken from the same source (e.g., H is often estimated from VP and S; therefore, the same source is generally used for all three property values). When one source provides several values for a given property, professional judgement is used to select the most appropriate. Obvious outliers may be dropped from consideration. The average or the midpoint of a range of values may be selected. K_d values for metals and K_{oc} values for ionizing organic compound are based on a

default pH of 6.8 (EPA, 1996) if the data are available. VP, S and H values are limited to those provided for normal ambient temperatures (0 to 30°C), but the temperatures reported in the original sources are not presented in the toxicity profile, nor is any attempt made to extrapolate K, VP or S to any default temperature.

When values for H were not located, they were calculated as follows, provided the requisite information was available (EPA, 1998):

$$H = \frac{VP \cdot MW}{S}$$

where:

H	=	Henry's law constant (atm-m^3/mole, calculated)
VP	=	vapor pressure (atm)
MW	=	molecular weight (g/mole)
S	=	solubility in water (mg/L).

When values for D_a were not located, they were calculated as follows (EPA, 1998):

$$D_a = \frac{1.9}{MW^{2/3}}$$

where:

D_a	=	diffusivity in air (cm^2/s, calculated)
MW	=	molecular weight (g/mole).

When values for D_w were not located, they were calculated as follows (EPA, 1998):

$$D_w = \frac{22E-5}{MW^{2/3}}$$

where:

D_w	=	diffusivity in water (cm^2/s, calculated)
MW	=	molecular weight (g/mole).

When values for K_{oc} were not located, they were calculated as follows for phthalates and polyaromatic aromatic hydrocarbons (PAH) provided log K_{ow} was available (EPA, 1998):

$$\log K_{oc} = 0.97 \log K_{ow} - 0.094$$

where:

K_{oc}	=	soil/organic carbon partition coefficient (unitless, calculated)
K_{ow}	=	octanol/water partition coefficient (unitless).

K_{oc} for other organic chemicals was calculated as follows provided log K_{ow} was available (EPA, 1998):

$$\log K_{oc} = 0.78 \log K_{ow} + 0.151$$

where:

K_{oc}	=	soil/organic carbon partition coefficient (unitless, calculated)
K_{ow}	=	octanol/water partition coefficient (unitless).

The toxicity profiles also present the predominant sources of release to the environment as well as a qualitative description of the fate of the chemical in air, surface water and sediment, and soil. No attempt is made to present quantitative data because environmental fate is usually highly dependent on climatic conditions and the characteristics of the medium to which the chemical is released, which may differ from location to location and change from time to time. The source and fate information may provide perspective regarding the likelihood that the chemical's presence is related to site activities, that the chemical will migrate across media, or that the chemical will persist at toxicologically significant levels.

Biotransfer factors are provided for chemicals for which food-chain pathways may be significant, which includes many inorganic chemicals and those organic chemicals that are highly lipophilic and persist in the environment. High lipophilicity is indicated by a log K_{ow} greater than 3 (Lyman et al., 1990). Lipophilicity enhances partitioning to biomedia and passage across biological membranes. Persistence in the environment is evidence that the chemical might resist biotransformation and, therefore, remain in edible tissues at toxicologically significant concentrations. VOCs tend to be mobile and labile (i.e., subject to rapid and extensive biotransformation and excretion), and generally do not participate significantly in food-chain pathways. Therefore, biotransfer factors are not estimated for VOCs. Some of the SVOCs, however, are highly lipophilic. They may persist or yield metabolites that are significant toxicants in their own right. For example, the organochlorine pesticide DDT is metabolized by mammals to DDE, which is similar in carcinogenic potency to the parent compound. Biotransfer factors are generally estimated for SVOCs that have log K_{ow} values greater than 3.

The biotransfer factors of interest are water-to-fish bioconcentration factors (BCF) or biota-sediment accumulation factors (BSAF), soil-to-plant biotransfer factors (Bp), cattle ingestion-to-beef factors (Bb) and cattle ingestion-to-milk factors (Bm). Separate soil-to-plant biotransfer factors are available for the reproductive parts of plants (e.g., fruits, seeds) and the vegetative parts of plants (e.g., stems, leaves) for inorganic and some organic chemicals. Soil-to-plant factors for the reproductive parts of plants are designated Bpr; soil-to-plant factors for the vegetative parts of plants are designated Bpv.

BCF values are adopted from empirical data when the data are clearly the best choice (i.e., similar results in multiple species of fin fish). When the empirical data are few or inconsistent,

BCFs for inorganic chemicals are taken from various sources. BCF values for organic chemicals are estimated from the following equation (Devillers et al., 1996):

$$\log BCF = 0.910 \log K_{ow} - 1.975 \log(6.8E-7K_{ow} + 1) - 0.786$$

where:

BCF	=	bioconcentration factor (L/kg, calculated)
K_{ow}	=	octanol/water partition coefficient (unitless).

The Bintein and Devillers model (Devillers et al., 1996) is selected over simpler models adopted by the EPA largely because the Bintein and Devillers approach has undergone scrutiny since first published (Bintein and Devillers, 1993), and considerable effort was expended to validate the model; i.e., to compare modeled and empirical results. The Bintein and Devillers model is probably more realistic than simpler models for chemicals with higher log K_{ow} values. BSAF values are chosen instead of BCFs for those very highly lipophilic chemicals such as the polychlorinated biphenyls (PCB), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF) and selected organochlorine pesticides expected to partition almost entirely to benthic sediment.

Soil-to-plant biotransfer factors (Bp) for SVOCs are estimated by a simple model by Travis and Arms (1988), which is based only on log K_{ow}:

$$\log Bp = 1.588 - 0.578 \log K_{ow}$$

where:

Bp	=	soil-to-plant biotransfer factor (unitless, calculated)
K_{ow}	=	octanol/water partition coefficient (unitless).

Separate biotransfer factors are not estimated for the reproductive parts of plants (Bpr) and the vegetative parts of plants (Bpv).

Cattle ingestion-to-beef factors (Bb) for SVOCs are estimated by a simple model by Travis and Arms (1988), which is based only on log K_{ow}:

$$\log Bb = -7.6 + \log K_{ow}$$

where:

Bb	=	cattle ingestion-to-beef biotransfer factor (days/kg, calculated)
K_{ow}	=	octanol/water partition coefficient (unitless).

Cattle ingestion-to-milk factors (Bm) for SVOCs are estimated by a simple model by Travis and Arms (1988), which is based only on log K_{ow}:

$$\log Bb = -8.10 + \log K_{ow}$$

where:

Bm	=	cattle ingestion-to-milk biotransfer factor (days/kg, calculated)
K_{ow}	=	octanol/water partition coefficient (unitless).

The toxicity profiles provide documentation for the gastrointestinal (GI) absorption factor (GAF), which is used to develop the dermal RfD and SF, the dermal absorption factor (ABS), which describes the extent of dermal uptake from soil, and the permeability coefficient (PC) and tau (τ), which are used to estimate the rate of dermal uptake from water. Usually PC and τ are taken from EPA (1992), unless EPA (1992) provides no values, or professional judgement suggests that a log K_{ow} value other than the one provided by EPA (1992) is clearly more appropriate. In these cases, PC is calculated as follows (EPA, 1992):

where:

$$\log(PC) = -2.72 + 0.71(\log K_{ow}) - 0.0061(MW)$$

where:

PC	=	permeability coefficient (centimeters per hour [cm/hour], calculated)
K_{ow}	=	octanol/water partition coefficient (unitless)
MW	=	molecular weight,

and τ is calculated as follows (EPA, 1992):

$$\tau = \frac{L_{sc}}{6 \cdot 10^{(-2.72 - 0.0061 * MW)}}$$

where:

τ	=	time for concentration of contaminant in stratum corneum to reach steady state (hours, calculated)
L_{sc}	=	effective thickness of the stratum corneum (1E-3 cm)
MW	=	molecular weight.

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INORGANIC CHEMICALS

ALUMINUM (7429-90-5)

Aluminum is a naturally occurring **metal** (ATSDR, 1992). It is the third most abundant element in nature, constituting approximately 8 percent of the earth's crust. Aluminum is highly reactive; thus, is always found in combination with other substances such as oxygen, floride or silica. Aluminum is used in a wide variety of applications, including packaging, kitchen utensils, auto bodies and components, airplanes and building components (Elinder and Sjogren, 1986). It is also used in cosmetics, food additives and some pharmaceuticals and cosmetics. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	K_d (L/kg)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
26.98	NA	NA	ND	NA	NA	NA	I[a]

NA = not applicable; ND = no data; I = insoluble in hot or cold water
[a]Hazardous Substance Data Bank (HSDB), 1999, National Library of Medicine, on line.

Aluminum is one of the few elements for which natural release far outweighs anthropogenic release (ATSDR, 1992; HSDB, 2000). The predominant natural process is the weathering and release of dust from soil and rocks into the air. Major anthropogenic sources include aluminum mining and smelting, coal combustion, and other mining or industrial activities that process crustal materials. Aluminum exists in the air as particulates that, presumably, are subject to wet and dry deposition.

Aluminum is deposited on soil from the atmosphere (ATSDR, 1992). Other anthropogenic sources include wastes from mines, smelters and coal combustion. Aluminum in soil exists in several soluble and insoluble forms, depending on pH and the nature of the minerals and organic material present in the soil. Generally, increasing acidity (decreasing pH) mobilizes aluminum and facilitates leaching.

Aluminum exists naturally in water in several hydrated and complexed forms (ATSDR, 1992). Sources include solution from surrounding soil, precipitation, and runoff and erosion from soil. The extent to which aluminum in water settles out is highly variable and depends on pH and the other constituents present in the water with which aluminum may form compounds and complexes. Generally an equilibrium is established between soluble and insoluble forms.

Acid conditions in soil mobilize aluminum for uptake by plants, but the extent of uptake and the distribution between the roots and the aerial parts is highly dependent on the species of plant (ATSDR, 1992). Bioconcentration in fish is largely a function of water quality (e.g., pH and total organic carbon). Highest concentrations of aluminum are generally found in the gills and lowest concentrations are found in edible muscle tissue. Concentrations decrease as the fish pass through the larval and juvenile stages. Therefore, the bioconcentration of aluminum in edible fish tissues is not expected to represent a toxicologically significant source to humans, and the lack of quantitative data (see table below) is not considered an important source of uncertainty in risk assessment.

Biotransfer factors for aluminum are compiled below:

BCF (L/kg)	Bpr (unitless)	Bpv (unitless)	Bb (unitless)	Bm (unitless)
ND	6.5E-4[a]	4.0E-3[a]	1.5E-3[a]	2.0E-4[a]

ND = no data.
[a]Baes, C.F., R.D. Sharp, A.L. Sjoreen, R.W. Shor, 1984, ***A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture***, Health and Safety Division, Oak Ridge National Laboratory, ORNL-5786, September.

Dietary intake accounts for the majority of human exposure to aluminum (Elinder and Sjogren, 1986); pharmaceuticals and medical procedures (e.g., dialysis treatment for kidney failure) are important sources of exposure for some individuals. A recent review (EPA, 1994) summarizes GI uptake in animals treated with single oral doses of aluminum chloride ranging from less than

one percent (rabbits) to 27 percent (rats). The data indicate that dose and the animal species may be more important than chemical form in determining the extent of GI absorption. Human GI absorption data range from 0.1 to 0.3 percent, but the chemical form and dose were not reported. These observations suggest that GI absorption by rodents may exceed absorption by rabbits or humans. The toxicokinetic study selected for derivation of the gastrointestinal absorption factor (GAF) should approximate, as closely as possible, the conditions of the critical study (the study upon which the toxicity value is based). The provisional oral RfD is based on a study in mice with aluminum lactate in the diet. The toxicokinetic study most adequately reflecting the conditions of the key study (rodents, oral exposure, soluble form of aluminum) is the study that identified GI absorption of 27 percent in rats. Therefore, the absorption factor of 0.27 observed in rats is chosen as the GAF for this evaluation.

Data were not located regarding the extent of dermal absorption of aluminum from soil. The OEPA (1998) default soil absorption factor ABS for metals of 0.01 is chosen for this evaluation. The EPA (1992) default PC of metals of 1E-3 cm/hour is selected for aluminum.

Aluminum is relatively nontoxic via oral exposure to physiologically normal humans, but recently concern has arisen regarding neurological effects, including Alzheimer's disease and similar forms of dementia (EPA, 1994). Much of this concern stems from studies with large oral doses of soluble aluminum salts (e.g., aluminum hydroxide) and from medical procedures that bypass the GI absorption barrier. A review of several animal studies with many different forms of aluminum identified the developing infant as potentially the most sensitive member of the human population. A provisional chronic oral RfD of 1E+0 mg/kg-day was derived from a LOAEL of 100 mg/kg-day for minimal and equivocal neurological effects in the offspring of mice. The nervous system is the target organ for oral exposure to aluminum. (The nervous system rather than the CNS is chosen as the target organ because it cannot be stated unequivocally that some of the neurologic effects observed do not involve the peripheral nerves.) The mice were fed diets fortified with aluminum lactate throughout gestation and lactation. An uncertainty factor of 100 was used. Confidence in the oral RfD is low.

Occupational exposure to aluminum metal dust and aluminum oxide is associated with pulmonary fibrosis and related respiratory effects such as cough, emphysema, pneumonia and decreased pulmonary function (ACGIH, 1991; EPA, 1997). The toxicity of occupational exposure to dusts of aluminum pyro powders is somewhat higher, and occupational exposure to salts such as the sulfate and chloride may yield hydrolysis to the corresponding acids. Pulmonary effects were also observed in animals exposed to powders and dusts of metallic aluminum and various aluminum compounds.

Results of testing Canadian gold and uranium miners prophylactically treated with aluminum oxide powders to prevent silicosis associated aluminum exposure with impaired cognitive performance (EPA, 1997). The likelihood of cognitive impairment was directly related to the duration of exposure. Neurological performance was also impaired in aluminum foundry workers exposed to fumes and aluminum dust (4.6 to 11.5 mg aluminum/m^3) for a mean of 12 years. Other studies also implicate aluminum as a cause of neurological impairment and neurophysical effects in exposed smelter workers and aluminum welders. A provisional inhalation RfC is based on the LOAEL of 4.6 mg aluminum/m^3 in the study of foundry workers

described above. The lower end of the exposure concentration adjusted for intermittent exposure is 1.64 mg/m^3. Application of an uncertainty factor of 300 yields an RfC of 5E-3 mg/m^3, which is equivalent to an inhalation RfD of 1.4E-3 mg/kg-day. Confidence in the inhalation RfC is medium. The nervous system is the target organ for inhalation exposure to aluminum.

Data were not located regarding the carcinogenicity of exposure to aluminum.

References for Aluminum

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ANTIMONY (7440-36-0)

Antimony is a naturally occurring brittle **metal** that is not readily fabricated (ATSDR, 1992). It is alloyed with lead and other metals, imparting hardness, mechanical strength, corrosion resistance, electrochemical stability, and decreasing the coefficient of friction. Major applications include its use in grid metal in acid storage batteries, solder, sheet metal and pipe, bearing metal, castings and type metal. Antimony trioxide is used as a fire retardant in plastics and textiles. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	K_d (L/kg)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
121.75	NA	NA	ND	NA	NA	NA	I[a]

NA = not applicable; ND = no data; I = insoluble in hot or cold water
[a] Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.

Antimony is naturally present in the earth's crust and is released to the environment in windblown dust, from volcanic eruptions, sea spray, forest fires, and biogenic sources (HSDB, 2000). The majority of antimony released to the environment arises from anthropogenic sources, including nonferrous metal mining, smelting and refining, and the production, use and disposal of antimony alloys and compounds. Coal combustion and refuse and sludge combustion are other major anthropogenic sources of antimony.

Antimony released to the atmosphere adsorbs to small particles, which may travel great distances before gravitational settling or removal (ATSDR, 1992; HSDB, 2000). Removal is primarily by wet and dry deposition. Antimony released to surface water generally sorbs to particulates and settles out in the benthic sediment. The fate of antimony released to soil depends on the form released and the nature of the soil. Generally, antimony sorbs strongly to soil and sediment, the extent correlated with the content of iron, manganese, and aluminum in the soil with which it coprecipitates as hydroxylated oxides. There appears to be little potential for mobility (leaching) in most soils, except that antimony in landfills or in sewage sludge applied to sandy soil may exhibit considerable mobility. Also, pH excursions substantially above or below neutrality may release antimony from soil or sediment.

Biotransfer factors for antimony are compiled below:

BCF (L/kg)	Bpr (unitless)	Bpv (unitless)	Bb (days/kg)	Bm (days/kg)
1[a]	3.0E-2[b]	2.0E-1[b]	1.0E-3[b]	1.0E-4[b]

ND = no data.
[a]U.S. Environmental Protection Agency (EPA), 1986, ***Superfund Public Health Evaluation Manual***, Office of Emergency and Remedial Response, Washington, DC, OSWER Directive 9285-4-1, EPA/540/1-86/060, PB87-183125, October.
[b]Baes, C.F., R.D. Sharp, A.L. Sjoreen, R.W. Shor, 1984, ***A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture***, Health and Safety Division, Oak Ridge National Laboratory, ORNL-5786, September.

Estimates of the GI absorption of antimony tartrate and antimony trichloride by animals range from two to seven percent (ATSDR, 1992); ten percent is recommended as a reference value for humans for GI absorption of antimony tartrate. Although empirical data are lacking, one percent is recommend for other forms of antimony. The key study for development of the chronic oral

RfD used potassium antimony tartrate (EPA, 2000); therefore, the GAF of ten percent (0.1) is chosen for this evaluation.

Data were not located regarding the extent of dermal uptake of antimony from soil. The default ABS of 0.01 for metals (OEPA, 1998) is used herein. The EPA (1992) default PC of metals of 1E-3 cm/hour is selected for antimony.

Acute intoxication from ingestion of large doses of antimony induces GI disturbances, dehydration and cardiac effects in humans (Iffland, 1988). Chronic effects from occupational exposure include irritation of the respiratory tract, pneumoconiosis, pustular eruptions of the skin called "antimony spots", allergic contact dermatitis, and cardiac effects, including abnormalities of the ECG and myocardial changes. Cardiac effects were also observed in rats and rabbits exposed by inhalation for six weeks and in animals (dogs, and possibly other species) treated by intravenous injection (Elinder and Friberg, 1986). The data are not sufficient for estimation of an inhalation RfD.

Chronic oral exposure studies in laboratory animals include two briefly reported lifetime drinking water studies in rats and mice (EPA, 2000). The only dose tested, 5 parts per million (ppm) potassium antimony tartrate, resulted in reduced longevity in both species and in reduced mean heart weight in the rats. EPA (2000) verified an RfD of 4E-4 mg/kg-day for chronic oral exposure to antimony from the LOAEL of 5 ppm potassium antimony tartrate (0.35 mg antimony/kg body weight-day) in the lifetime study in rats. An uncertainty factor of 1000 was applied; factors of 10 each for inter- and intraspecies variation and to estimate a no-observed-adverse-effect level (NOAEL) from a LOAEL. Confidence in the oral RfD is low. The heart is considered a likely target organ for chronic oral exposure of humans.

Data were not located regarding the carcinogenicity of antimony to humans. Antimony fed to rats did not produce an excess of tumors (Goyer, 1991), but a high frequency of lung tumors was observed in rats exposed by inhalation to antimony trioxide for one year (Elinder and Friberg, 1986). Antimony is classified in EPA cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans) (EPA, 1987).

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ARSENIC (7440-38-2)

Arsenic is a natural **metalloid** that occurs in both inorganic and organic forms (ATSDR, 1993). Inorganic arsenic is more toxic than organic forms. Major uses in the U.S. include its incorporation into wood preservatives and other agricultural chemicals. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	K_d (L/kg)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
74.92 (element)	NA	NA	2.9E+1[a]	NA	NA	Note 1[b]	Note 2[b]

NA = not applicable
Note 1: Variable: inorganic arsenic compounds are not likely to volatilize; some organic arsenic compounds are low-boiling liquids or gases at normal temperatures.
Note 2: Variable: inorganic arsenic compounds range from practically insoluble to freely miscible in water; most organic arsenic compounds are not readily soluble, most arsenic acid compounds are soluble to freely miscible.
[a]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.
[b]Agency for Toxic Substances and Disease Registry, (ATSDR), 1993, ***Update Toxicological Profile for Arsenic***, U.S. Public Health Service, Atlanta, Georgia, April.

The major source of arsenic release to the environment is from copper, zinc and lead smelting operations (HSDB, 2000). Releases also occur from several other industries that use arsenic.

Arsenic occurs in the air as a combination of trivalent and pentavalent forms almost entirely adsorbed to small particles that permit dispersion over long distances (ATSDR, 1993). Removal is largely by wet and dry deposition. Arsenic in surface water can undergo a variety of transformations and exist in several soluble forms. Sorption to sediment is often an important removal process, but biotransformation in sediment may return soluble forms to the water. Arsenic in soil generally exists as insoluble forms sorbed to clay or organic matter or complexed with calcium or iron. Mobility is low and leaching is not generally significant.

Biotransfer factors for arsenic are compiled below:

BCF (L/kg)	Bpr (unitless)	Bpv (unitless)	Bb (days/kg)	Bm (days/kg)
20[a]	6.0E-3[b]	4.0E-2[b]	2.0E-3[b]	6.0E-5[b]

[a]U.S. Environmental Protection Agency (EPA), 1998, ***Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Volume Two***, Peer Review Draft, Office of Solid Waste and Emergency Response, Washington, DC, EPA530-D-98-001B, July.
[b]Baes, C.F., R.D. Sharp, A.L. Sjoreen, R.W. Shor, 1984, ***A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture***, Health and Safety Division, Oak Ridge National Laboratory, ORNL-5786, September.

Several studies confirm that soluble inorganic arsenic compounds and organic arsenic compounds are nearly completely (>90%) absorbed from the GI tract in both animals and humans (Ishinishi et al., 1986). The absorption efficiency of insoluble inorganic arsenic compounds depends on particle size and stomach pH. The GAF of 0.95 (EPA, 1993) is adopted for this evaluation.

Data regarding the dermal uptake of arsenic were not located. The default ABS of 0.01 for metals (OEPA, 1998) is used herein. The EPA (1992) default PC for metals of 1E-3 cm/hour is selected for arsenic.

Inorganic arsenic may be an essential nutrient, exerting beneficial effects on growth, health and feed conversion efficiency (Underwood, 1977). A lethal dose of arsenic trioxide in humans is 70-180 mg (≈50-140 mg arsenic (Ishinishi et al., 1986). Acute oral exposure of humans to high doses of arsenic produces liver swelling, skin lesions, disturbed heart function and neurological effects. The only noncancer effects in humans clearly attributable to chronic oral exposure to arsenic are dermal hyperpigmentation and keratosis, as revealed by studies of several hundred Chinese exposed to naturally occurring arsenic in well water (EPA, 2000). Similar effects were observed in persons exposed to high levels of arsenic in water in Utah and the northern part of Mexico. EPA (2000) verified an RfD of 3E-4 mg/kg-day for chronic oral exposure, based on a NOAEL of 8E-4 mg/kg-day for hyperpigmentation and kertatosis of the skin from the Chinese data. An uncertainty factor of 3 was applied. An increased incidence of Blackfoot disease was also observed, which may not be related to arsenic alone. Goyer (1991) describes black-foot

disease as a peripheral vascular disorder manifested as acrocyanosis and Raynaud's disease, which may progress to gangrene. Confidence in the RfD is medium. EPA (2000) notes that the skin is the more sensitive target organ. Nonetheless, in keeping with EPA (1989) guidance regarding selection of target organ, both the skin and peripheral vascular system are selected as target organs for prolonged oral exposure to arsenic.

Occupational (predominantly inhalation) exposure is also associated with neurological deficits, anemia, and vascular effects (Ishinishi et al., 1986), but concomitant exposure to other chemicals cannot be ruled out. The data are not sufficient for estimation of an inhalation RfC.

Inorganic arsenic is clearly a carcinogen in humans. Inhalation exposure is associated with increased risk of lung cancer in persons employed as smelter workers, in arsenical pesticide applicators, and in a population residing near a pesticide manufacturing plant (EPA, 2000). Oral exposure to high levels in well water is associated with increased risk of skin cancer (EPA, 2000). Extensive animal testing with various forms of arsenic given by many routes of exposure to several species, however, has not demonstrated the carcinogenicity of arsenic. EPA (2000) classified inorganic arsenic in cancer weight-of-evidence Group A (human carcinogen), and recommended an oral SF of 1.5E+0 per mg/kg-day, based on the incidence of skin cancer in the Chinese study. EPA (2000) noted that the uncertainties associated with the oral unit risk are considerably less than those for most carcinogens, so that the unit risk might be reduced an order of magnitude. An inhalation URF of 4E-3 per $\mu g/m^3$, equivalent to an inhalation SF of 1.5E+1 per mg/kg-day, was derived for inorganic arsenic from the incidence of lung cancer in occupationally exposed men.

References for Arsenic

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CHROMIUM

Chromium is a naturally occurring **metal** (7440-47-3). It occurs in several valence states; chromium (III) (16065-83-1) and chromium (VI) (18540-29-9) are the forms most commonly encountered in the environment. Chromium is used largely in the metallurgical, refractory and chemical industries (ATSDR, 1998). The largest amount is used in the metallurgical industry in various steels and nonferrous alloys. The second largest use is by the chemical industry in such products as pigments, metal finishing, leather tanning and wood treatment. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	K_d (L/kg)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
52.00 (element)	NA	NA	1.8E+6 (CrIII) 1.9E+1 (CrVI)[a]	NA	NA	ND	Note 1[b]

NA = not applicable, ND = no data.
Note 1: Chromium compounds vary from insoluble to soluble.
[a]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.
[b]Agency for Toxic Substances and Disease Registry, (ATSDR), 1998, ***Toxicological Profile for Chromium***, U.S. Public Health Service, Atlanta, Georgia, July.

Chromium is released into the atmosphere from natural gas, oil and coal combustion, and from use by the industries mentioned above (ATSDR, 1998). Other sources include wind transport from road dust, cement producing plants, the wearing down of asbestos brake linings from automobiles, incineration of municipal refuse and sewage sludge, exhaust emission from automotive catalytic converters, and emissions from cooling towers that use chromium

compounds as rust inhibitors. Chromium from these sources exists in a particulate form that may travel great distances from the point of emissions; wet and dry deposition account for the majority of removal from air. Most chromium released to surface water eventually adsorbs to particles and becomes deposited in bottom sediment, but small quantities may remain in the water in both soluble and insoluble forms. Chromium in aquatic media is unlikely to bioaccumulate significantly. Chromium in soil is present mainly as insoluble oxides that are unlikely to be mobile to any significant extent. Soluble forms may also be present, depending on the form of the chemical released, that may be quite mobile in soil.

Biotransfer factors for chromium are compiled below:

BCF (L/kg)	Bpr (unitless)	Bpv (unitless)	Bb (days/kg)	Bm (days/kg)
16[a]	4.5E-3[b]	7.5E-3[b]	5.5E-3[b]	1.5E-3[b]

ND = no data.
[a]U.S. Environmental Protection Agency (EPA), 1986, ***Superfund Public Health Evaluation Manual***, Office of Emergency and Remedial Response, Washington, DC, OSWER Directive 9285-4-1, EPA/540/1-86/060, PB87-183125, October.
[b]Baes, C.F., R.D. Sharp, A.L. Sjoreen, R.W. Shor, 1984, ***A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture***, Health and Safety Division, Oak Ridge National Laboratory, ORNL-5786, September.

A review of several studies suggests that 0.4 to 14.5 percent of orally administered chromium is absorbed by the GI tract of humans, but valence and chemical form and nutritional status (fed vs fasting) appear to influence efficiency of absorption (ATSDR, 1998). The toxicity studies on which the oral RfDs on IRIS for chromium (III) and chromium (VI) are based were performed with rats. The oral RfD for chromium (III) is based on dietary exposure; the oral RfD for chromium (VI) is based on drinking water exposure. Ingestion in both cases is expected to have been gradual throughout the day. Studies reviewed by ATSDR (1998) suggest that GI absorption in rats approximates 1 percent. A GAF of 0.01 VI is selected for this evaluation.

Quantitative data regarding dermal absorption of chromium were not located; therefore, the default ABS of 0.01 (OEPA, 1998) is adopted. The EPA (1992) empirically determined PC of 1E-3 cm/hour for sodium dichromate is selected for chromium compounds for this evaluation.

Chromium (III) is an essential nutrient involved in maintenance of normal fat, cholesterol and glucose metabolism (ATSDR, 1998). EPA (2000) verified an RfD of 1.5E+0 mg/kg-day for chronic oral exposure to chromium (III) by applying an uncertainty factor of 1000 to a NOEL of 1800 g/kg (1.468 mg/kg body weight/day) as an average total ingested dose in a dietary study in which rats were given 600 feedings of chromic oxide baked into bread. No other dose levels were tested. Confidence in the RfD is low. No target organ was identified for the toxicity of oral exposure to chromium (III).

EPA (2000) verified an RfD for chronic oral exposure to chromium (VI) of 3E-3 mg/kg-day based on a NOAEL of 25 mg/L (2.5 mg/kg body weight/day) in the drinking water of rats exposed for one year. An uncertainty factor of 900 was applied. Confidence in the oral RfD is low.

The data summarized by EPA (2000) are insufficient to identify a mechanism of toxicity or target organ(s) for chronic oral exposure to chromium (VI). Data from other sources, however, are sufficient to identify potential target organs. Goyer (1991) reported that renal tubular necrosis is the major effect in humans from ingestion of chromium compounds. The context, however, suggests that this effect is associated with acute exposure to high doses (e.g., accidental or attempted suicide ingestion); therefore, the kidney is not an acceptable candidate as a target organ for chronic oral exposure. Furthermore, a review of human and animal studies by EPA (1998a) did not implicate the kidney as a target organ for chronic oral exposure. EPA (1998a), however, reported GI effects in a cohort of 155 Chinese villagers who consumed water from a well located adjacent to a chromium alloy plant. Symptoms included oral ulcers, diarrhea, abdominal pain, indigestion and leukocytosis with a left shift. The dose rate of chromium (VI) was estimated at 0.57 mg/kg-day, nearly 200 times the oral RfD. It is likely that the GI symptoms reflect the irritant nature of chromium (VI).

EPA (1998a) also reviewed several reproductive studies. An early and inadequately conducted study reported no effects in rats fed a diet containing 0.125 percent K_2CrO_4. A diet containing 0.25 percent resulted in "subnormal condition" (including rough coat) and "subnormal" offspring; a diet containing 0.5 percent resulted in diarrhea and sterility. Assuming rats consume food equivalent to 5 percent of their body weight each day (EPA, 1980), dietary levels of 0.125, 0.25 and 0.5 percent correspond to chromium (VI) dose rates of 17, 33, and 67 mg/kg/day, respectively. A well controlled study reported slightly decreased erythrocyte size and hemoglobin content in rats and mice of either sex fed diets containing 400 ppm K_2CrO_4. The effects were interpreted as "suggestive of a potential bone marrow/erythroid response." The 400 ppm diet is equivalent to a chromium (VI) dose rates of 6.4 mg/kg-day in rats (EPA, 1998a) and approximately 11 mg/kg-day in mice, assuming that mice consume food equivalent to 10 percent of their body weight/day (EPA, 1980). In addition, cytoplasmic vacuolization of hepatocytes was observed in mice fed diets containing 50, 100 or 400 ppm K_2CrO_4, but it is not clear if either the incidence or intensity occurred in a dose-related manner. The 50 ppm diet, the lowest associated with hepatocellular vacuolization, is equivalent to a chromium (VI) intake rate of approximately 1.3 mg/kg-day. A subsequent study reported decreased erythrocyte hemoglobin content in female mice fed a diet containing 100 ppm K_2CrO_4, equivalent to a chromium (VI) dose rate of 6.0 mg/kg-day.

The GI signs reported in humans are clearly an indication of adverse effects; therefore, the GI tract is selected as a target organ. The mechanism of toxicity is assumed to be the irritation induced by tissue contact with chromium (VI). The slight hematologic changes observed in rats and mice and the hepatocellular vacuolization observed in mice do not appear to be sufficiently threatening to be considered adverse. They do, however, suggest that the bone marrow and the liver may be target organs as dose increases. Therefore, target organs selected for chronic oral exposure to chromium (VI) include the GI tract, bone marrow and liver.

The oral RfD for chromium (VI) is 500-fold lower than the oral RfD for chromium (III). No adverse effects, however, were observed for ingestion exposure to either chromium (VI) or chromium (III). The difference in the oral RfDs, therefore, arises solely from the available data, and does not reflect differences in the chronic toxicity of ingestion exposure to low levels of chromium (VI) and chromium (III). Furthermore, recent investigations reveal that ingested chromium (VI) is rapidly and virtually completely reduced to chromium (III) in the acid milieu of the stomach before reaching the blood stream (Kerger et al., 1997; Finley et al., 1997). Since there is no evidence of differences in toxicity, and since chromium (VI) is readily converted to chromium (III), the verified oral RfD of 1.5E+0 mg/kg-day for chromium (III) is likely to be sufficiently protective for chronic ingestion of chromium in either valence state, and is selected as the oral RfD for total chromium for this evaluation.

Inhalation (occupational) exposure to chromium may induce respiratory symptoms, changes in lung function and irritation, erosion or perforation of the nasal septum, depending in part on the exposure level (EPA, 1993). No adverse effects were observed in workers exposed to 1E-3 mg/m^3 for 0.2 to 23.6 years (average 2.5 years). EPA (1998b, 2000) reviewed several human and animal studies, and determined that effects observed from inhalation exposure to chromium (VI) are not relevant to exposure to chromium (III). EPA (1998c) concluded that chromium (VI) is the only species of concern for inhalation exposure to chromium.

EPA (2000) developed separate chronic inhalation RfC values for human exposure to chromic acid mists and dissolved chromium (VI) aerosols, and for exposure to chromium (VI) particulates. A verified inhalation RfC of 8E-6 mg/m^3 for chromic acid mists and dissolved chromium (VI) aerosols is based on an adjusted LOAEL of 7.14E-4 mg/m^3 associated with atrophy of the nasal septum in occupationally exposed humans. An uncertainty factor of 90 was used. Confidence in the inhalation RfC is low. The upper respiratory tract is considered the target organ for inhalation exposure to chromic acid mists and dissolved chromium (VI) aerosols. The RfC is equivalent to an inhalation RfD of 2.3E-6 mg/kg-day.

Inhalation exposure to chromium (VI) particulates is associated with pneumocyte toxicity; i.e., with effects on the lungs themselves. EPA (2000) derived an RfC of 1E-4 mg/m^3 for chronic inhalation exposure to chromium (VI) particulates from an adjusted benchmark concentration of 3.4E-2 mg/m^3 associated with altered enzyme activity in bronchioalveolar lavage fluid from rats exposed to sodium dichromate dust intermittently for up to 90 days. An uncertainty factor of 300 was used. Confidence in the RfC is medium. The RfC is equivalent to a chronic inhalation RfD of 2.9E-5 mg/kg-day. The lung is considered to be the target organ for chronic inhalation exposure to chromium (VI) particulates.

EPA (1998c) notes that exposure to chromic acid mists and dissolved chromium (VI) aerosols is likely to be restricted to occupational settings and that most environmental exposures would involve exposure to chromium (VI) particulates. Chromium in soil was not speciated regarding valence in TNT Area B soil. Therefore, the inhalation RfC for chromium particulates of 1E-4 mg/m^3 equivalent to an inhalation RfD of 2.9E-5 mg/kg-day, will be used in this evaluation.

Chromium (VI) is classified in cancer weight-of-evidence group A based on the consistent finding of lung cancer in epidemiologic studies of occupationally exposed workers in chromate

production and the chrome pigment industry (EPA, 2000). There is no evidence that oral exposure to chromium (VI) induces cancer. An inhalation URF of 1.2E-2 per ug/m^3 equivalent to an inhalation SF of 4.2E+1 per mg/kg-day was based on increased risk of lung cancer deaths in chromate production workers.

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U.S. Environmental Protection Agency (EPA), 2000, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, OH, on line.

LEAD (7439-92-1)

Lead is a naturally occurring **metal** used in the manufacture of batteries, ammunition, and other metal products (ATSDR, 1993). Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	K_d (L/kg)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
207.2 (element)	NA	NA	ND	NA	NA	ND	9.9E+3[a]

NA = not applicable, ND = no data.
[a] Value for lead chloride as a typical lead salt (Agency for Toxic Substances and Disease Registry, [ATSDR], 1993, ***Update Toxicological Profile for Lead***, Draft for Public Comment, U.S. Public Health Service, Atlanta, Georgia, April.)

Lead may enter the environment during mining, ore processing, smelting, refining, use, recycling or disposal (ATSDR, 1993; HSDB, 2000). Emission from automobile exhaust was at one time the largest source of atmospheric lead. Natural sources are minor compared with anthropogenic sources. Generally the form of lead that enters the atmosphere is not known. However, metallic lead may be released from smelting and refining plants. Lead in air exists attached to small particles that may travel great distances before removal by wet or dry deposition. Lead deposited on or released to soil generally remains in the top 2 to 5 cm where it remains relatively immobile, although a small percentage may be present in soluble forms that are subject to leaching. Acid conditions increase the potential for leaching. Lead released to surface water tends to form salts that are only sparingly soluble. Deposition in bed sediment is the primary removal mechanism, although biomethylation may mobilize lead and return it to the water column. Soil and sediment act as sinks for anthropogenic releases of lead.

Lead in fish is localized in the mucus on the epidermis, the dermis, and scales so that the edible portions do not pose a hazard to human health (HSDB, 2000). Therefore, the BCF listed below probably overstates the danger to humans. Lead does not biomagnify through the aquatic or terrestrial food chains (ATSDR, 1993). Biotransfer factors for lead are compiled below:

BCF (L/kg)	Bpr (unitless)	Bpv (unitless)	Bb (days/kg)	Bm (days/kg)
49[a]	9.0E-3[b]	4.5E-2[b]	3.0E-4[b]	2.5E-4[b]

ND = no data.
[a]U.S. Environmental Protection Agency (EPA), 1986, ***Superfund Public Health Evaluation Manual***, Office of Emergency and Remedial Response, Washington, DC, OSWER Directive 9285-4-1, EPA/540/1-86/060, PB87-183125, October.
[b]Baes, C.F., R.D. Sharp, A.L. Sjoreen, R.W. Shor, 1984, ***A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture***, Health and Safety Division, Oak Ridge National Laboratory, ORNL-5786, September.

Studies in humans indicate that an average of 10 percent of ingested lead is absorbed, but estimates as high as 40% were obtained in some individuals (Tsuchiya, 1986). Nutritional factors have a marked effect on GI absorption efficiency. Children absorb ingested lead more efficiently than adults; absorption efficiencies up to 53% were recorded for children three months to eight years of age. Similar results were obtained for laboratory animals; absorption efficiencies of 5-10% were obtained for adults and ≥50% were obtained for young animals. Data were not located regarding dermal uptake of lead from soil. For purposes of this evaluation, the GAF of 0.1 (EPA, 1993) and the default ABS of 0.01 (OEPA, 1998) were chosen. The EPA (1992) recommended PC for lead compounds of 4E-6 cm/hour based on empirical data with lead acetate is used in this evaluation.

The noncancer toxicity of lead to humans has been well characterized through decades of medical observation and scientific research (EPA, 2000). The principal effects of acute oral exposure are gastrointestinal colic with diffuse paroxysmal abdominal pain (probably due to vagal irritation), anemia, and, in severe cases, acute encephalopathy, particularly in children (Tsuchiya, 1986). The primary effects of long-term exposure are neurological and hematological. Limited occupational data indicate that long-term exposure to lead may induce kidney damage. The principal target organs of lead toxicity are the nervous system and the erythrocyte. Some of the effects on the blood, particularly changes in levels of certain blood enzymes, and subtle neurobehavioral changes in children, appear to occur at levels so low as to be considered non-threshold effects. In part for this reason the EPA (1990, 2000) considered inappropriate the derivation of an RfD for chronic oral exposure.

The Integrated Exposure, Uptake Biokinetic Model (IEUBK) Version 0.99D (EPA, 1994a) is generally used to evaluate lead in children, the most sensitive receptor. The IEUBK model integrates lead uptake from inhalation, drinking water, diet, soil and dust ingestion, and ingestion of incidental sources such as chips of lead-based paint, and estimates blood lead concentrations over the first seven years of a child's life. Generally, it is considered that childhood blood lead levels below 10 µg/dL reflect minimal likelihood of adverse effects from exposure to lead. Since it is plausible that children could be present under most residential site-use scenarios, it is appropriate to use the IEUBK to establish target levels for lead in soil for residential use. EPA (1994b) used the IEUBK to estimate a lead concentration of 400 mg/kg in bare soil to which

children might be regularly exposed as the level below which further evaluation and exposure-reduction action is not necessary.

The IEUBK, however, does not address lead concentrations in media to which adults may be exposed in a non-residential site-use scenario. EPA (1996) adopted a model similar to the IEUBK to estimate blood lead concentrations in adult women in an occupational exposure scenario. The pregnant woman is assumed to be the member of the adult population most sensitive to exposure to lead because of the potential for developmental effects on the fetus. The EPA (1996) adult blood lead model estimates a lead concentration in soil of approximately 880 mg/kg as the level below which the 95th percentile fetal blood lead concentration would not exceed 10 µg/dL.

EPA (2000) classified lead in cancer weight-of-evidence Group B2 (probable human carcinogen), based on inadequate evidence in humans and sufficient animal evidence. The human data consist of several epidemiologic occupational studies that yield confusing results. All the studies lacked quantitative exposure date and failed to control for smoking and concomitant exposure to other possibly carcinogenic metals. Rat and mouse bioassays showed statistically significant increases in renal tumors following dietary and subcutaneous exposure to several soluble lead salts. Various lead compounds were observed to induce chromosomal alterations in vivo and in vitro, sister chromatid exchange in exposed workers and cell transformation in Syrian hamster embryo cells, to enhance simian adenovirus induction, and to alter molecular processes that regulate gene expression. EPA (2000) declined to estimate risk for oral exposure to lead because many factors (e.g., age, general health, nutritional status, existing body burden and duration of exposure) influence the bioavailability of ingested lead, introducing a great deal of uncertainty into any estimate of risk.

References for Lead

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U.S. Environmental Protection Agency (EPA), 1996, ***Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil***, Technical Review Workgroup for Lead, December.

U.S. Environmental Protection Agency (EPA), 2000, ***Integrated Risk Information System (IRIS)***, On-line, Environmental Criteria and Assessment Office, Cincinnati, OH.

MANGANESE (7439-96-5)

Manganese is a naturally occurring **metal** used in the manufacture of steel, and in other metallurgical processes, batteries, and various manganese-containing chemicals (Keen and Leach, 1988). Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	K_d (L/kg)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
54.94 (element)	NA	NA	ND	NA	NA	ND	Note1[a]

NA = not applicable, ND = no data.
Note 1: Manganous chloride as a typical manganese salt: 7.23E+5.
[a]Agency for Toxic Substances and Disease Registry, (ATSDR), 1992, ***Toxicological Profile for Manganese***, U.S. Public Health Service, Atlanta, Georgia, July.

Anthropogenic sources of atmospheric manganese include metal processing, disposal of manganese-containing materials, resuspension of manganese-containing soil dust, and formerly, the combustion of gasoline containing manganese anti-knock ingredients (ATSDR, 1992; HSDB, 2000). Manganese exists in the air bound to particles; dry deposition is the primary removal mechanism, although wet deposition may also be significant. Manganese in water exists as any number of sparingly soluble salts that attach to suspended sediment. Sedimentation is the

primary removal process. Soluble forms also exist and may be released from sediment. The extent of absorption to constituents of soil is highly variable. Low concentrations may occur in an irreversibly "fixed" form to clay, but higher concentrations often manifest considerable mobitity.

Biotransfer factors for manganese are compiled below:

BCF (L/kg)	Bpr (unitless)	Bpv (unitless)	Bb (unitless)	Bm (unitless)
See below	5.0E-2[a]	2.5E-1[a]	4.0E-4[a]	3.5E-4[a]

[a]Baes, C.F., R.D. Sharp, A.L. Sjoreen, R.W. Shor, 1984, ***A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture***, Health and Safety Division, Oak Ridge National Laboratory, ORNL-5786, September.

Manganese in aquatic systems tends to bioaccumulate more strongly in plants and lower trophic levels, and less strongly in edible fish. ATSDR (1992) reports BCFs of 10,000 to 20, 000 L/kg for marine and freshwater plants, 2500 to 6300 L/kg for phytoplankton, 300 to 5500 L/kg for marine algae, 800 to 830 L/kg for intertidal mussels, and 100 to 600 L/kg reported for fin fish. BCF values of 815 L/kg are recommended for shellfish and 350 L/kg are recommended for fin fish.

Keen and Leach (1988) and ATSDR (1992) reviewed the empirical data and reported that approximately three to five percent of dietary manganese is absorbed, regardless of the amount present in the diet. EPA (2000) selected five percent as a rough approximation of the extent of GI absorption. This value (0.05) is selected as the GAF for manganese.

The ABS of 0.01 is an OEPA (1998) default for metals for which empirical data are lacking. The EPA (1992) default PC of 1E-3 cm/hour for metals is used in this evaluation.

Manganese is nutritionally required in humans for normal growth and health (EPA, 2000). Humans exposed to approximately 0.8 mg manganese/kg-day in drinking water (28 mg/L) exhibited lethargy, increased muscle tonus, tremor and mental disturbances. The elderly appeared to be more sensitive than children. Oral treatment of laboratory rodents induces biochemical changes in the brain, but rodents do not exhibit the neurological signs exhibited by humans. Occupational exposure to high concentrations in air induce a generally typical spectrum of neurological effects, and increased incidence of pneumonia (ACGIH, 1991).

EPA (2000) derived an oral RfD for manganese of 1.4E-1 mg/kg-day from a NOAEL of 1.4E-1 mg/kg-day for neurologic effects from human dietary studies and an uncertainty factor of 1. Confidence in the RfD is medium. The oral RfD of 1.4E-1 mg/kg-day will be used for dietary items other than drinking water. EPA (2000) recommends that a modifying factor of 3 should be used to adjust the RfD for use when oral exposure involves drinking water and non-dietary

ingestion. The oral RfD resulting from application of the modifying factor, 4.7E-2 mg/kg-day, will be used for drinking water and incidental ingestion of non-dietary items, and will serve as the basis for developing the dermal RfD. The CNS is the target organ for chronic oral exposure to manganese.

EPA (2000) presents a verified chronic inhalation RfC of 5E-5 mg/m^3 (equivalent to an inhalation RfD of 1.4E-5 mg/kg-day) based on a LOAEL for neurological effects in occupationally exposed humans and an uncertainty factor of 1000. Confidence in the RfC is medium. The CNS is the target organ for inhalation exposure to manganese.

EPA (2000) classified manganese in cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans). Quantitative cancer risk estimates are not derived for Group D chemicals.

References for Manganese

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American Conference of Governmental Industrial Hygienists (ACGIH), 1991, ***Documentation of the Threshold Limit Values and Biological Exposure Indices***, Sixth Edition, ACGIH, Cincinnati, OH, pp. 876-878.

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Ohio Environmental Protection Agency (OEPA), 1998, ***U.S. NASA Plum Brook, Erie County, Ohio LD#: 322-0552, Risk Assessment Work Plans***, letter from R.E. Nabors, Site Coordinator, to L.S. Ingram, Department of the Army, June 22.

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ORGANIC CHEMICALS

ACETONE (67-64-1)

Acetone is a **VOC** used principally as an intermediate in chemical synthesis and as a solvent in a wide variety of applications (ATSDR, 1992; HSDB, 2000). Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
58.08	-0.22[a]	3.88E-5[b]	-0.24[b]	1.24E-1[b]	1.14E-5[b]	2.99E-1[a]	Miscible[b]

[a]U.S. Environmental Protection Agency (EPA), 1994, ***Technical Background Document for Soil Screening Guidance***, Review Draft, Office of Solid Waste and Emergency Response, Washington, DC, Publication No. 9355.4-17, EPA540/R-94/106, PB95-963532, November.
[b]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.

Acetone's production and use as a solvent in many applications may result in its release to the environment through various waste streams (HSDB, 2000). Its use as an extracting reagent and starting material or intermediate in the manufacture of chemical products will also lead to its release to the environment. Other important sources include vehicular exhaust, tobacco smoke, wood burning and pulping, refuse and polyethylene combustion, off-gassing from petroleum storage, and landfills (ATSDR, 1992). Acetone occurs naturally as a metabolic byproduct of plants and animals and is released into the atmosphere by animals, plants, and in volcanoes and forest fires. Municipal and industrial discharge to landfills may lead to soil contamination and, by leaching, groundwater contamination.

Acetone is expected to exist in the ambient atmosphere solely as a vapor, based on its high vapor pressure (ATSDR, 1992; HSDB, 2000). Vapor-phase acetone is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals and by photodecomposition by sunlight. Half-life estimates range from 22 to 80 days, suggesting the potential for long distance transport in the atmosphere. Acetone is expected to have very high mobility in soils based upon its low K_{oc}, indicating that the compound will leach readily to groundwater. Volatilization from moist or dry soil surfaces is expected to be a major transport process for acetone. Acetone is expected to biodegrade under aerobic and anaerobic conditions. Acetone in water is not expected to adsorb to suspended solids or sediment. Volatilization from water surfaces is expected to be an important environmental fate process. Acetone is not expected to participate significantly in food-chain pathways; therefore, biotransfer factors are not provided.

Acetone is "rapidly and almost completely absorbed" following oral administration to laboratory animals (ATSDR, 1992). Inhalation and urinary excretion studies with radiolabeled acetone orally administered to rats indicate GI absorption of at least 74 to 83 percent of the dose. This estimate does not account for C14 retained in the body. The upper end of the empirical range, 0.83, is selected as the GAF for this evaluation. Application of neat compound to the skin of humans results in fairly rapid absorption, as reflected in increased blood concentrations of acetone.

Data regarding dermal uptake from soil, however, were not located. The OEPA (1998) default ABS of 0.1 for organic chemicals is adopted for this evaluation. From the molecular weight and log K_{ow} provided above, a PC of 5.88E-4 cm/hour and a τ of 1.98E-1 hours are estimated by the method of EPA (1992).

Studies of workers exposed to acetone reveal irritation of the ocular and respiratory tract mucosa, and, at high concentrations, central nervous system (CNS) effects (ACGIH, 1991). Rats exposed by inhalation to high concentrations exhibit narcosis and slight decreases in organ and body weight, compared with controls, but no clinicopathological or histopathological evidence of organ damage. The data, however, are insufficient for derivation of an inhalation RfC for acetone.

Oral LD_{50} values for adult rats range from 5.8 to 10.7 g/kg, indicating that the acute toxicity of acetone is low (ATSDR, 1992). Prolonged oral exposure toxicity data are limited to a comprehensive 90-day gavage study in rats, in which 100 mg/kg-day was a NOEL and 500 mg/kg-day was a LOAEL associated with increased liver and kidney weight and tubular nephropathy (EPA, 2000). A verified RfD for chronic oral exposure of 1E-1 mg/kg-day was derived by applying an uncertainty factor of 1000 to the NOEL of 100 mg/kg-day. Confidence in the RfD is low. The liver and kidney are both considered to be target organs for prolonged oral exposure to acetone.

Acetone is classified as a cancer weight-of-evidence Group D compound (not classifiable as to carcinogenicity to humans), based on a lack of human or animal carcinogenicity data (EPA, 2000). Quantitative cancer potency estimates are not available for Group D chemicals.

References for Acetone

Agency for Toxic Substances and Disease Registry, (ATSDR), 1992, ***Toxicological Profile for Acetone***, Draft for Public Comment, U.S. Public Health Service, Atlanta, Georgia.

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AMINODINITROTOLUENES (ADNT)

The ADNTs, 2-amino-4,6-dinitrotoluene (35572-78-2) and 4-amino-2,6-dinitrotoluene (1946-51-0) are **SVOCs** that are present in environmental media presumably as microbial reduction

products of 2,4,6-trinitrotoluene (TNT) (ATSDR, 1993; HSDB, 2000). Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
Note[a]							
197.17	1.60[b]	4.57E-7[b]	3.20[b]	5.61E-2[c]	6.8E-6[d]	2.62E-7[b]	1.30E+2[b]

[a]The values provided herein (except for molecular weight and diffusivity in air) are for 2,4,6-trinitrotoluene, which is adopted as a surrogate based on structural similarity.
[b]Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[c]Calculated as described in Introduction to the Toxicity Profiles.
[d]Montgomery, J.H., 1996, ***Groundwater Chemicals Desk Reference, Second Edition***, Lewis Publishers, New York, pp. 1043-1044.

The ADNTs may be released to the environment as degradation products of TNT or similar compounds (HSDB, 2000).

Data regarding the environmental fate of the ADNTs were not located in the available literature. It is assumed, however, that the ADNTs may behave similarly to TNT because of the structural similarity of these compounds. Under this assumption, the ADNTs are likely to persist in soil; hydrolysis and volatilization are unlikely to be significant (HSDB, 2000). They are likely to occur almost entirely in the vapor phase in the atmosphere, and may be subject to direct photolysis and photochemical degradation.

The capability of microorganisms to biotransform TNT under aerobic conditions in water is well established; however, reduction rates under aerobic conditions are very slow (HSDB, 2000). It is unclear the extent to which the ADNTs may be subject to further microbial reduction. Photolysis, which is the most important removal process for TNT in surface water, may also be significant for the ADNTs. Hydrolysis and volatilization are not significant for TNT and also are not expected to be significant for the ADNTs. The extent of adsorption to suspended or benthic sediment is expected to be moderate.

Generally TNT is not expected to bioconcentrate in aquatic systems or participate significantly in food chain pathways under normal environmental conditions (HSDB, 2000). It is assumed that the ADNTs will not bioconcentrate significantly and biotransfer factors are not estimated.

Data regarding the extent of GI absorption of the ADNTs were not located in the available literature. ATSDR (1993) summarized the results of toxicokinetic studies in which a single oral dose of radiolabeled TNT was given to rats, mice, dogs and rabbits, and radiolabel was quantified in various body compartments 24 hours after dosing. The appearance of red pigment in the urine of the rats and mice indicated that absorption is rapid. Urinary recovery accounted for approximately 60 percent of the dose in rats, mice and dogs, and 74 percent of the dose in rabbits. The extent of urinary recovery may serve as a conservative estimate of the extent of GI

absorption. Assuming that the ADNTs may be absorbed to the same extent as TNT, the GAF for TNT of 0.6 is also adopted for the ADNTs.

Data regarding the extent of dermal uptake of the ADNTs from soil were not located. The OEPA (1998) default ABS of 0.1 for organic chemicals is adopted for this evaluation. A PC of 1.07E-3 cm/hour and a τ of 2.12E+0 hours are estimated from the data provided above by the method of EPA (1992).

Data regarding the acute toxicity of oral exposure to the ADNTs are limited to LD_{50} values. Oral LD_{50} values in rats and mice are summarized below (EPA, 1993a):

Oral LD_{50} Values in Rats (mg/kg)		
Chemical	Males	Females
TNT	1010	820
2-Amino-4,6-dinitrotoluene	2240	1394
4-Amino-2,6-dinitrotoluene	1360	959
Oral LD_{50} Values in Mice (mg/kg)		
TNT	1009	1014
2-Amino-4,6-dinitrotoluene	1522	1722
4-Amino-2,6-dinitrotoluene	1342	1495

The data suggest that the acute toxicity of the ADNTs is not greater than TNT.

Data were not located regarding the chronic oral toxicity of the ADNTs. EPA (1993a) evaluated the toxicity of TNT and the 2,4-dinitrotoluene, and concluded that TNT is the more appropriate surrogate for the ADNTs. A verified oral RfD for TNT of 5E-4 mg/kg-day is based on a LOAEL for liver effects of 0.5 mg/kg-day in a 26-week feeding study in dogs (EPA, 2000). An uncertainty factor of 1000 was applied to the LOAEL to derive the oral RfD. Data reviewed by ATSDR (1993) clearly identifies the erythrocyte (methemoglobinemia and hemolytic anemia) as another target for low-level exposure of mice, rats and dogs to TNT. Target organs for TNT; therefore, include the liver and erythrocyte. EPA (1993a) estimated a LOAEL for the ADNTs of 0.58 mg/kg-day by adjusting the TNT LOAEL of 0.5 mg/kg-day by the difference in molecular weight (MW) (i.e., MW of TNT divided by MW of ADNT). Application of an uncertainty factor of 10,000 yields a provisional RfD for chronic oral exposure of the ADNTs of 5.8E-5 mg/kg-day, which is rounded to 6E-5 mg/kg-day. The liver and erythrocyte are assumed to be the target organs for prolonged oral exposure to the ADNTs. Confidence in the provisional oral RfD is low.

EPA (1993b) classified the ADNTs in EPA cancer weight-of-evidence Group D, not classifiable as to carcinogenicity in humans, to reflect a total lack of human or animal data.

References for Aminodinitrotoluenes

Agency for Toxic Substances and Disease Registry (ATSDR), 1993, ***Toxicological Profile for 2,4,6-Trinitrotoluene***, Draft for Public Comment, U.S. Department of Health and Human Services, May.

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U.S. Environmental Protection Agency (EPA), 1993a, ***Risk Assessment Issue Paper for: Derivation of Oral RfD for 2-Amino-4,6-Dinitrotoluene (CASRN 35572-78-2) and 4-Amino-2,6-Dinitrotoluene (CASRN 19406-51-0) By Analogy to 2,4,6-Trinitrotoluene Systemic Toxicity Assessment***, National Center for Environmental Assessment, Cincinnati, OH, 23 February.

U.S. Environmental Protection Agency (EPA), 1993b, ***Risk Assessment Issue Paper for: Carcinogenicity of 2-Amino-4,6-Dinitrotoluene (CASRN 35572-78-2) and 4-Amino-2,6-Dinitrotoluene (CASRN 19406-51-0)*** , National Center for Environmental Assessment, Cincinnati, OH, 23 February.

U.S. Environmental Protection Agency (EPA), 2000, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, OH, on line.

AMINONITROTOLUENES

Several aminonitrotoluene isomers are possible; isomers for which CAS registry numbers are available include 2-amino-4-nitrotoluene (2-methyl-5-nitroaniline, 5-nitro-o-toluidine) (99-55-8), 2-amino-6-nitrotoluene (603-83-8), 3-amino-4-nitrotoluene (578-46-1), 4-amino-2-nitrotoluene (119-32-4) and 4-amino-3-nitrotoluene (89-62-3) (Howard and Neal, 1992). 2-Amino-4-nitrotoluene is used primarily as a chemical intermediate in the production of some azoic and diazo pigments (HSDB, 2000). Data regarding the uses of the other members of this class of organic compounds were not located. Henry's Law constants are not available for the aminonitrotoluenes; however, they are considered to be **SVOCs** because of their structural similarity to the dinitrotoluenes, which are also considered to be SVOCs. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
2-Amino-4-nitrotoluene							
152.16	1.96[a]	ND	2.44[a]	6.67E-2[b]	7.72E-6[b]	1.71E-8[a]	ND
2-Amino-6-nitrotoluene							
152.16	ND	ND	ND	6.67E-2[b]	7.72E-6[b]	ND	ND
3-Amino-4-nitrotoluene							
152.16	ND	ND	ND	6.67E-2[b]	7.72E-6[b]	ND	ND
4-Amino-2-nitrotoluene							
152.16	ND	ND	ND	6.67E-2[b]	7.72E-6[b]	ND	ND
4-Amino-3-nitrotoluene							
152.16	ND	ND	ND	6.67E-2[b]	7.72E-6[b]	ND	ND

ND = no data.
[a]Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[b]Calculated as described in Introduction to Toxicological Profiles.

Data regarding the release and environmental behavior of the aminonitrotoluenes are limited to 2-amino-4-nitrotoluene. However, it is likely that all the aminonitrotoluenes behave similarly in the environment. 2-Amino-4-nitrotoluene may be released to the environment during its manufacture and use as a dye intermediate and it may be released in the effluent from the manufacture of 2,4,6-trinitrotoluene (HSDB, 2000). It may also be formed in the environment as a result of anaerobic biodegradation of 2,4-dinitrotoluene. The compound also occurs naturally, and has been identified as a volatile flavor component of Idaho Russet Burbank baked potatoes.

2-Amino-4-nitrotoluene released to soil is not expected to hydrolyze (HSDB, 2000). 2-Amino-4-nitrotoluene is expected to have low mobility in soil due to covalent bonding to humates in soil, although estimated K_{oc} values suggest that it would be moderate mobility. Therefore, leaching to groundwater may be important, especially in soils with low humate content. Volatilization from dry soil surfaces is not expected to be a significant removal process.

2-Amino-4-nitrotoluene is not expected to hydrolyze in water (HSDB, 2000). Reaction with alkyl peroxy radicals may be a significant removal process; a half-life of 14 days has been estimated for this reaction. The potential exists for direct photolysis in sunlight, and the presence of algae may accelerate photochemical degradation. Adsorption to suspended solids and sediments by chemical bonding is expected to be significant.

2-Amino-4-nitrotoluene in air is expected to react with hydroxyl radicals (estimated vapor phase half-life of about 8 hours) and has the potential to undergo direct photolysis (HSDB, 2000). The compound is not expected to travel long distances in the atmosphere because of its relatively short residence time in air.

The relatively low log K_{ow} for 2-amino-4-nitrotoluene suggests that the compound is unlikely to bioconcentrate or bioaccumulate significantly (HSDB, 2000); therefore, biotransfer factors are not estimated for the aminonitrotoluenes.

Data regarding the GI absorption of the aminonitrotoluenes were not located in the available literature. However, as noted above, the aminonitrotoluene and dinitrotoluenes are similar in chemical structure. Empirical data using rats and mice indicates that the dinitrotoluenes are rapidly and essentially completely absorbed from the GI tract (ATSDR, 1997; EPA, 1992a, HSDB, 2000). Assuming that the aminonitrotoluenes behave similarly, a GAF of 1 is selected for the aminonitrotoluenes.

Data regarding the extent of dermal uptake of the aminonitrotoluenes from soil were not located. The OEPA (1998) default ABS of 0.1 for organic chemicals is adopted for this evaluation. From the data compiled above and the EPA (1992b) method, a PC of 5.54E-3 cm/hour and a τ of 7.41E-1 hours are estimated for 2-amino-4-nitrotoluene, which is applied to all the aminonitrotoluenes.

A 78-week dietary study in rats and mice provided information that was used to address the potential carcinogenicity of 2-amino-4-nitrotoluene (EPA, 1987). Data regarding the noncancer effects were not reported in sufficient depth to permit estimation of an RfD for chronic oral exposure.

Data regarding the effects of inhalation exposure to 2-amino-4-nitrotoluene were not located in the available literature. Inhalation and dermal exposure are expected to be significant in the occupational setting where the compound is produced or used (HSDB, 2000). The data are insufficient for developing an inhalation RfC.

EPA (1987, 1997) classified 2-amino-4-nitrotoluene in cancer weight-of-evidence Group C – possible human carcinogen – based on an increased incidence of liver carcinomas in male and female mice in the 78-week dietary study mentioned above. There was no evidence of carcinogenicity in the rats in the same study. Although the compound has a history of occupational exposure, there is no evidence to suggest a carcinogenic role in humans. An oral SF of 3.3E-2 per mg/kg-day was estimated from the liver carcinoma data in mice. The data are insufficient to develop potency factors for inhalation exposure.

<u>References for Aminonitrotoluenes</u>

Agency for Toxic Substances and Disease Registry, (ATSDR), 1997, ***Update Toxicological Profile for 2,4-Dinitrotoluene and 2,6-Dinitrotoluene***, Draft for Public Comment, U.S. Department of Health and Human Services, Atlanta, GA, September.

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U.S. Environmental Protection Agency (EPA), 1992a, ***Health Advisory for 2,4- and 2,6-Dinitrotoluene (DNT)***, Health and Ecological Criteria Division, Office of Water, Washington, DC.

U.S. Environmental Protection Agency (EPA), 1992b, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.

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DINITROBENZENES

The dinitrobenzenes are **SVOCs** that exist in three isomeric forms: 1,2-dinitrobenzene (ortho- or o- dinitrobenzene), 1,3-dinitrobenzene (meta- or m-dinitrobenzene), and 1,4-dinitrobenzene (para- or p-dinitrobenzene). The dinitrobenzenes are used in organic synthesis, particularly in the manufacture of dyes, in explosives, and as a camphor substitute in the production of celluloids (ACGIH, 1991; Lewis, 1997; HSDB, 2000). 1,3-Dinitrobenzene, the isomer most frequently encountered in the environment, is also used in the preparation of m-phenylenediamine, in the detection of 17-ketosteroids, in the production of aminocresols and other aromatic amines (HSDB, 2000). Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
1,2-Dinitrobenzene (528-29-0)							
168.11	1.58[a]	2.33E-6[b,c]	1.47[b]	6.24E-2[d]	7.9E-6[a]	5.13E-6[b,c]	1.32E+2[a]
1,3-Dinitrobenzene (99-65-0)							
168.11	1.49[a]	2.33E-6[b]	1.39[b]	6.24E-2[d]	7.9E-6[a]	5.13E-6[b]	5.0E+2[a]
1,-4-Dinitrobenzene (100-25-4)							
168.11	1.48[a]	4.79E-7[a]	1.36[b]	6.24E-2[d]	7.9E-6[a]	2.96E-7[a]	8.0E+1[a]

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)

ND = no data.
[a]Montgomery, J.H., 1996, ***Groundwater Chemicals Desk Reference, Second Edition***, Lewis Publishers, New York, pp. 421-426.
[b]Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[c]Value for 1,3-dinitrobenzene used as a surrogate (HSDB, 2000).
[d]Calculated as described in Introduction to Toxicity Profiles.

Environmental release of the dinitrobenzenes may result from their use as intermediates in organic syntheses, during the production of 2,4,6-trinitrotoluene (TNT) and in the production of dyes (ATSDR, 1993; HSDB, 2000). Its presence in environmental media at former ordnance works may reflect its formation as a degradation product of TNT. Dinitrobenzene released to soil may adsorb to clay but adsorption to soils that are not predominantly clay is expected to be weak. Therefore, the dinitrobenzenes are expected to be mobile or highly mobile in soil and may readily leach to groundwater. Volatilization from soil surfaces may occur but this expected to be slow. Reduction to aromatic amines may occur under anaerobic conditions.

The dinitrobenzenes are expected to exist largely in the vapor phase in air (ATSDR, 1993). These chemicals are expected to react with photochemically generated hydroxyl radicals with an estimated half-life of 14.15 hours (HSDB, 2000). Direct photolysis in the atmosphere may also occur, but a rate cannot be estimated.

The dinitrobenzenes may biodegrade in water and volatilization may occur, but these removal processes are expected to be slow (HSDB, 2000). Direct photolysis may also occur, but rate data are not available. Information was not located regarding partitioning to sediment.

The low log K_{ow} values for these compounds suggest that bioconcentration or bioaccumulation are unlikely to be important (HSDB, 2000). Empirical data for 1,4-dinitrobenzene supports this assumption; therefore, biotransfer factors are not estimated for the dinitrobenzenes.

Of the three dinitrobenzenes, toxicokinetic data are available only for the 1,3-isomer. Rabbits and rats treated with a single oral dose of radiolabeled 1,3-dinitrobenzene excreted 63 to 80 percent of the radioactivity in the urine within 48 hours (ATSDR, 1993). This observation suggests that absorption from the GI tract is rapid; the 63 to 80 percent urinary excretion can be adopted as a minimal estimate of the extent of absorption. A GAF of 0.8 is adopted for all the dinitrobenzenes for the purposes of this evaluation.

The dinitrobenzenes are readily absorbed through the skin, either as solid, liquid, or vapor. However, data regarding the extent of dermal uptake from soil were not located. In the absence of empirical data, the OEPA (1998) default ABS of 0.1 for organic compounds is selected for this evaluation. From the MW and log K_{ow} values given above and the EPA (1992) method, PC and τ values are estimated as follows:

Chemical	PC (cm/hour)	τ (hours)
1,2-Dinitrobenzene	2.38E-3	9.28E-1
1,3-Dinitrobenzene	2.05E-3	9.28E-1
1,4-Dinitrobenzene	2.02E-3	9.28E-1

Acute oral LD_{50} values are limited to an LD_{50} of 83 mg/kg for 1,3-dinitrobenzene in rats (ATSDR, 1993; Montgomery, 1997; HSDB, 2000). Acute exposure is associated with cyanosis resulting from the oxidation of hemoglobin to methemoglobin in the erythrocytes. Methemoglobin is unable to release oxygen to the tissues resulting in tissue anoxia. Doses approximately one-half the oral LD_{50} are also associated with testicular degeneration and impaired fertility.

Prolonged oral exposure of laboratory animals to 1,3-dinitrobenzene is associated with reduced blood hemoglobin concentrations,equivocal evidence of neurotoxicity and testicular degeneration (ATSDR, 1993; EPA, 2000). EPA (2000) verified an RfD for chronic oral exposure of 1E-4 mg/kg-day based on a NOAEL of 3 ppm (0.4 mg/kg-day) in a 16-week drinking water study in male and female rats. An uncertainty factor of 3000 was applied to the NOAEL to derive the RfD. The LOAEL, 8 ppm, was associated with increased spleen weights, an indication of accelerated erythrocyte turnover. The concentration of 20 ppm was associated with decreased body weight gain in females, decreased hemoglobin concentrations and testicular atrophy in males, and splenic enlargement and hemosiderin deposits in both rats of either sex. The erythrocyte and testis are considered the target organs for prolonged oral exposure to 1,3-dinitrobenzene. Effects on the spleen are judged to be secondary to erythrocyte destruction. Confidence in the verified oral RfD is low.

Data regarding the toxicity of prolonged oral exposure to the other dinitrobenzene isomers was not located in the available literature. EPA (1997) derived a provisional oral RfD of 4E-4 mg/kg-day for 1,2-dinitrobenzene and 1,4-dinitrobenzene by analogy to 1,3-dinitrobenzene. Although it is not entirely clear, it appears that EPA (1997) applied an uncertainty factor of 1000 to the NOAEL of 0.4 mg/kg-day for 1,3-dinitrobenzene described above. Justification for using an uncertainty factor of 1000, rather than 3000, was not presented; however, HSDB (2000) notes that the meta isomer is the most important toxicologically, especially as a methemoglobin former.

Human (occupational) exposure to the dinitrobenzenes is associated with effects on the liver, aplastic anemia, yellowing of the skin, cornea and conjunctiva, and several overt symptoms including headache, burning pain and paresthesias in the feet, ankles, hands, and forearms, cyanosis, visual disturbance, central scotomas, bad taste, burning mouth, and dry throat (ACGIH, 1991; HSDB, 2000). The skin, conjunctiva, and ocular fundus may show bluish discoloration from formation of methemoglobin. Vision has been affected in numerous cases of occupational exposure. The vision fields have been slightly contracted, and visual acuity has been much reduced, with central scotomas, particularly for red and green. Partial optic atrophy has been

observed in some cases. Dermal exposure is thought to play a major role in the effects associated with occupational exposure (ACGIH, 1991). The data are insufficient for development of an inhalation RfC for any of the dinitrobenzenes.

EPA (2000) classifies 1,3-dinitrobenzene in weight-of-evidence cancer Group D – not classifiable as to human carcinogenicity because of a lack of relevant human or animal data. Data regarding the carcinogenicity of 1,2- or 1,4-dinitrobenzene were not located, and these isomers were not assigned to a cancer weight-of-evidence group. URFs and SFs are not available for any of the dinitrobenzenes.

References for Dinitrobenzene

Agency for Toxic Substances and Disease Registry (ATSDR), 1993, ***Toxicological Profile for 1,3-Dinitrobenzene and 1,3,5-Trinitrobenzene***, Draft for Public Comment, U.S. Department of Health and Human Services, May.

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Ohio Environmental Protection Agency (OEPA), 1998, ***U.S. NASA Plum Brook, Erie County, Ohio LD#: 322-0552, Risk Assessment Work Plans***, letter from R.E. Nabors, Site Coordinator, to L.S. Ingram, Department of the Army, June 22.

U.S. Environmental Protection Agency (EPA), 1997, ***Health Effects Assessment Summary Tables, FY 1997 Update***, Office of Solid Waste and Emergency Response, Washington, DC, 9200.6-303(97-1), EPA 540/R-97-036, PB97-921199.

U.S. Environmental Protection Agency (EPA), 2000, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, OH, on line.

DINITROTOLUENE (DNT)

The dinitrotoluenes are **SVOCs** that are used predominantly as intermediates in the production of polyurethanes, dyes, rubber, plastics, toluidines, toluenediisocyanates, flexible and rigid foams, surface coatings, and other organic chemicals (ATSDR, 1997; HSDB, 2000). Another use is as a gelatinizing and waterproofing agent in the production of explosives. The dinitrotoluenes may appear in environmental media as break down products of 2,4,6-trinitrotoluene. Isomers include 2,3-, 2,4-, 2,5-, 2,6-, 3,4- and 3,5-dinitrotoluene. The compounds of most interest in environmental exposure include 2,4- and 2,6-dinitrotoluene. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
2,3-Dinitrotoluene (602-01-7)							
182.1	2.0[a]	ND	2.46[a]	5.91E-2[b]	6.85E-6[b]	ND	ND
2,4-Dinitrotoluene (121-14-2)							
182.1	1.98[c]	9.27E-8[d]	1.98[d]	2.03E-1[d]	7.06E-6[d]	2.29E-7[e]	2.70E+2[d]
2,5-Dinitrotoluene (619-15-8)							
182.1	2.0[a]	ND	2.46[a]	5.91E-2[b]	6.85E-6[b]	ND	ND
2,6-Dinitrotoluene (606-20-2)							
182.1	1.72[c]	7.46E-7[d]	1.84[d]	3.27E-2[d]	7.26E-6[d]	7.47E-7[e]	1.82E+2[d]
3,4-Dinitrotoluene (610-39-9)							
182.1	2.0[a]	ND	2.46[a]	5.91E-2[b]	6.85E-6[b]	ND	ND
3,5-Dinitrotoluene (618-85-9)							
182.1	2.28[a]	3.97E-7[a]	2.62[a]	5.91E-2[b]	6.85E-6[b]	ND	ND

ND = no data.
[a]Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[b]Calculated as described in Introduction to the Toxicity Profiles.
[c]U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.
[d]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.
[e]U.S. Environmental Protection Agency (EPA), 1994, ***Technical Background Document for Soil Screening Guidance***, Review Draft, Office of Solid Waste and Emergency Response, Washington, DC, Publication No. 9355.4-17, EPA540/R-94/106, PB95-963532, November.

The physical properties of 2,4-dinitrotoluene can be used for the dinitrotoluene mixture (25321-14-6) and for isomers where chemical-specific data are not available.

The dinitrotoluenes are released into the environment in waste streams from processes in which they are manufactured or used (ATSDR, 1997; HSDB, 2000). They may also be present as products of 2,4,6-trinitrotoluene degradation. Dinitrotoluenes released to soil are expected to have moderate mobility and may leach to groundwater. No information on biodegradation in soil was found; however, biodegradation may be an important fate process in soil based on the observation that all dinitrotoluene isomers are metabolized in surface water to which yeast extract was added. Dinitrotoluenes are not expected to hydrolyze in soils.

Dinitrotoluenes released to water, may sorb weakly to moderately to sediment (ATSDR, 1997; HSDB, 2000). Evaporation from water is not expected to be an important transport process.

Biodegradation may be an important fate process in water, as indicated above. Dinitrotoluenes in water may be susceptible to photolysis, based on the behavior of 2,4- and 2-6-dinitrotoluene, which had photolytic half-lives ranging from 2.7 to 43 hours (2,4-dinitrotoluene) or 0.2 hours (2,6-dinitrotoluene) in various water environments.

Dinitrotoluenes released to the atmosphere may be susceptible to direct and indirect photolysis (ATSDR, 1997; HSDB, 2000). The estimated vapor phase half-life in the atmosphere is 8 hours. Data regarding the partitioning of the dinitrotoluenes between particulate and vapor phase were not located.

Bioconcentration of the dinitrotoluenes is expected to be negligible (ATSDR, 1997); therefore, biotransfer factors are not estimated.

The rapid disappearance of radioactivity from the small intestine of rats following oral administration of radiolabeled 2,4- or 2,6-dinitrotoluene suggests that absorption from the GI tract is rapid and essentially complete (ATSDR, 1997; EPA, 1992a). Species differences in the excretion of dinitrotoluene, however, confound quantification of the extent of GI absorption. Fecal excretion and the GI tract (tissue + contents) accounted for 9.2 to 17.3 percent of the dose of radioactivity 24 hours after administration of radiolabeled 2,4-dinitrotoluene to rats, rabbits, dogs and monkeys, and 83.1 to 85 percent in mice in the same study (EPA, 1992a). Biliary excretion appears to have been more important in mice than in the other species tested. Somewhat different results were obtained in another study. The elimination and metabolism of a single oral 100 mg/kg dose of 2,4-dinitrotoluene (2,4-dinitrotoluene) in A/J mice was examined (HSDB, 2000). Four hours after oral administration, only 28.5% of the dose was excreted in the urine, which increased to 66% after 8 hours. Elimination via the feces was minimal (< 2.1% of the dose), suggesting that GI absorption is virtually complete. Together, the data for the 2,4-isomer suggest that the GI absorption of the dinitrotoluenes is virtually complete; the GAF of 1 is adopted for the dinitrotoluenes for this evaluation.

Data regarding dermal uptake from soil were not located; therefore, the OEPA (1998) default ABS of 0.1 for organic chemicals is chosen. PC and τ values are estimated as follows:

Chemical	PC (cm/hour)	τ (hours)
2,3-Dinitrotoluene	3.88E-3[a]	1.13E+0[a]
2,4-Dinitrotoluene	3.8E-3[b]	1.1E+0[b]
2,5-Dinitrotoluene	3.88E-3[a]	1.13E+0[a]
2,6-Dinitrotoluene	2.5E-3[b]	1.1E+0[b]
3,4-Dinitrotoluene	3.88E-3[a]	1.13E+0[a]
3,5-Dinitrotoluene	6.14E-3[a]	1.13E+0[a]

[a]Estimated from the data compiled above by the method of EPA (1992b).
[b]Taken from EPA (1992b).

Data regarding the toxicity of oral exposure to 2,3-dinitrotoluene is limited to the statement that the 2,4-, 2,6- and 3,4-isomers are more toxic to rats than the 2,3- or 2,5-isomers.

Acute oral exposure to 2,4-dinitrotoluene induces methemoglobinemia; dogs appear to be more sensitive than rats, which are more sensitive than mice (ATSDR, 1997). Oral LD_{50} values include 270 mg/kg for rats and 1630 mg/kg for mice. Subchronic or chronic oral exposure to 2,4-dinitrotoluene in rats is associated with depressed weight gain, reticulocytosis and splenic hemosiderosis, and decreased spermatogenesis (HSDB, 2000). Some rats had widespread and stiff-legged gaits and demyelination in the cerebellum and brain stem. A verified chronic oral RfD of 2E-3 mg/kg-day for 2,4-dinitrotoluene is based on neurotoxicity, hematologic effects and biliary tract hyperplasia in dogs given capsules containing the test substance for 2 years (EPA, 2000). Progressive paralysis, accompanied by degenerative lesions in the central nervous system, were observed in dogs treated with 10 mg/kg-day. Hematologic effects, including methemoglobinemia and its sequelae, were observed in dogs treated with 1.5 mg/kg-day, which is the LOAEL for this study. No adverse effects were observed in dogs treated with 0.2 mg/kg-day. Application of an uncertainty factor of 100 to the NOAEL of 0.2 mg/kg-day yields an RfD of 2E-3 mg/kg-day. Confidence in the RfD is high. The CNS, erythrocyte and liver appear to be the target organs for prolonged oral exposure, at least in dogs.

HSDB (2000) reports oral LD_{50} values for 2,5-dinitrotoluene of 707 mg/kg for rats and 1231 mg/kg for mice. Data regarding the effects of prolonged oral exposure were not reported.

Oral LD_{50} values for 2,6-dinitrotoluene for rats (665 mg/kg) and mice (714 mg/kg) are similar. Dogs, however, appear to be more sensitive than rodents in subchronic studies. A provisional oral RfD of 1E-3 mg/kg-day for 2,6-dinitrotoluene is based on a 13-week dietary study with 2,6-dinitrotoluene in dogs (EPA, 1997). The NOAEL in this study was 4 mg/kg-day, somewhat higher than the LOAEL for 2,4-dinitrotoluene. An uncertainty factor of 3000 was applied. The CNS, erythrocyte, liver and kidney appear to be the target organs for prolonged oral exposure to 2,6-dinitrotoluene. The oral data in dogs suggest that the 2,6-isomer is somewhat less toxic than the 2,4-isomer for prolonged oral exposure. The oral RfD for the 2,6-isomer, however, is less than the oral RfD for the 2,4-isomer. This apparent contradiction is an artifact of the lesser quality data base for 2,6-dinitrotoluene and, consequently, the higher uncertainty factor used to derive the RfD for the 2,6-isomer.

The verified oral RfD of 2E-3 mg/kg-day for 2,4-dinitrotoluene can be used for the other dinitrotoluene isomers for which data are not available.

Occupational studies indicate that acute exposure to dinitrotoluene causes methemoglobinemia, which produces headache, irritability, dizziness, weakness, nausea, vomiting, dyspnea, drowsiness, unconsciousness and, in extreme cases, death (ACGIH, 1991). Occupational exposure may lead to increased risk of ischemic heart disease, possibly arising from decreased

oxygen-carrying capacity of the blood. The data are insufficient to develop inhalation RfCs for the dinitrotoluene isomers.

EPA (2000) classified the 2,4-/2,6-dinitrotoluene mixture in EPA cancer weight-of-evidence Group B2 (probably human carcinogen) on the basis of multiple tumor types in male and female rats and renal tumors in male mice in several dietary studies. Occupational data provide no evidence of carcinogenicity, but the studies reviewed lack the power to reveal small differences in cancer risk (ACGIH, 1991). EPA (2000) verified an oral SF of 6.8E-1 per mg/kg-day for exposure to the 2,4-/2,6-dinitrotoluene mixture based on an increased incidence of a variety of tumors in female rats. The test material contained about 98 percent 2,4-dinitrotoluene and 2 percent 2,6-dinitrotoluene. Other studies suggest that much of the carcinogenicity of the mixture is the result of the 2,6-isomer. The B2 classification and the oral SF of 6.8E-1 per mg/kg-day are used in this evaluation for both 2,4- and 2,6-dinitrotoluene and the 2,4-/2,6-dinitrotoluene mixture. The data are insufficient for development of potency factors for inhalation exposure. Data are not available regarding the carcinogenicity of the other dinitrotoluene isomers.

References for Dinitrotoluenes

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U.S. Environmental Protection Agency (EPA), 2000, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, OH, on line.

METHYLENE CHLORIDE (DICHLOROMETHANE) (75-09-2)

Methylene chloride is a **VOC** used predominantly as a paint remover and as a solvent and flammability depressant in aerosol products such as coatings, paint removers, hair sprays, room deodorants, herbicides and insecticides (ATSDR, 1993). Methylene chloride is also used in the foam blowing of polyurethanes, in metal degreasing, stripping and degreasing of electronic components, in resin production, photographic film splicing, adhesive production, and other solvent, cleaning and thinning applications. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
84.9	1.25[a]	2.19E-3[b]	1.07[b]	1.01E-1[b]	1.17E-5[b]	4.87E-1[c]	1.30E+4[b]

[a]U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.
[b]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.
[c]U.S. Environmental Protection Agency (EPA), 1994, ***Technical Background Document for Soil Screening Guidance***, Review Draft, Office of Solid Waste and Emergency Response, Washington, DC, Publication No. 9355.4-17, EPA540/R-94/106, PB95-963532, November.

Methylene chloride is highly volatile; therefore, most environmental releases are to the atmosphere (ATSDR, 1993). Large amounts (several hundred million pounds) are released each year during its industrial and consumer use. Methylene chloride exists solely as a vapor in air and may travel long distances before removal. It is subject to reaction with photochemically generated hydroxyl radicals with a half-life of a few months. It is also subject to direct photolysis (HSDB, 2000).

Methylene chloride released to soil will be highly mobile and will infiltrate or leach to greater depths or to groundwater (ATSDR, 1993; HSDB, 2000). Some will also volatilize. Methylene chloride released to water will be rapidly lost primarily by volatilization. It is not expected to partition to sediment. It is subject to hydrolysis and biodegradation, but these processes are less significant than volatilization. Methylene chloride is not expected to participate significantly in food-chain pathways; therefore, biotransfer factors are not provided.

Animal studies indicate that methylene chloride is readily absorbed from the GI tract (ATSDR, 1993). The GAF of 1.0 suggested by Jones and Owen (1989) is consistent with the ATSDR (1993) summary and is used in this evaluation.

Data were not located for dermal uptake of methylene chloride from soil. The OEPA (1998) default ABS of 0.1 for organic chemicals is adopted for this evaluation. EPA (1992) provides a PC of 4.5E-3 cm/hour and a τ of 2.9E-1 hours for methylene chloride.

Oral LD_{50} values in rats and mice approximate 2 g/kg, suggesting that the acute toxicity of methylene chloride is moderate (ATSDR, 1993). Prolonged oral exposure induces liver lesions in laboratory animals. EPA (2000) verified an RfD for chronic oral exposure of 6E-2 mg/kg-day by applying an uncertainty factor of 100 to a NOAEL of about 6 mg/kg-day in a two-year drinking water study in rats. The LOAEL, about 55 mg/kg-day, was associated with histopathologic lesions in the liver. Confidence in the RfD is medium. The liver is the target organ for oral exposure to methylene chloride. In addition, metabolism of the dihalogenated methanes is known to yield carbon monoxide, which combines with hemoglobin to form carboxyhemoglobin in the erythrocytes. Carboxyhemoglobin is incapable of transporting oxygen to the tissues. This mechanism of toxicity should also be considered when combining hazard indices for simultaneous exposure to multiple chemicals.

Occupational exposure to high concentrations of methylene chloride is associated with a wide variety of neurological dysfunction and elevated blood levels of carbon monoxide (a metabolite of methylene chloride) and carboxyhemoglobin (ACGIH, 1991). Chronic inhalation exposure of laboratory animals induces liver effects. EPA (1997) derived a provisional inhalation RfC of 3E+0 mg/m^3 based on a NOAEL of 695 mg/m^3 in a two-year intermittent exposure study in rats. An uncertainty factor of 100 was used. Higher levels were associated with unspecified effects on the liver. The RfC is equivalent to an inhalation RfD of 8.6E-1 mg/kg-day. The liver is considered the target organ for prolonged inhalation exposure. In addition, metabolism of the dihalogenated methanes is known to yield carbon monoxide, which combines with hemoglobin to form carboxyhemoglobin in the erythrocytes. Carboxyhemoglobin is incapable of transporting oxygen to the tissues. This mechanism of toxicity should also be considered when combining hazard indices for simultaneous exposure to multiple chemicals.

Methylene chloride is classified in EPA cancer weight-of-evidence Group B2 (probable human carcinogen), based on inadequate human data and sufficient evidence of carcinogenicity in animals (EPA, 2000). Animal inhalation studies showed increased incidence of hepatocellular neoplasms and alveolar/bronchiolar neoplasms in male and female mice, mammary tumors in rats of either sex, salivary gland sarcomas in male rats and leukemia in female rats. Oral studies were inconclusive. An oral SF of 7.5E-3 per mg/kg-day was based on the incidence of liver tumors in two inhalation studies in mice. An inhalation URF of 4.7E-7 per ug/m^3 was based on the incidence of liver and lung tumors in one inhalation study. The inhalation URF is equivalent to 1.6E-3 per mg/kg-day.

References for Methylene Chloride

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NITROANILINES

There are three nitroaniline isomers: 2-nitroaniline (o-nitroaniline), 3-nitroaniline (m-nitroaniline) and 4-nitroaniline (p-nitroaniline). The nitroanilines are **SVOCs** used as chemical intermediates for the synthesis of a wide range of red, yellow and orange pigments and dyes (HSDB, 2000). 2-nitroaniline is also used in the synthesis of photographic antifogging agents, and 2- and 4-nitroaniline are used in the synthesis of phenylenediamine coccidiostats for treatment of poultry. 3-nitroaniline is used also in the production of 3-amnoacetanilide. 4-nitroaniline is also used to improve the fastness of dyes, and as an intermediate in the synthesis of antioxidants and gasoline gum inhibitors. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
2-Nitroaniline (88-74-4)							
138.13	1.85[a]	1.81E-8[a]	1.79[a]	ND	7.8E-6[b]	1.16E-6[a]	1.47E+3[a]
3-Nitroaniline (99-09-2)							
138.13	1.37[a]	7.2E-9[a]	1.94[a]	ND	7.8E-6[b]	4.76E-8[a]	9.10E+2[a]
4-Nitroaniline (100-01-6)							
138.13	1.39[a]	1.81E-8[a]	1.93[a]	ND	7.8E-6[b]	4.21E-9[a]	2.80E+2[a]

ND = no data.
[a]Hazardous Substance Data Bank (HSDB), 1999, National Library of Medicine, on line.
[b]Montgomery, J.H., 1996, ***Groundwater Chemicals Desk Reference, Second Edition***, Lewis Publishers, New York, pp. 757-764.

2-Nitroaniline may be released to the environment in waste effluents generated at sites of its commercial production or use as a chemical intermediate (HSDB, 2000). It may also occur as a microbial decomposition product of dinitrobenzene. 3-Nitroaniline may be released to the

environment from process and waste emissions involved in its production or use as a chemical intermediate. 4-Nitroaniline may be released to the environment from process and waste emissions involved in its production or use as a chemical intermediate and through stack emissions from hazardous waste incineration.

The nitroanilines released to the atmosphere are expected to exist in the vapor phase and degrade rapidly (estimated half-life of 14 hours to 1.2 days) by reaction with photochemically produced hydroxyl radicals (HSDB, 2000). Nitroanilines released to soil may undergo covalent bonding to humic materials, which may convert these compounds to a latent form that remains relatively immobile in soil. If this covalent bonding does not occur, the nitroanilines are expected to leach readily through soils. Photodegradation may occur on soil surfaces exposed to sunlight. Volatilization of the nitroanilines is not expected to be important in either moist or dry soils.

Nitroanilines will covalently bind with humic materials in the water column and sediments (HSDB, 2000). Photodegradation in the aquatic environment may be possible, but hydrolysis, volatilization, and biodegradation are not expected to be important removal processes.

Empirical data suggest that the nitroanilines have little potential for bioconcentration or bioaccumulation (HSDB, 2000). Therefore, biotransfer factors are not estimated for this class of compounds.

The fate of radiolabelled 4-nitroaniline was studied in male and female Sprague-Dawley rats treated by gavage with 6.10-7.76 mg/kg (HSDB, 2000). Urine, feces, and expired air were collected at intervals of 0-8, 8-16, 16-24, 24-48, and 48-72 hours following dosing. Animals were sacrificed at 72 hours following dosing. The majority of the radioactivity was found in the urine (98.24 to 97.96 percent of the dose) and most of this was excreted in the 0-8 hour period. The amount of radioactivity found in the feces ranged from 3.78 to 5.83 percent of the dose. The total amount of radioactivity found in the expired air ranged from 0.01 to 0.07 percent of the dose. These data suggest that the nitroanilines are nearly completely absorbed from the GI tract; a GAF of 0.95 is adopted for the nitroanilines.

3-Nitroaniline is readily absorbed through intact skin (HSDB, 2000); however, data regarding dermal uptake from soil were not located. The OEPA (1998) default ABS of 0.1 for organic chemicals is selected for this evaluation. PC and τ values are developed from the data compiled above by the EPA (1992) method as follows:

Chemical	PC (cm/hour)	τ (hours)
2-Nitroaniline	5.64E-3	6.09E-1
3-Nitroaniline	2.57E-3	6.09E-1
4-Nitroaniline	2.66E-3	6.09E-1

Oral LD_{50} values for 2-nitroaniline include 1600 to 3650 mg/kg in rats, 2350 mg/kg in guinea pigs and 1070 mg/kg in mice (HSDB, 2000; Montgomery, 1996), suggesting that the acute toxicity is low. Prolonged oral exposure to 2-nitroaniline is associated with methemoglobinemia. EPA (no date #1) provides a provisional oral RfD for 2-nitroaniline of 3E-4 mg/kg-day by applying an additional uncertainty factor of 10 to a provisional oral RfD for 4-nitroaniline of 3E-3 mg/kg-day (EPA, no date #2). Confidence in the key study and data base for 4-nitroaniline are considered high. EPA (no date #1) declined to describe confidence in the provisional oral RfD for 2-nitroaniline, but notes that it is probably unnecessarily conservative because the evidence suggests that 4-nitroaniline is more potent than 2-nitroaniline. The provisional oral RfD for 4-nitroaniline is described below. The target organ for prolonged oral exposure to 2-nitroaniline is the erythrocyte; oxidation of hemoglobin to methemoglobin is the mechanism of toxicity.

Oral LD_{50} values for 3-nitroaniline include 535 to 900 mg/kg in rats, 540 mg/kg in guinea pigs and 308 mg/kg in mice (HSDB, 2000; Montgomery, 1996), suggesting that the acute toxicity of 3-nitroaniline is somewhat greater than 2-nitroaniline. 3-Nitroaniline induces methemoglobinemia in rats (HSDB, 2000). EPA (no date #2) provides a provisional oral RfD for 3-nitroaniline of 3E-4 mg/kg-day by applying an additional uncertainty factor of 10 to a provisional oral RfD for 4-nitroaniline of 3E-3 mg/kg-day. Confidence in the provisional oral RfD for 3-nitroaniline is low. The target organ for prolonged oral exposure to 3-nitroaniline is the erythrocyte; oxidation of hemoglobin to methemoglobin is the mechanism of toxicity.

Oral LD_{50} values for 4-nitroaniline include 750 mg/kg in rats, 450 mg/kg in guinea pigs and 810 mg/kg in mice (Montgomery, 1996), suggesting that the acute toxicity of 4-nitroaniline is somewhat greater than 2-nitroaniline. Prolonged oral exposure to 4-nitroaniline is associated with methemoglobinemia, with hemolytic anemia and increased hematopoiesis as common sequellae (EPA, no date # 2). Rats appear to be more sensitive than mice. A 2-year gavage study in rats identified 0.25 mg/kg-day as a NOAEL and 1.5 mg/kg-day as a LOAEL, with increased mortality at 9 mg/kg-day, the highest dose rate tested. The LOAEL was associated with increased blood methemoglobin concentration, decreased blood hemoglobin concentration, decreased erythrocyte count and increased reticulocyte count. Brown pigment deposits (probably hemosiderin associated with erythrocyte destruction) were observed in the liver and spleen. Application of an uncertainty factor of 100 to the NOAEL yields a provisional oral RfD for 4-nitroaniline of 3E-3 mg/kg-day. Confidence in the oral RfD is high. The target organ for prolonged oral exposure to 4-nitroaniline is the erythrocyte; oxidation of hemoglobin to methemoglobin is the mechanism of toxicity.

Occupational exposure to the nitroanilines is associated with methemoglobinemia and possibly liver damage (HSDB, 2000). A provisional inhalation RfC of 2E-4 mg/m^3 for 2-nitroaniline is based on a LOAEL of 9.8 mg/m^3 in a 4-week intermittent inhalation study in male rats (EPA, 1997). The LOAEL was associated with methemoglobinemia and increased hematocrit. An uncertainty factor of 10,000 was applied. The inhalation RfC is equivalent to an inhalation RfD of 5.7E-5 mg/kg-day. The target organ for prolonged inhalation exposure to 2-nitroaniline is the erythrocyte; oxidation of hemoglobin to methemoglobin is the mechanism of toxicity.

The EPA has not evaluated the carcinogenicity of the nitroanilines.

References for Nitroanilines

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U.S. Environmental Protection Agency (EPA), 1997, ***Health Effects Assessment Summary Tables, FY 1997 Update***, Office of Solid Waste and Emergency Response, Washington, DC, 9200.6-303(97-1), EPA 540/R-97-036, PB97-921199.

POLYAROMATIC HYDROCARBONS (PAHs)

The PAHs regularly observed in environmental media include acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, carbazole, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene and pyrene. All are **SVOCs** except acenaphthene, acenaphthylene and naphthalene, which are **VOCs**. PAHs are the products of incomplete combustion of fossil fuels or other organic matter, hence include both natural and anthropogenic sources (ATSDR, 1993a). Naphthalene is used in the synthesis of phthalic anhydride, the insecticide carbaryl, leather tanning agents and surface active agents, and is a component of diesel and other fuel oils (ATSDR, 1993b). The PAHs are ubiquitous, arising from natural combustion, the widespread practice of fossil fuel combustion, and wide dissemination via wind currents. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
Acenaphthene (83-32-9)							
154.21	3.98[a]	1.46E-4[b]	3.66[a]	6.61E-2[c]	6.4E-6[b]	2.9E-11[a]	I[a]

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
Acenaphthylene (208-96-8)							
154.2	4.07[a]	1.45E-3[a]	1.40[a]	6.61E-2[c]	6.6E-6[b]	3.82E-5[a]	3.93+0[a]
Anthracene (120-12-7)							
178.2	4.45[a]	8.6E-5[a]	4.15[a]	3.24E-2[d]	7.74E-6[d]	2.2E-8[a]	I[a]
Benzo(a)anthracene (56-55-3)							
228.29	5.66[e]	1E-6[a]	5.30[a]	5.10E-2[d]	9.00E-6[d]	2.9E-11[a]	I[a]
Benzo(a)pyrene (50-32-8)							
252.3	6.16[e]	4.9E-7[a]	6.74[a]	4.30E-2[d]	9.00E-6[d]	7.4E-12[a]	3.8E-3[a]
Benzo(b)fluoranthene (205-99-2)							
252.3	6.12[e]	1.22E-5[a]	5.74[a]	2.26E-2[d]	5.56E-6[d]	1.3E-9[a]	I[a]
Benzo(k)fluoranthene. (207-08-9)							
252.3	6.06[a]	3.87E-5[a]	5.74[a]	2.26E-2[d]	5.56E-6[d]	6.6E-10[a]	I[a]
Benzo(g,h,i)perylene (191-24-2)							
276.34	6.50[a]	1.44E-7[a]	6.20[a]	4.48E-2[c]	4.9E-6[b]	1.4E-13[a]	2.6E-3[a]
Carbazole (86-74-8)							
167.20	3.57[f]	1.53E-8[d]	3.53[d]	3.90E-2[d]	7.03E-6[d]	3.50E-7[f]	7.48E+0[d]
Chrysene (218-01-9)							
228.3	5.66[e]	1.05E-6[a]	5.30[a]	2.48E-2[d]	6.21E-6[d]	8.3E-12[a]	I[a]
Dibenzo(a,h)anthracene (53-70-3)							
278.35	6.84[e]	7.3E-8[a]	6.52[a]	2.02E-2[d]	5.18E-6[d]	8.2E-12[a]	5E-7[a]
Fluoranthene (206-44-0)							
202.26	4.95[e]	6.5E-6[a]	4.58[a]	3.02E-2[d]	6.35E-6[d]	6.6E-9[a]	2.06E-1[d]
Fluorene (86-73-7)							
166.2	4.18[a]	6.4E-5[a]	3.86[a]	3.63E-2[d]	7.88E-6[d]	9.3E-7[a]	1.83E+0[a]
Indeno(1,2,3-cd)pyrene (193-39-5)							
276.3	6.58[e]	6.95E-8[a]	6.20[a]	1.90E-2[d]	5.66E-6[d]	1.3E-12[a]	6.23E-2[a]
Naphthalene (91-20-3)							
128.19	3.30[e]	4.6E-4[f]	2.97[g]	5.90E-2[d]	7.50E-6[d]	1.14E-4[g]	3.17E+1[g]
Phenanthrene (85-01-8)							
178.2	4.57[e]	2.26E-4[a]	4.15[a]	6.00E-2[c]	5.9E-6[b]	1.3E-6[a]	I[a]

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
Pyrene (129-00-0)							
202.3	4.88[a]	5.1E-6[a]	4.58[a]	2.72E-2[d]	7.24E-6[d]	3.3E-9[a]	I[a]

I = virtually insoluble in water.
[a]Agency for Toxic Substances and Disease Registry (ATSDR), 1993a, ***Update Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs)***, Draft for Public Comment, U.S. Department of Health and Human Services, Atlanta, Georgia, October.
[b]Montgomery, J.H., 1996, ***Groundwater Chemicals Desk Reference, Second Edition***, Lewis Publishers, New York.
[c]Calculated as described in Introduction to the Toxicity Profiles.
[d]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.
[e]U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.
[f]U.S. Environmental Protection Agency (EPA), 1994, ***Technical Background Document for Soil Screening Guidance***, Review Draft, Office of Solid Waste and Emergency Response, Washington, DC, Publication No. 9355.4-17, EPA540/R-94/106, PB95-963532, November.
[g] Agency for Toxic Substances and Disease Registry, (ATSDR), 1993b, ***Update Toxicological Profile for Naphthalene***, Draft for Public Comment, U.S. Public Health Service, Atlanta, Georgia, October.

The PAHs are products of incomplete combustion; natural sources include volcanoes and forest fires (ATSDR, 1993a,b; HSDB, 2000). There is some evidence for biosynthesis by plants, bacteria and algae. Some of the PAHs occur naturally in fossil fuels. Anthropogenic releases to the environment, primarily to the atmosphere, greatly outweigh the natural sources and include any processes that involve incomplete combustion of fossil fuels and organic matter, including wood-burning for home heat (the predominant source), cigarette smoke, gasoline engine exhaust, diesel engine exhaust, and fuel oil emissions. Other sources include various crude oils, fresh and used motor oils, gasolines, charcoal-broiled foods, processed foods, various oils, margarine, butter and fats, fruits, vegetables, and cereals, roasted coffee and tea. Naphthalene is released during its manufacture and processes that involve its use (e.g., vaporization from moth balls). PAHs exist in the atmosphere as both gases and particulates, the proportion depending on the vapor pressure of the individual chemical. They may travel short or long distances before removal from the air. Wet and dry deposition accounts for removal of the particulates. Vapor forms are subject to chemical oxidation processes in the air.

The predominant sources of PAHs to surface water are deposition from the atmosphere, industrial and sewage effluent and oil spills (ATSDR, 1993a,b). Runoff and erosion can also contribute PAHs to surface water bodies. Depending on solubility and vapor pressure, volatilization is a significant fate process for some of the PAHs in surface water. Adsorption to sediment is another significant removal process. Low molecular weight PAHs (acenaphthene,

acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene) are subject to chemical degradation and biodegradation. Naphthalene is relatively water soluble and may remain largely in solution. PAHs in sediment may biodegrade or accumulate in living organisms.

Deposition is the principal source of PAHs in soil (ATSDR, 1993a,b). Other sources include industrial activities, disposal of sewage sludge, and leaching from coal storage sites. Most PAHs sorb to soil constituents because of their low solubility and high affinity for organic matter. Volatilization is an important removal process for the low molecular weight compounds. Some of the low molecular weight compounds, particularly naphthalene, may leach fairly rapidly to groundwater.

The propensity for the PAHs to participate in food-chain pathways is chemical specific, depending largely on the tendency for biodegradation or biotransformation (ATSDR, 1993a,b; HSDB, 2000). Biotransfer factors for the PAHs are compiled below:

BCF (L/kg)	Bpr[a,b] (unitless)	Bpv[a,b] (unitless)	Bb[a] (days/kg)	Bm[a] (days/kg)
Acenaphthene				
400[c]	1.94E-1	1.94E-1	2.40E-4	7.59E-5
Acenaphthylene				
272[d]	1.72E-1	1.72E-1	2.95E-4	9.33E-5
Anthracene				
675[c]	1.04E-1	1.04E-1	7.08E-4	2.24E-4
Benzo(a)anthracene				
350[e]	2.07E-2	2.07E-2	1.15E-2	3.63E-3
Benzo(a)pyrene				
480[e]	1.07E-2	1.07E-2	3.63E-2	1.15E-2
Benzo(b)fluoranthene				
2800[f]	1.12E-2	1.12E-2	3.31E-2	1.05E-2
Benzo(k)fluoranthene				
17,100[a]	1.22E-2	1.22E-2	2.88E-2	9.12E-3
Benzo(g,h,i)perylene				
14,000[a]	6.78E-3	6.78E-3	7.94E-2	2.51E-2
Carbazole				

BCF (L/kg)	Bpr[a,b] (unitless)	Bpv[a,b] (unitless)	Bb[a] (days/kg)	Bm[a] (days/kg)
500[g]	3.35E-1	3.35E-1	9.33E-5	2.95E-5
Chrysene				
700[f]	2.07E-2	2.07E-2	1.15E-2	3.63E-3
Dibenzo(a,h)anthracene				
10[e]	4.31E-3	4.31E-3	1.74E-1	5.50E-2
Fluoranthene				
4000[h]	5.33E-2	5.33E-2	2.24E-3	7.08E-4
Fluorene				
1500[h]	1.49E-1	1.49E-1	3.80E-4	1.20E-4
Indeno(1,2,3-cd)pyrene				
12,800[a]	6.09E-3	6.09E-3	9.55E-2	3.02E-2
Naphthalene				
ND[i]	4.79E-1	4.79E-1	5.01E-5	1.58E-5
Phenanthrene				
2250[a]	8.84E-2	8.84E-2	9.33E-4	2.95E-4
Pyrene				
785[h]	5.85E-2	5.85E-2	1.91E-3	6.03E-4

BCF (L/kg)	Bpr[a,b] (unitless)	Bpv[a,b] (unitless)	Bb[a] (days/kg)	Bm[a] (days/kg)

ND = no data.
[a]Calculated as described in Introduction to the Toxicity Profiles.
[b]The methodology for estimating biotransfer of organic chemicals to plants does not differentiate vegetative and reproductive portions.
[c]Empirical data in Bluegill Sunfish (Lepomis macrochirus) from Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[d]Estimated value from Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[e]Empirical data in golden ide fish (Leuciscus idus melanotus) from Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[f]Empirical data in clams from Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[g]Empirical data in guppies (Poecilia reticulata), from Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[h]Empirical data in fathead minnows, from Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[i]It is assumed that VOCs are labile and do not bioconcentrate significantly.

The BCFs for acenaphthylene, indeno(1,2,3-cd)pyrene, naphthalene and phenanthrene may be overestimated because the PAHs are generally readily metabolized by vertebrates, reducing the potential for bioconcentration (ATSDR, 1993a; HSDB, 2000). The BCF for benzo(b)fluoranthene is probably overestimated for fin fish because fin fish biotransform and eliminate PAHs much more readily than invertebrates.

Jones and Owen (1989) report that the GI absorption of naphthalene is 100 percent. The GAF of 1.0 from the Jones and Owen (1989) compilation is adopted for naphthalene. Toxicokinetic studies of several PAHs summarized by ATSDR (1993a) provide limited quantitative information regarding the extent of GI absorption. Qualitatively, these studies indicate that absorption is incomplete. A study of benzo(a)pyrene in rats suggested that GI absorption ranges from 38 to 58 percent. The GAF of 0.5 (Jones and Owen, 1989), near the midpoint of the range from the rat study, is selected for benzo(a)pyrene and the other PAHs for which quantitative data are not available. A study in rats reported absorption efficiency for anthracene ranging from 53 to 74 percent; 0.7 is selected as the GAF for this evaluation. GI absorption of pyrene, chrysene and dibenzo(a,h)anthracene is described as high; a GAF of 0.8 is assumed for these compounds.

Anecdotal evidence from using cloth diapers stored in contact with naphthalene indicates that naphthalene is absorbed by the skin, but quantitative data are not available (ATSDR, 1993b). Empirical data with pure compound dissolved or suspended in vehicles suggest that dermal uptake of benzo(a)pyrene is extensive (ATSDR, 1993a), but data regarding absorption from soil were not located. Lacking suitable empirical data for dermal uptake from soil, the OEPA (1998) default ABS of 0.1 for organic chemicals is chosen for the PAHs. PC and τ values are estimated as follows:

Chemical	PC (cm/hour)	τ (hours)
Acenaphthene	1.46E-1[a]	7.63E-1[a]
Acenaphthylene	1.69E-1[a]	7.63E-1[a]
Anthracene	2.25E-1[a]	1.07E+0[a]
Benzo(a)anthracene	8.1E-1[b]	2.23E+0[b]
Benzo(a)pyrene	1.2E+0[b]	2.9E+0[b]
Benzo(b)fluoranthene	1.2E+0[b]	3.03E+0[b]
Benzo(k)fluoranthene	1.11E+0[a]	3.03E+0[a]
Benzo(g,h,i)perylene	1.62E+0[a]	4.24E+0[a]
Carbazole	6.23E-2[a]	9.16E-1[a]
Chrysene	8.1E-1[b]	2.2E+0[b]
Dibenzo(a,h)anthracene	2.7E+0[b]	4.4E+0[b]
Fluoranthene	3.6E-1[b]	1.5E+0[b]
Fluorene	1.71E-1[a]	9.03E-1[a]
Indeno(1,2,3-cd)pyrene	1.9E+0[b]	4.2E+0[b]
Naphthalene	6.9E-2[b]	5.3E-1[b]
Phenanthrene	2.3E-1[b]	1.1E+0[b]
Pyrene	3.24E-1[a]	1.50E+0[a]

[a]Estimated by the method of U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.
[b]Taken from U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.

Data regarding the toxicity of acute oral exposure to the PAHs are generally scarce. Prolonged oral exposure to the PAHs is associated with a number of renal, hematologic and other effects, depending on the compound. However, data regarding prolonged exposure are not available for some PAHs, requiring the use of surrogates for development of toxicity values. Many of the PAHs for which toxicity data are not available are classified in EPA cancer weight-of-evidence Group D – not classifiable as to carcinogenicity to humans (EPA, 2000). It is inappropriate to develop cancer potency estimates for these PAHs because EPA (1986) determined that potency

estimates are developed only for chemicals in Groups A, B and C. Therefore, surrogates are used only to develop toxicity values for the noncancer effects.

Generally surrogates are chosen on the basis of the following hierarchy:

- Toxicological similarity (effects and dose-response relationship).
- Toxicokinetic similarity, assuming that likeness in absorption, distribution and especially products of biotransformation suggests toxicological similarity.
- Structural similarity, assuming that likeness in structure suggests similarity in toxicokinetics.

Selection of defensible surrogates for the PAHs is compromised because toxicological and toxicokinetic data are virtually non-existent, and the structural similarities are not very convincing, which imparts a great deal of uncertainty to the effort. Therefore, the most defensible approach for some of the PAHs is to select the most conservative surrogate; i.e., the PAH with the smallest verified oral RfD, which happens to be pyrene.

Subchronic (90 day) gavage treatment of mice with acenaphthene is associated with histopathologic evidence of liver hypertrophy. A verified RfD of 6E-2 mg/kg-day for chronic oral exposure was derived from the NOAEL of 175 mg/kg-day and an uncertainty factor of 3000 (EPA, 2000). The LOAEL in this study was 350 mg/kg-day. Confidence in the RfD is low. The liver is considered the target organ for prolonged oral exposure to acenaphthene.

A verified RfD of 3E-1 mg/kg-day for chronic oral exposure to anthracene was derived from a NOEL of 1000 mg/kg-day, the highest dose tested, in a 90-day gavage study in mice (EPA, 2000). An uncertainty factor of 3000 was applied. Confidence in the RfD is low. The data are inadequate to identify a target organ for prolonged oral exposure to anthracene.

Subchronic exposure to fluoranthene induces liver and kidney effects and hematologic alterations in orally treated mice (EPA, 2000). A verified RfD of 4E-2 mg/kg-day for chronic oral exposure was derived from a NOAEL of 125 mg/kg-day in a 13-week gavage study. The LOAEL was 250 mg/kg-day in this study. An uncertainty factor of 3000 was applied. Confidence in the oral RfD is low. The kidney, liver and blood cells are chosen as the target organs for prolonged oral exposure to fluoranthene.

Subchronic exposure to fluorene induces hemolytic anemia in orally treated mice (EPA, 2000). A verified RfD of 4E-2 mg/kg-day for chronic oral exposure was derived from a NOAEL of 125 mg/kg-day in a 13-week gavage study. The LOAEL was 250 mg/kg-day in this study. An uncertainty factor of 3000 was applied. Confidence in the oral RfD is low. The erythrocyte is the target organ for prolonged oral exposure to fluorene.

Single-dose LD_{50} values for naphthalene include 533 to 710 mg/kg for mice and 2200 to 2400 mg/kg for rats, establishing the mouse as more sensitive to the lethal effects of acute oral exposure (ATSDR, 1993b). Decreased terminal body weights, accompanied by a remarkable

absence of hematological and histopathological effects, were observed in rats treated by gavage for 13 weeks (EPA, 2000). The LOAEL in this study was 142 mg/kg-day associated with greater than 10 percent reduction in terminal body weights. The NOAEL was 71 mg/kg-day. The high dose rate, 286 mg/kg-day was a FEL associated with increased mortality. Application of an uncertainty factor of 3000 to the NOAEL of 71 mg/kg-day yields the verified oral RfD of 2E-2 mg/kg-day. Confidence in the RfD is low.

Adults, children and neonates exposed to moth balls have exhibited hemolytic anemia, evidence of liver disease and neurological deficits (EPA, 1993a, 1998). The liver effects and neurological deficits may be secondary to hemolytic anemia and reduced oxygen-carrying capacity of the blood. Hemolytic anemia and cataract formation have been seen also in orally exposed humans (EPA, 1998). The data suggest that the erythrocyte may be the most sensitive tissue in humans. Among commonly used species of laboratory mammals, hemolytic anemia is seen only in dogs (EPA, 1998). Cataracts are seen in several laboratory mammals, but only at relatively high doses. The key study identifies reduced body weight as the critical effect in rats. Rats, however, do not exhibit hemolytic anemia, and exhibit cataracts only at very high doses, suggesting that rats may not be a totally acceptable model for the toxicity of naphthalene to humans. Therefore, based on the effects observed in humans, the erythrocyte is selected as the target organ for prolonged oral exposure to naphthalene. Reduced body weight is also included as a "target organ" because this was the only endpoint observed in rats in the critical study with naphthalene.

EPA (1993a, 2000) reported a 2-year study in which mice were exposed to naphthalene vapors for 6 hours/day on 5 days/week. Inflammation of the nasal and olfactory epithelium was the most consistently observed sign; granulomatous lesions were also observed in the lungs. There was equivocal evidence of hematologic involvement. The lowest exposure concentration, 10 ppm, was a LOAEL for the nasal effects, which are considered the critical effects of inhalation exposure. The LOAEL is equivalent to a human equivalent concentration of 9.3 mg/m^3 (EPA, 2000). Application of an uncertainty factor of 3000 yields a verified RfC of 3E-3 mg/m^3, which is equivalent to an inhalation RfD of 8.6E-4 mg/kg-day. The nasal and olfactory epithelia are the target organ for inhalation exposure to naphthalene. Confidence in the RfC is medium.

Subchronic exposure to pyrene induces mild renal tubular degeneration and reduced kidney weight in orally treated mice (EPA, 2000). A verified RfD of 3E-2 mg/kg-day for chronic oral exposure was derived from a NOAEL of 75 mg/kg-day in a 13-week gavage study. The LOAEL was 125 mg/kg-day in this study. An uncertainty factor of 3000 was applied. Confidence in the oral RfD is low. The kidney tubule is chosen as the target organ for chronic oral exposure to pyrene.

Data regarding the effects of chronic or subchronic exposure to acenaphthylene were not located in the available literature. Acenaphthene is adopted as a reasonable surrogate for acenaphthylene based on structural similarity, since the surrogate differs from the principal chemical only in the presence of two hydrogen atoms and the absence of a double bond. Therefore, the oral RfD of 6E-2 mg/kg-day for acenaphthene is adopted as the oral RfD for chronic exposure to acenaphthylene. The liver, which is the target organ for acenaphthene, is adopted for oral exposure to acenaphthylene.

Data regarding the effects of chronic or subchronic exposure to benzo(g,h,i)perylene were not located in the available literature. Pyrene is adopted as a reasonable surrogate for benzo(g,h,i)perylene based somewhat on structural similarity, but more on the selection of a conservative approach as justified above. Therefore, the oral RfD of 3E-2 mg/kg-day for pyrene is adopted as the oral RfD for chronic exposure to benzo(g,h,i)perylene. The kidney tubule, which is the target organ for pyrene, is adopted for oral exposure to benzo(g,h,i)perylene.

Relevant data regarding chronic or subchronic exposure to phenanthrene were not located. Potential surrogates based on similarity in chemical structure include anthracene and pyrene. Pyrene is selected as the surrogate only because it is the more conservative choice. Therefore, the oral RfD of 3E-2 mg/kg-day for pyrene is adopted as the oral RfD for chronic exposure to phenanthrene. The kidney tubule, which is the target organ for pyrene, is adopted for oral exposure to phenanthrene.

Acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene and pyrene are classified in EPA cancer weight-of-evidence Group D (not classifiable as to carcinogenicity to humans) because of a lack of human data and inadequate animal data (EPA, 2000). Data regarding the carcinogenicity of acenaphthene were not located. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene are classified in EPA weight-of-evidence Group B2 (probable human carcinogens) (EPA, 1997, 2000). Benzo(a)pyrene is the most extensively studied member of the class, inducing tumors in tissues at the point of contact of virtually all laboratory species tested by all routes of exposure. Although epidemiology studies suggested that complex mixtures that contain PAHs (coal tar, soots, coke oven emissions, cigarette smoke) are carcinogenic to humans, the carcinogenicity cannot be attributed to PAHs alone because of the presence of other potentially carcinogenic substances in these mixtures (ATSDR, 1993a). In addition, recent investigations showed that the PAH fraction of roofing tar, cigarette smoke and coke oven emissions accounted for only 0.1-8% of the total mutagenic activity in *Salmonella* of the unfractionated complex mixture (Lewtas, 1988). Aromatic amines, nitrogen heterocyclic compounds, highly oxygenated quinones, diones, and nitrooxygenated compounds, none of which would be expected to arise from in vivo metabolism of PAHs, probably accounts for the majority of the mutagenicity of coke oven emissions and cigarette smoke. Furthermore, coal tar, which contains a mixture of many PAHs, has a long history of use in the clinical treatment of a variety of skin disorders in humans (ATSDR, 1993a).

Because of the lack of human cancer data, assignment of individual PAHs to EPA cancer weight-of-evidence groups is based largely on the results of animal studies with large doses of purified compound (EPA, 2000). Frequently, unnatural routes of exposure, including implants of the test chemical in beeswax and trioctanoin in the lungs of female rats, intratracheal instillation, and subcutaneous or intraperitoneal injection, were used.

EPA (2000) verified a SF for oral exposure to benzo(a)pyrene of 7.3E+0 per mg/kg-day, based on several dietary studies in mice and rats. Recent reevaluations of the carcinogenicity and mutagenicity of the Group B2 PAHs suggest that there are large differences between individual PAHs in cancer potency (Krewski et al., 1989). Based on the available cancer and mutagenicity data, and assuming that there is a constant relative potency between different carcinogens across

different bioassay systems and that the PAHs under consideration have similar dose-response curves, EPA (1993b) adopted relative potency values for several PAHs. These values and the corresponding oral SFs, based on a relative potency for benzo(a)pyrene of 1.0, are presented below.

Relative Potencies and Slope Factors for PAHs				
PAH	Relative Potency	Oral Slope Factor (/mg/kg-day)	Inhalation	
			Unit Risk (/µg/m^3)	Slope Factor (/mg/kg-day)
Benzo[a]pyrene	1.0	7.3E+0	8.8E-4	3.1E+0
Benzo[a]anthracene	0.1	7.3E-1	8.8E-5	3.1E-1
Benzo[b]fluoranthene	0.1	7.3E-1	8.8E-5	3.1E-1
Benzo[k]fluoranthene	0.01	7.3E-2	8.8E-6	3.1E-2
Chrysene	0.001	7.3E-3	8.8E-7	3.1E-3
Dibenzo[a,h]anthracene	1.0	7.3E+0	8.8E-4	3.1E+0
Indeno[1,2,3-cd]pyrene	0.1	7.3E-1	8.8E-5	3.1E-1

Although the EPA has not verified SFs for Group B2 PAHs other than benzo(a)pyrene, the SFs above represent reasonable estimates based on the data available. The relative potency approach employed here meets criteria considered to be desirable for this type of analysis (Lewtas, 1988). For example, the chemicals compared have similar chemical structures and would be expected to have similar toxicokinetic fate in mammalian systems. In addition, the available data suggest that the Group B2 PAHs have a similar mechanism of action, inducing frameshift mutations in *Salmonella* and tumor initiation in the mouse skin painting assay. Similar noncancer effects (minor changes in the blood, liver, kidneys) of the Group D PAHs support the hypothesis of a common mechanism of toxicity. Finally, the same endpoints of toxicity, i.e., potency in various cancer assays, and related data, were used to derive the relative potency values (Krewski et al., 1989). The oral SF for benzo(a)pyrene of 7.3E+0 per mg/kg-day, and the SFs presented above for the other Group B2 PAHs are adopted for the purposes of this evaluation.

A recent EPA (1994) evaluation of the inhalation cancer data suggests adoption of an inhalation SF for benzo(a)pyrene of 3.1E+0 per mg/kg-day, based on the incidence of upper respiratory and digestive tract tumors in hamsters. Applying the relative potency estimates presented above yield the inhalation SFs for the other Group B2 PAHs presented above.

Carbazole was not investigated in the relative potency investigations described above. EPA (1997) presents a provisional oral SF of 2E-2 per mg/kg-day based on the incidence of liver tumors in a 96-week dietary study in mice. The location of primary tumors distal to the point of contact (the GI tract) suggests a mechanism of toxicity different from benzo(a)pyrene and the

other Group B2 PAHs discussed above. The data are inadequate for estimation of an inhalation URF or SF for carbazole.

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TOLUENE

Toluene is a **VOC** that is back-blended into gasoline to improve octane rating, used to produce benzene, used as a solvent in paints, coatings, adhesives, inks and cleaning agents, and used in the synthesis of a wide range of organic chemicals (ATSDR, 1994; HSDB, 2000). Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
92.1	2.73[a]	6.63E-3[b]	2.26[b]	8.70E-2[b]	8.60E-6[b]	3.71E-2[c]	3.10E+2[b]

[a]U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.
[b]U.S. Environmental Protection Agency (EPA), 1996, ***Soil Screening Guidance: Users Guide***, Office of Solid Waste and Emergency Response, Washington, DC, Publication 9355.4-23, April.
[c]U.S. Environmental Protection Agency (EPA), 1994, ***Technical Background Document for Soil Screening Guidance***, Review Draft, Office of Solid Waste and Emergency Response, Washington, DC, Publication No. 9355.4-17, EPA540/R-94/106, PB95-963532, November.

Large amounts of toluene are released into the atmosphere each year, principally from the production, transport and use of gasoline (ATSDR, 1994; HSDB, 2000). Other major sources include volatilization of toluene-based solvents and thinners, and motor vehicle exhaust. Considerable amounts are discharged into waterways or spilled on land during the storage, transport and disposal of fuels and oils.

Toluene in the atmosphere will exist predominantly in the vapor phase , where it is subject to reaction with photochemically produced hydroxyl radicals (ATSDR, 1994; ATSDR, 2000). It is also subject to reaction with various oxidizing agents in the atmosphere, but these reactions are

far less significant. Wet deposition is another important process for removal of toluene from the atmosphere. Toluene is expected to be moderately to highly mobile in soil and may leach to groundwater. Volatilization is another important removal process for toluene near the surface of the soil. Biodegradation may also be significant in soil. Toluene in water will be lost by both volatilization to the atmosphere and biodegradation. Whic process predominates will depend on water temperature, mixing conditions and the existence of acclimated microorganisms at the site. The compound is not expected to sorb significantly to sediment or suspended organic matter in water. Toluene theoretically may be expected to bioconcentrate because of its lipophilicity (ATSDR, 1994), but empirical data show that it is subject to rapid biotransformation, which greatly reduces this tendency. Overall, biotransfer is not expected to be significant and biotransfer factors are not provided.

ATSDR (1994) reviewed data regarding the mechanism of absorption and concluded that toluene was readily absorbed from the GI tract, but provided no quantitative estimates. Jones and Owen (1989), however, reported an absorption efficiency of 1.0. This value is consistent with rapid absorption of lipophilic solvents and is adopted as the GAF for this evaluation. ATSDR (1994) noted that binding to soil slowed GI absorption but did not decrease the overall extent of GI absorption.

In the absence of quantitative data, the default ABS of 0.1 for organic compounds recommended by OEPA (1998) is adopted for this evaluation. EPA (1992) provides a PC of 4.5E-2 cm/hour and a τ of 3.2E-1 hours, which are used herein.

Acute inhalation (glue sniffing, solvent abuse, industrial accidents) or ingestion exposure to high levels of toluene induces CNS dysfunction and narcosis (ATSDR, 1994). Acute oral LD_{50} values include 2.6 to 7.5 g/kg in rats (HSDB, 2000). Acute ingestion is associated with lesions in the heart, liver, lungs and kidneys (ATSDR, 1994). Prolonged oral exposure to lower levels is associated with pathological changes in the liver, kidney and brain. Changes in liver and kidney weights were observed in rats treated by gavage for 13 weeks at a dose rate of 446 mg/kg-day (EPA, 2000). The NOAEL in this study was 223 mg/kg-day. Application of an uncertainty factor of 1000 yields a verified RfD of 2E-1 mg/kg-day for oral exposure. Confidence in the RfD is medium. The liver and kidney and brain are considered the target organs for oral exposure to toluene.

Prolonged (occupational) inhalation exposure to toluene at concentrations near 100 ppm induces upper respiratory tract irritation and CNS dysfunction (EPA, 2000). The CNS effects appear to be the more sensitive endpoint, and serve as the basis for a verified inhalation RfC of 4E-1 mg/m^3. The RfC is based on an exposure-adjusted LOAEL of 119 mg/m^3 and an uncertainty factor of 300. The RfC is equivalent to an inhalation RfD of 1.1E-1 mg/kg-day. Confidence in the RfC is medium. The CNS and upper respiratory tract are the target organs for inhalation exposure to toluene.

EPA (2000) verified toluene as a cancer weight-of-evidence Group D compound (not classifiable as to carcinogenicity to humans) based on a lack of human data and inadequate animal testing data.

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TRINITROBENZENES (TNB)

There are three TNB isomers; however, 1,3,5-TNB is the isomer most often found in environmental media. It is used as an explosive, being less sensitive to impact, but more powerful and brisant than 2,4,6-trinitrotoluene (TNT) (Budavari, 1989). The TNBs are considered to be **SVOCs** because of their MWs and Henry's Law constants. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
1,2,3-Trinitrobenzene							
213.11	ND	ND	ND	5.33E-2[a]	6.17E-6[a]	ND	ND
1,2,4-Trinitrobenzene							
213.11	ND	ND	ND	5.33E-2[a]	6.17E-6[a]	ND	ND
1,3,5-Trinitrobenzene (99-35-4)							
213.11	1.18[a]	3.08E-9[b]	2.15[b]	5.33E-2[a]	6.17E-6[a]	4.21E-9[b]	3.4E+2[b]

ND = no data.
[a]Calculated as described in Introduction to Toxicological Profiles.
[b]Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.

Data regarding the release and environmental behavior of the TNBs are limited to 1,3,5-TNB. It is likely that all the TNBs behave similarly in the environment. 1,3,5-TNB may be released to the environment primarily in wastewater from the manufacture of TNT or from the disposal of some TNT wastes (HSDB, 2000). It may also appear in environmental media as a product of TNT degradation.

1,3,5-TNB is expected to be moderately to highly mobile in soil (HSDB, 2000). The compound has the potential to photolyze on soil surfaces. Volatilization from soil surfaces is predicted to be an insignificant removal process. Insufficient data are available to predict the significance of biodegradation in soil.

1,3,5-TNB in water is likely to be subject to direct photolysis when exposed to sunlight (HSDB, 2000). Volatilization is not expected to be environmentally important removal processes. The compound may exhibit moderate to low adsorption to suspended solids and sediments. Insufficient data are available to predict the significance of biodegradation in water.

Based on its vapor pressure, 1,3,5-TNB is expected to exist partly in the vapor phase and partly adsorbed onto particulate matter in the atmosphere (HSDB, 2000). It may be subject to direct photolysis in the air. Its water solubility suggests that wet deposition may be a potential removal process.

The relatively low log K_{ow} and relatively high water solubility of 1,3,5-TNB suggest that the potential for bioconcentration or bioaccumulation is low. Therefore, biotransfer factors are not developed for the TNBs.

Data regarding the extent of GI absorption of the TNBs were not located in the available literature. ATSDR (1993) summarized the results of toxicokinetic studies in which a single oral dose of radiolabeled TNT was given to rats, mice, dogs and rabbits, and radiolabel was quantified in various body compartments 24 hours after dosing. The appearance of red pigment in the urine of the rats and mice indicated that absorption is rapid. Urinary recovery accounted for approximately 60 percent of the dose in rats, mice and dogs, and 74 percent of the dose in rabbits. The extent of urinary recovery may serve as a conservative estimate of the extent of GI absorption. Assuming that the TNBs may be absorbed to the same extent as TNT, the GAF for TNT of 0.6 is also adopted for the TNBs.

Data regarding the extent of dermal uptake of the TNBs from soil were not located. The OEPA (1998) default ABS of 0.1 for organic chemicals is selected for this evaluation. From the data compiled above and the EPA (1992) method, a PC of 6.57E-4 cm/hour and a τ of 1.75E+0 hours are estimated for 1,3,5-TNB, which is applied to all the TNB isomers.

Data regarding the effects of acute oral exposure to the TNBs were not located in the available literature. A verified RfD for chronic oral exposure to 1,3,5-TNB of 3E-2 mg/kg-day is based on a NOAEL of 2.68 mg/kg-day in a 2-year dietary study in rats (EPA, 1999). The LOAEL, 13.31 mg/kg-day, estimated from the highest dietary concentration tested (300 ppm) was associated with methhemoglobinemia accompanied by splenic erythroid cell hyperplasia. An uncertainty factor of 100 was used. Confidence in the RfD is medium. The erythrocyte is the target organ

for prolonged oral exposure to 1,3,5-TNB. The oral RfD for 1,3,5-TNB may also be applied to the other TNBs because the chemicals are structurally similar and chemical-specific data are not available.

Data regarding the toxicity of inhalation exposure to the TNBs were not located in the available literature; an inhalation RfC cannot be developed for any of the TNBs.

Data regarding the carcinogenicity of the TNBs were not located in the available literature. The TNBs are not assigned to a cancer weight-of-evidence group, and URFs and SFs are not available.

References for Trinitrobenzenes

Agency for Toxic Substances and Disease Registry (ATSDR), 1993, ***Toxicological Profile for 2,4,6-Trinitrotoluene***, Draft for Public Comment, U.S. Department of Health and Human Services, May.

Budavari, S, Ed., 1989, ***The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals***, Eleventh Edition, Merck & Co., Rahway, NJ.

Ohio Environmental Protection Agency (OEPA), 1998, ***U.S. NASA Plum Brook, Erie County, Ohio LD#: 322-0552, Risk Assessment Work Plans***, letter from R.E. Nabors, Site Coordinator, to L.S. Ingram, Department of the Army, June 22.

U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.

U.S. Environmental Protection Agency (EPA), 1999, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, OH, on line.

2,4,6-TRINITROTOLUENE (TNT) (118-96-7)

TNT is an **SVOC** classified as a high explosive and is used as a military explosive in bombs and grenades (ATSDR, 1993). It has found wide use in filling shells and airborne detonation bombs because it can withstand the shock of ejection from a gun barrel but can be exploded on impact with a detonator mechanism. It is used as a pure compound or combined with other explosive chemicals for military application. Small amounts are used in industrial explosives. Minor applications include use as a chemical intermediate in the manufacture of dyestuffs and photographic chemicals. Relevant physical properties are compiled below:

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)
227.13	1.60[a]	4.57E-7[a]	3.20[a]	ND	6.8E-6[b]	2.62E-7[a]	1.30E+2[b]

MW (g/mole)	log K_{ow} (unitless)	H (atm-m^3/mole)	log K_{oc} (unitless)	D_a (cm^2/s)	D_w (cm^2/s)	VP (atm)	S (mg/L)

ND = no data.
[a]Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.
[b]Montgomery, J.H., 1996, ***Groundwater Chemicals Desk Reference, Second Edition***, Lewis Publishers, New York, pp. 1043-1044.

TNT may be released to the environment in wastewater and air effluents from its production and use as a military explosive and propellant, and during the disposal or open detonation of outdated or unwanted munitions (ATSDR, 1993; HSDB, 2000). The behavior of TNT in the environment is expected to be controlled largely by its relatively high water solubility and relatively low vapor pressure. In addition, photolysis yields a large number of degradation products, many of which are persistent in environmental media.

Although low, the vapor pressure of TNT is sufficient to suggest that the compound will exist largely in the vapor phase in the atmosphere, where it is expected to be subject to photolysis (HSDB, 2000). Its solubility in water suggests that wet deposition may be a significant removal process.

TNT on the surface of soil is subject to photolysis (ATSDR, 1993; HSDB, 2000). Mobility in soil is expected to be low to moderate. Large quantities released to soil (e.g., from former munitions production works) may result in substantial concentrations in groundwater. TNT in soil is subject to degradation to a number of nitro reduction products (amino compounds, mono- and dinitro compounds).

TNT in surface water is subject to photolysis; volatilization and hydrolysis are not expected to be significant (ATSDR, 1993; HSDB, 2000). Photolysis gives rise to the persistent red or pink water condition frequently observed with TNT contamination. Biodegradation occurs too slowly to be an important removal process. TNT and some of its degradation products will partition moderately to sediment or suspended particles in water.

Bioconcentration or bioaccumulation are not expected to be significant for TNT (ATSDR, 1993; HSDB, 2000); therefore, biotransfer factors are not developed.

Pharmacokinetic data are limited to studies of oral administration of radiolabeled compound to several species followed by collection and measurement of radioactivity in urine, gastrointestinal tract (including contents) and feces (ATSDR, 1993). Total recovery from these compartments ranged from 92 to 104 percent, suggesting little metabolism to radioactive metabolites that were exhaled. The percent of the dose recovered in the urine is adopted as a minimal estimate of GI absorption, because the extent of biliary excretion and enterohepatic recirculation has not been investigated. Urinary recovery averaged 60 percent in rats, mice and dogs, and approximately 74 percent in rabbits. The 60 percent recovery in the urine of dogs is selected as the GAF for this evaluation.

Studies indicate that TNT is rapidly absorbed through the skin of occupationally exposed humans, but quantitative data were not located (ATSDR, 1993). Dermal absorption ranged from 17 to 68 percent of a single dose of radioactivity in studies using laboratory animals exposed for 24 hours to radiolabeled compound. Absorption appeared to be more complete in rabbits and mice than in rats and dogs, suggesting that species differences are significant. Data were not located regarding the dermal uptake of TNT from soil, which would account for the matrix effect, or the ability of soil to bind the chemical and retard its dermal uptake. In the absence of quantitative data, the default ABS of 0.1 for organic compounds recommended by OEPA (1998) is adopted for this evaluation. A PC of 1.07E-3 cm/hour and a τ of 2.12E+0 hours are estimated from the data provided above by the method of EPA (1992).

Information regarding the inhalation toxicity of TNT are limited to occupational studies, which probably also include dermal exposure, generally associated with the manufacture of explosives for World War I and World War II (ATSDR, 1993). Effects attributed to occupational exposure include deaths from liver disease and aplastic anemia, anemia, dermatitis and cataracts. The data are insufficient to derive an RfC for inhalation exposure to TNT.

The critical effect of prolonged oral exposure of animals to TNT is liver damage (EPA, 2000). Dogs appear to be more sensitive than rats or mice. A verified RfD for chronic oral exposure of 5E-4 mg/kg-day was derived from a LOAEL of 0.5 mg/kg-day associated with hepatic swelling and hepatocytomegaly in a 26-week feeding study in dogs. An uncertainty factor of 1000 was applied. Hemosiderosis, evidence of erythrocyte destruction, was observed in dogs treated at a dose rate as low as 2 mg/kg-day (ATSDR, 1993). Confidence in the oral RfD is medium.

Although the key study is described as a comprehensive and well designed subchronic study, only effects on the liver were reported by EPA (2000), presumably because the liver effects were the critical effects upon which the oral RfD is based. Specifically, observations regarding clinical chemistry, hematology, urinalyses, periodic electrocardiography and ophthalmic examinations were not reported. Additional information, however, indicates that anemia is one of the major signs of TNT toxicity consistently observed in rats, mice and dogs (ATSDR, 1993). TNT and/or its metabolites induce the oxidation of intracellular hemoglobin to methemoglobin, which results in erythrocytic hemolysis. Hemolytic anemia is followed by a compensatory response manifested primarily as reticulocytosis. Effects on the testes, including irreversible atrophy and decreased reproductive performance, apparently secondary to altered zinc and copper nutrition, are observed in rats treated with much higher dose rates (e.g., 125 mg/kg-day).

Target organs at or near the threshold for toxicity include the erythrocyte and liver. Effects on the erythrocyte arise from the oxidation of hemoglobin to methemoglobin, which is consistently observed with exposure to inorganic nitrates and nitrites, as well as with many other nitroaromatic compounds (HSDB, 2000). Mild effects on the liver occur at slightly lower doses; the mechanism of hepatotoxicity has not been elucidated. Effects on the testes at higher levels probably arise from reduced levels of circulating ceruloplasmin, which is necessary for proper zinc nutrition at the cellular level.

TNT is classified in EPA weight-of-evidence Group C (possible human carcinogen) on the basis of positive mutagenicity studies and dietary studies that showed an increased incidence of urinary

bladder tumors in rats (EPA, 2000). Human data are inadequate. An oral SF of 3E-2 per mg/kg-day is based on the incidence of bladder tumors in female rats in a 24-month dietary study. The data are inadequate for potency estimation for inhalation exposure.

References for 2,4,6-Trinitrotoluene

Agency for Toxic Substances and Disease Registry, (ATSDR), 1993, ***Toxicological Profile for 2,4,6-Trinitrotoluene***, Draft for Public Comment, U.S. Public Health Service, Atlanta, GA, May.

Hazardous Substance Data Bank (HSDB), 2000, National Library of Medicine, on line.

Ohio Environmental Protection Agency (OEPA), 1998, ***U.S. NASA Plum Brook, Erie County, Ohio LD#: 322-0552, Risk Assessment Work Plans***, letter from R.E. Nabors, Site Coordinator, to L.S. Ingram, Department of the Army, June 22.

U.S. Environmental Protection Agency (EPA), 1992, ***Dermal Exposure Assessment: Principles and Applications***, Interim Report, Office of Research and Development, Washington, DC, EPA/600/8-91/011B, January.

U.S. Environmental Protection Agency (EPA), 2000, ***Integrated Risk Information System (IRIS)***, National Center for Environmental Assessment, Cincinnati, OH, on line.

APPENDIX I

ECOLOGICAL REFERENCE INFORMATION

APPENDIX I.1

TABLE I-1, VASCULAR PLANT SPECIES OBSERVED ON SITE

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Acer negundo	box-elder maple	Frequent		Stream banks, ditches,	1
*Acer platanoides	Norway maple	Occasional		Disturbed woods	1
Acer rubrum	red maple	Common		Dry to moist woods	1, 2a, 2b
Acer saccharum	Sugar maple	Occasional		Dry to moist woods	2a
*Achillea millefolium	Yarrow	Frequent		Dry fields, roadsides, and	1, 2a, 2b
Agalinis purpurea	purple false-foxglove	Frequent		Moist openings and	1
Agrimonia parviflora	southern agrimony	Frequent		Moist fields and ditches	1, 2a, 2b
*Agropyron repens	Quack grass	Frequent		Old fields and roadsides	2b
Agrostis hyemalis	Ticklegrass	Occasional		Dry, grassy fields and	1
*Agrostis gigantea	Redtop	Common		Moist fields, ditches, and	1
Agrostis perennans	autumn bent-grass	Frequent		Dry woods and borders	1
Alisma subcordatum	water-plantain	Occasional		Ponds and ditches	1, 2b
*Alliaria petiolata	garlic mustard	Frequent		Dry to moist wood lots	1, 2a, 2b
*Allium canadense	Field garlic	Frequent		Dry to moist woods	2a
Ambrosia artemisiifolia	common ragweed	Frequent		Dry fields and roadsides	1
Ambrosia trifida	giant ragweed	Occasional		Dry fields and roadsides	1
Andropogon gerardii	big bluestem	Frequent		Dry to moist fields and	1
*Andropogon virginicus	broom-sedge	Occasional		Dry fields and roadsides	1, 2b
Antennaria parlinii	pussy-toes	Occasional		Dry fields and openings,	1
*Anthoxanthum odoratum	vernal-grass	Occasional		Dry fields and openings,	1
Apocynum cannabinum	Dogbane	Frequent		Dry to moist fields and	1
Apocynum sibiricum	Dogbane	Common		Dry to moist fields and	2b
*Arabidopsis thaliana	mouse-ear cress	Occasional		Road berms and about	1
*Arctium minus	Burdock	Occasional		Disturbed fields and	1
Arenaria lateriflora	grove sandwort	Rare	T	Woods along Ransom	1
Arisaema triphyllum	Jack-in-the-pulpit	Rare		Moist to dry woods	2a

Table I-1

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Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Aristida dichotoma	Churchmouse grass	Occasional		Dry fields and openings	1
Aristida longespica	slimspike triple-	Common		Dry fields and openings	1
Aristida oligantha	prairie triple-awned	Occasional		Dry openings and	1
*Artemisia ludoviciana	white sage	Occasional		Grassy roadsides	1
Asclepias hirtella	prairie milkweed	Common		Dry to moist openings	1
Asclepias sullivantii	Sullivant's milkweed	Rare		Moist field along Patrol	1
Asclepias syriaca	common milkweed	Frequent		Dry to moist fields and	1, 2a, 2b
Asclepias tuberosa	butterfly-weed	Occasional		Dry openings and	1
Aster ericoides	white heath aster	Rare		Grassy strip along Patrol	1
Aster laevis	smooth aster	Rare		White oak grove on Taft	1
Aster lateriflorus	calico aster	Common		Moist woods and thickets	1
Aster novae-angliae	New England aster	Occasional		Dry fields and roadsides	1
Aster pilosus	common white aster	Common		Dry fields, roadsides, and	1
Aster umbellatus	flat-top aster	Frequent		Dry to moist fields and	1
Baptisia lactea	prairie false indigo	Occasional	P	Dry openings in bunker	1
Baptisia tinctoria	yellow false indigo	Occasional		Dry openings in bunker	1
*Berberis thunbergii	Japanese barberry	Occasional		Woodland borders	1, 2a
Bidens coronata	northern tickseed-	Common		Moist fields and ditches	1
Boehmeria cylindrica	false nettle	Occasional		Ponds and ditches	1
*Brassica nigra	black mustard	Occasional		Roadsides	1, 2b
*Bromus inermis	smooth brome	Frequent		Dry to moist fields and	1
*Bromus tectorum	downy chess	Occasional		Dry openings and	1
Cacalia atriplicifolia	pale Indian-plantain	Occasional		Dry fields and roadsides	1
Calamagrostis canadensis	blue-joint	Occasional		Moist fields and ditches	1
Callitriche heterophylla	water-starwort	Occasional		Pond margins and	1
*Campsis radicans	trumpet-vine	Occasional		Disturbed openings and	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
*Capsella bursa-pastoris	shepherd's-purse	Occasional		Roadsides and about	1
*Cardamine hirsuta	bitter-cress	Occasional		Roadsides and about	1
*Carduus nutans	musk-thistle	Occasional		Dry fields and roadsides	1, 2a, 2b
Carex aggregata	sedge	Occasional		Moist woods	2a
Carex alata	broad-winged sedge	Rare	P	Grassy field along Patrol	1
Carex amphibola	NA	Occasional		Thickets and woods	1, 2a
Carex annectens	NA	Occasional		Moist, grassy fields	1
Carex annectens	yellow-fruited sedge	Occasional		Moist, grassy fields	1
Carex blanda	NA	Frequent		Moist woods	1
Carex cephaloidea	thin-leaf sedge	Rare	E	Woods border along	1
Carex complanata	NA	Frequent		Dry fields and woods	1
Carex conoidea	field sedge	Rare	T	Grassy depression along	1
Carex cristatella	NA	Occasional		Moist fields and ditches	1
Carex festucacea	fescue sedge	Occasional		Moist, grassy fields	1
Carex gracillima	NA	Occasional		Moist woods	1, 2a
Carex granularis	meadow sedge	Common		Moist, grassy fields and	1
Carex hirtifolia	NA	Rare		Disturbed oak woods	1
Carex hystericina	Bottlebrush sedge	Rare		Moist depression along	1
Carex jamesii	sedge	Rare		Moist woods	2a
Carex lanuginosa	sedge	frequent		Moist to dry woods	2b
Carex lupulina	Hop sedge	occasional		Wet meadows	2b
Carex pensylvanica	Pennsylvania sedge	Common		Dry woods	1
Carex rosea	NA	Frequent		Dry to moist woods	1, 2a
Carex scoparia	NA	Frequent		Moist, grassy fields	1, 2b
Carex stipata	NA	Frequent		Moist fields and ditches	1
Carex stricta	tussock sedge	Occasional		Moist fields and ditches	1, 2a

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Carex swanii	Swan's sedge	Occasional		Dry, grassy fields	1
Carex tribuloides	NA	Occasional		Moist, grassy fields and	1, 2b
Carex umbellata	NA	Occasional		Well-drained, grassy	1
Carex vulpinoidea	fox sedge	Common		Moist fields, ditches, and	1, 2b
Carya laciniosa	Shellbark hickory	Occasional		Moist to dry woods	2a, 2b
Carya ovata	shagbark hickory	Rare		Sandy soil along fence at	1
Celtis occidentalis	Hackberry	Occasional		dry to moist woods and	1, 2a
Cephalanthus occidentalis	Buttonbush	Occasional		Moist depressions and	1
Cerastium arvense	field chickweed	Rare		White oak grove along	1
*Cerastium fontanum	mouse-ear chickweed	Frequent		Road berms and about	1
*Cerastium semidecandrum	NA	Occasional		Road berms and about	1
*Chaenorrhinum minus	dwarf snapdragon	Occasional		Road berms and about	1
Chamaecrista fasciculata	partridge-pea	Occasional		Dry openings on shale	1
*Chrysanthemum	ox-eye daisy	Frequent		Dry to moist fields and	1, 2a, 2b
*Cichorium intybus	Chicory	Occasional		Roadsides	1
Circaea lutetiana	Southern broad-	Frequent		Woods	2a, 2b
*Cirsium arvense	Canada thistle	Common		Disturbed fields and	1, 2a, 2b
Cirsium discolor	prairie thistle	Frequent		Grassy fields and	1
*Cirsium vulgare	bull thistle	Frequent		Disturbed fields and	1, 2b
Clinopodium vulgaris	wild basil	Occasional		Dry roadsides and	1
Collinsonia canadensis	Horse balm	2a-C		Upland wooded areas	2a, 2b
*Confolvulus arvensis	field bindweed	Occasional		Disturbed fields and	1, 2b
*Convallaria majalis	lily-of-the-valley	Rare		Grassy field along	1
Conyza canadensis	Horseweed	Frequent		Dry fields and roadsides	1
Cornus amomum	swamp dogwood	Frequent		Moist fields and thickets	1
Cornus drummondii	rough-leaved	Frequent		Moist borders, thickets,	1, 2a, 2b

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Cornus florida	flowering dogwood	Occasional		Woodland borders and	1
Cornus racemosa	gray dogwood	Frequent		Dry fields and roadsides	1
*Coronilla varia	crown-vetch	Occasional		Grassy fields and	1, 2b
Crataegus mollis	downy hawthorn	Frequent		Thickets and woodland	1
Crataegus punctata	dotted hawthorn	Frequent		Thickets and woodland	1
Cryptotaenia canadensis	honewort	Occasional		Dry to moist woods	1
Cuscuta gronovii	dodder	Frequent		Moist fields and ditches	1
*Cyperus esculentus	yellow nutgrass	Occasional		Moist, disturbed openings	1
Cyperus strigosus	umbrella-sedge	Frequent		Moist openings, ponds,	1
*Dactylis glomerata	orchard-grass	Occasional		Dry to moist fields and	1, 2a, 2b
Danthonia spicata	poverty-grass	Occasional		Dry openings over shale	1
Datura stramonium	jimson-weed	Occasional		Disturbed openings and	1
*Daucus carota	wild carrot	Frequent		Dry fields and roadsides	1, 2a
*Dianthus armeria	Deptford pink	Occasional		Dry openings and	1, 2a, 2b
Diodia teres	buttonweed	Occasional		Dry openings over shale	1
Dioscorea villosa	Wild yam root	Occasional		Dry to moist woods	2b
*Dipsacus fullonum	common teasel	Frequent		Dry, disturbed openings	1, 2b
*Draba verna	early whitlow-wort	Occasional		Dry roadsides and about	1
Dryopteris carthusiana	spinulose woodfern	Frequent		Moist woods and shaded	1
*Eleagnus umbellata	autumn-olive	Occasional		Roadsides and woodland	1, 2a
Eleocharis acicularis	needle spikerush	Frequent		Margins of artificial pond	1
Eleocharis erythropoda	red-footed spikerush	Occasional		Moist openings and	1
Eleocharis obtusa	NA	Common		Moist openings and	1
Eleocharis smallii	Small's spikerush	Frequent		Margins of artificial pond	1
Eleocharis tenuis	NA	Frequent		Moist openings and	1
Elymus virginica	Wild rye	Frequent		Moist to dry woods	2a, 2b

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
*Elytrigia repens	quack-grass	Frequent		Dry fields and roadsides	1
Equisetum arvense	horsetail	Frequent		Moist openings,	1, 2b
Equisetum hyemale	scouring-rush	Occasional		Moist roadsides and	1
Eragrostis frankii	NA	Occasional		Moist openings and	1
Eragrostis spectabilis	showy lovegrass	Occasional		Dry to moist fields	1
Erechtites hieracifolia	Pilewort	Common, 2b-		Disturbed woods,	1, 2b
Erigeron annuus	fleabane	frequent		Old fields	2b
Erigeron philadelphicus	Philadelphia fleabane	Frequent		Roadsides and borders	1, 2a
Erigeron strigosus	smooth fleabane	Occasional		Dry openings and	1
Eupatorium perfoliatum	Boneset	Occasional		Moist fields, ponds, and	1
Eupatorium purpureum	purple joe-pye-weed	Occasional		Borders of moist woods	1
Euphorbia corollata	Flowering spurge	Occasional		Dry fields	1
Euphorbia maculata	Prostrate spurge	Occasional		Dry openings, road	1
Euthamia graminifolia	grass-leaved	Common		Dry to moist fields and	1, 2b
*Festuca elatior	tall fescue	Occasional		Roadsides and grassy	1, 2a, 2b
*Festuca obtusa	Fescue	Common		Old fields	2b
Fragaria virginiana	wild strawberry	Frequent		Dry to moist fields and	1, 2a, 2b
Fraxinus americana	white ash	Frequent		Dry to moist woods and	1
Fraxinus pensylvanica	green ash	Frequent		Moist woods and stream	1, 2a, 2b
Galine aparine	Cleavers	Occasional		Moist woods and borders	1, 2a
Galium circaezans	wild licorice	Rare		Dry woods along angling	1
Galium pilosum	Bedstraw	Occasional		Woods	2a, 2b
Galium tinctorium	Southern bedstraw	Rare		Moist depression along	1
Geranium maculatum	Wild geranium	Occasional		Moist to dry woods	2a, 2b
Geum laciniatum	Avens	Occasional		Moist woods	2b
Geum vernum	spring avens	Occasional		Moist woods and borders	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Geum virginianum	white avens	Occasional		Woods borders and	1
*Glechoma hederacea	ground-ivy	Frequent		Moist openings,	1, 2a
Gleditsia triacanthos	honey-locust	Occasional		Dry to moist woods and	1, 2a
Glyceria striata	manna-grass	Occasional		Moist woods and about	1, 2a
Gnaphalium obtusifolium	Cudweed	Frequent		Dry openings on shale	1
Gratiola virginiana	round-fruited hedge-	Rare	P	ca 20 plants; moist,	1
Hedyotis caerula	Bluets	Occasional		Dry openings and	1
Helenium flexuosum	Southern	Occasional		Moist, open ground and	1
Helianthus mollis	ashy sunflower	Rare	T	ca 200 plants in grassy	1
Hibiscus moscheutos	rose-mallow	Rare		Moist swale along	1
*Hieracium piloselloides	king-devil	Frequent		Dry openings on shale	1
Hypericum gentianoides	orange-grass	Frequent		Dry openings	1
Hypericum gymnanthum	least St. John's-wort	Rare	E	ca 50 plants; moist, open	1
Hypericum majus	tall St. John's-wort	Rare	P	Moist, shaded ground by	1
Hypericum mutilum	little St. John's-wort	Frequent		Moist openings, ponds,	1
*Hypericum perforatum	dotted St. John's-wort	Frequent		Disturbed fields and	1, 2b
Hypoxis hirsuta	yellow-eyed-grass	Occasional		Grassy fields	1
Impatiens sp.	Jewelweed	Occasional		Moist woods	2a
*Inula helenium	Elecampane	Rare		Moist roadside along Taft	1
Ipomoea pandurata	wild sweet-potato	Occasional		Dry openings over shale	1
Iris versicolor	Northern blue flag	Occasional		Moist woods and ditches	1
Isanthus brachiatus	false pennyroyal	Rare		Moist opening on	1
Juglans nigra	black walnut	Rare		A few young trees at	1, 2b
Juncus acuminatus	NA	Common		Moist openings and	1
Juncus biflorus	NA	Occasional		Moist openings and	1
Juncus brachycarpus	NA	Occasional		Moist openings	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Juncus canadensis	Canada rush	Frequent		Moist openings	1
Juncus dudleyi	Dudley's rush	Frequent		Moist openings	1
Juncus effusus	Common rush	Frequent		Moist openings, ponds,	1, 2b
Juncus marginatus	NA	Occasional		Moist openings	1
Juncus tenuis	path rush	Frequent		Dry openings, road	1
*Lamium purpureum	dead-nettle	Frequent		Disturbed fields,	1
Leersia oryzoides	rice cutgrass	Occasional		Moist fields and ditches	1
Leersia virginica	White grass	Frequent		Moist woods	2a
Lemna minor	little duckweed	Occasional		Ponds and standing	1, 2a
*Lepidium campestre	field-cress	Occasional		Roadsides and about	1
Lepidium virginicum	poor man's pepper	Frequent		Roadsides, disturbed	1
Lespedeza capitata	bush-clover	Occasional		Dry fields	1
Leucospora multifida	NA	Rare		Moist opening on	1
Liatris scariosa var. novae-	northern blazing-star	Rare		Dry ground along Patrol	1
Liatris spicata	spiked blazing-star	Occasional		Moist openings	1
*Linaria vulgaris	butter-and-eggs	Occasional		Roadsides and about	1
Lindera benzoin	spicebush	Occasional		Moist woods	2a
Lindernia dubia	false pimpernel	Occasional		Moist openings, ditches,	1
Linum medium	wild flax	Frequent		Dry to moist openings	1
Linum virginianum	Virginia flax	Rare		About pond in northern	1
*Lonicera maackii	Amur honeysuckle	Rare		Roadsides and thickets	1
*Lonicera morrowii	Asiatic honeysuckle	Frequent		Thickets, borders, and	1
*Lonicera tatarica	Tatarian honeysuckle	Frequent		Thickets, borders, and	1
*Lotus corniculatus	bird's-foot trefoil	Occasional		Grassy fields and road	1
Ludwigia alternifolia	rattlebox	Occasional		Ponds and ditches	1
Ludwigia palustris	water-purslane	Frequent		Ponds and ditches	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Ludwigia polycarpa	NA	Rare		Moist, shaded ground by	1
Lycopus americanus	American water-	Frequent, 2b-O		Ponds and ditches	1, 2b
Lycopus uniflorus	northern water-	Frequent		Moist woods and shaded	1
*Lysimachia nummularia	moneywort	Frequent		Moist woods, wet	2a
Lysimachia terrestris	swamp loosestrife	Occasional		Moist openings	1
Lythrum alatum	prairie loosestrife	Occasional		Moist openings	1, 2b
Maclura pomifera	osage-orange	Occasional		Disturbed woods and	1
*Matricaria matricarioides	pineapple-weed	Occasional		Roadsides and about	1
*Medicago lupulina	Black medic	Occasional		Old fields and disturbed	2a
*Melilotus alba	white sweet-clover	Occasional		Disturbed fields and	1
*Melilotus officinalis	yellow sweet-clover	Occasional		Disturbed fields and	1
Mimulus ringens	monkey-flower	Occasional		Moist openings and	1
Monarda fistulosa	bergamont	Occasional		Grassy fields	1
Muhlenbergia frondosa	muhly grass	Frequent		Moist fields and ditches	1
Najas flexilis	northern naiad	Occasional		Artificial ponds	1
*Najas minor	Eurasian naiad	Frequent		Artificial ponds	1
*Nepeta cataria	catnip	Occasional		Roadsides and weedy	1, 2b
Nyssa sylvatica	blackgum	Occasional		Thickets and woods	1
Oenothera biennis	evening-primrose	Frequent		Dry fields, roadsides, and	1
Oenothera tetragona	northern sundrops	Frequent		Moist, grassy fields	1
Onoclea sensibilis	Sensitive fern	frequent		Wet areas	2b
Osmunda cinnamomea	cinnamon fern	Rare		Depressions in moist	1
Osmunda regalis	royal fern	Occasional		Depressions in moist	1
*Oxalis europea	Sorrel	2a-O, 2b-F		Old fields and disturbed	2a, 2b
Oxalis violacea	purple wood-sorrel	Occasional		Drier oak woods and	1
Panicum flexile	wiry witch-grass	Rare		Moist opening on	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Panicum lanuginosum	hairy panic-grass	Frequent		Dry, grassy fields and	1, 2b
Panicum oligosanthes	sand panic-grass	Occasional		Dry, grassy fields	1
Panicum rigidulum	stiff panic-grass	Frequent		Moist openings and	1
Panicum virgatum	switch-grass	Occasional		Dry fields	1
Parietaria pensylvanica	pellitory	Occasional		Dry, disturbed wood lots	1
Paronychia fastigata	forked chickweed	Occasional		Dry woods and borders	1
Parthenocissus	Virginia-creeper	Occasional		Dry to moist woods	1, 2a, 2b
Parthenocissus vitacea	grape-woodbine	Rare		Dry opening north of	1
*Pastinaca sativa	wild parsnip	Occasional		Roadsides	1
Penstemon digitalis	tall white beard-	Frequent		Grassy fields and	1, 2a, 2b
Phalaris arundinacea	reed canary-grass	Common		Moist fields and ditches	1, 2a, 2b
*Phleum pratense	timothy	Frequent		Disturbed fields and	1, 2b
Phragmites australis	reed-grass	Occasional,		Moist openings and	1, 2b
Phryma leptostachya	lopseed	Rare		Edge of woods along	1
Phytolacca americana	pokeberry	Occasional		Moist woods and borders	1
Pilea pumila	Canada clearweed	Occasional		Moist woods	2a
*Plantago lanceolata	English plantain	Frequent		Disturbed openings and	1, 2b
*Plantago major	broad-leaved plantain	Frequent		Road berms and about	1, 2a
Platanthera lacera	ragged fringe-orchid	Rare		Ditch along south Patrol	1
Platanus occidentalis	sycamore	Occasional		Moist woods and stream	1, 2a
*Poa annua	early bluegrass	Common		Road berms and about	1
*Poa compressa	Canada bluegrass	Frequent		Dry openings, especially	1
Podophyllum peltatum	may-apple	Occasional		Dry to moist woods	1, 2b
Polygala sanguinea	blood milkwort	Frequent		Moist openings	1
Polygala verticillata	whorled milkwort	Occasional		Moist openings	1
*Polygonum caespitosum	NA	Rare		Moist, shaded ground in	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
*Polygonum hydropiper	water-pepper	Occasional		Margins of ponds	1
Polygonum	false water-pepper	Occasional		Wet ditches and pond	1
Polygonum sagittatum	arrow-leaved	Occasional		Moist thickets and ditches	1
Polygonum scandens	climbing false	Occasional		Thickets and roadsides	1
Polygonum virginianum	Virginia knotweed	Frequent		Moist to dry woods	2a, 2b
Populus deltoides	cottonwood	Frequent		Moist woods, borders,	1, 2a, 2b
Potamogeton diversifolius	snailseed pondweed	Frequent		Artificial ponds	1
Potamogeton foliosus	leafy pondweed	Occasional		Artificial ponds	1
Potamogeton nodosus	longleaf pondweed	Occasional		Artificial ponds	1
Potentilla simplex	cinquefoil	Frequent		Dry openings and	1
Prunella vulgaris	self-heal	Occasional		Roadsides and about	1
Prunus americana	wild plum	Occasional		Thickets and roadsides	1
*Prunus avium	Sweet cherry	Occasional		Dry woods	2b
Prunus serotina	wild black cherry	Frequent		Dry to moist woods and	1, 2a, 2b
Pycnanthemum tenuifolium	narrow-leaved	Frequent		Moist openings,	1, 2b
Pycnanthemum virginianum	Virginia mountain-	Occasional		Moist openings and	1
Pyrus coronaria	crab-apple	Frequent		Thickets and borders	1
Quercus alba	white oak	Occasional		Dry woods and sandy	1, 2a, 2b
Quercus bicolor	swamp white oak	Frequent		Moist woodlands	1
Quercus imbricaria	shingle oak	Frequent		Moist to dry woodlands	1, 2a
Quercus macrocarpa	bur oak	Rare		ca 5 trees on sandy ridge	1, 2a
Quercus palustris	pin oak	Common		Moist woods	1, 2a
Quercus rubra	Red oak	Occasional		Dry woods	2b
Ratibida pinnata	green-headed	Occasional		Roadsides and dry fields	1
Rhexia virginica	Virginia meadow-	Occasional	P	Moist openings and pond	1
Rhus glabra	Smooth sumac	Rare		Old fields and disturbed	2a

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Rosa carolina	pasture rose	Occasional		Dry fields	1
*Rosa multiflora	multiflora rose	Occasional		Disturbed openings,	1, 2a, 2b
Rosa setigera	prairie rose	Rare		Grassy roadside and	1
Rotala ramosior	toothcup	Occasional		Moist openings and about	1
Rubus allegheniensis	blackberry	Occasional		Woods, fields, and	2b
Rubus flagellaris	dewberry	Frequent		Dry openings and	1, 2a, 2b
Rubus occidentalis	Black raspberry	Occasional		Dry woods, and borders	2b
Rudbeckia hirta	black-eyed susan	Frequent		Dry fields and roadsides	1
*Rumex acetosella	red sorrel	Occasional		Dry openings over shale	1
*Rumex crispus	curly dock	Occasional		Roadsides and about	1, 2b
Sagittaria latifolia	broad-leaved	Occasional		Ponds and ditches	1, 2b
Salix amygdaloides	peachleaf willow	Occasional		Ditches and about ponds	1
Salix discolor	pussy willow	Occasional		Moist openings, ponds,	1
Salix exigua	sandbar willow	Frequent		Moist openings, stream	1
Salix nigra	black willow	Comm. (1,2b)		Moist woods, stream	1, 2a, 2b
Sambucus canadensis	elder-berry	Frequent		Moist openings, stream	1
*Saponaria officinalis	soapwort	Frequent		Dry fields, roadsides, and	1
Sassafras albidum	sassafras	Occasional		Dry woods and borders	1
Schizachyrium scoparium	little bluestem	Frequent		Dry fields and roadsides	1
Scirpus acutus	hardstem bulrush	Rare		Moist depression west of	1
Scirpus atrovirens	dark green bulrush	Common, 2b-F		Moist openings,	1, 2b
Scirpus cyperinus	woolgrass	Occasional		About artificial ponds	1, 2b
Scirpus fluviatilis	river bulrush	Rare		Moist depression west of	1
Scirpus pendulus	NA	Occasional		Moist openings	1
Scirpus validus	softstem bulrush	Occasional		Moist openings, ponds,	1
Scleria triglomerata	tall nut-rush	Rare	P	Moist swale in northern	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Scutellaria lateriflora	mad-dog skullcap	Occasional		Moist depressions and	1
Senecio aureus	golden ragwort	Occasional		Moist woods borders	1
*Setaria faberi	nodding foxtail-grass	Occasional		Grassy roadsides in the	1
*Setaria viridis	green foxtail-grass	Frequent		Dry roadsides and about	1
Silphium terebinthinaceum	prairie-dock	Rare		Dry openings at crossing	1
Sisyrinchium albidum	prairie blue-eyed-	Frequent		Grassy fields	1
Sisyrinchium angustifolium	common blue-eyed-	Frequent		Grassy fields	1, 2b
Smilax rotundifolia	greenbriar	Occasional		Moist to dry woods	2a
*Solanum caroliniense	horse-nettle	Occasional		Dry openings and	1, 2b
*Solanum dulcamara	bittersweet-	Occasional		Roadsides, ditches,	1
Solidago canadensis	Canada goldenrod	Common		Grassy fields	1
Solidago juncea	early goldenrod	Frequent		Dry to moist fields and	1
Solidago nemoralis	gray goldenrod	Common		Dry fields and roadsides	1
Solidago riddellii	Riddell's goldenrod	Rare		Moist opening over	1
Sparganium eurycarpum	giant bur-reed	Rare		Wet ditch along Ransom	1
Spartina pectinata	prairie cord-grass	Frequent		Moist depressions, fields,	1
Spiranthes ochroleuca	creamy ladies'-	Occasional		Ditches and moist	1
Sporobolus asper	tall dropseed	Rare		A single stand in dry	1
Sporobolus neglectus	NA	Frequent		Dry openings and road	1
Stellaria longifolia	long-leaved stitchwort	Occasional		Moist, grassy fields	1
*Stellaria media	chickweed	Common		Road berms and about	1
Symphoricarpos orbiculatus	coralberry	Occasional		Thickets, woods borders,	1
*Taraxacum officinalis	dandelion	Frequent		Roadsides and about	1
Teucrium canadense	American germander	Occasional		Moist openings	1
Thelypteris palustris	marsh fern	Occasional		Moist depressions and	1
Tilia americana	American basswood	Occasional		Woods	2a, 2b

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Toxicodendron radicans	Poison ivy	Occasional		Upland and facultative	2a, 2b
Tradescantia ohioensis	Ohio spiderwort	Occasional		Old fields	2b
*Tragopogon pratensis	Yellow goatsbeard	Rare		Old fields	2b
Triadenum virgnianum	pink St. John's-wort	Rare		Moist swale in northern	1
Tridens flavus	purpletop	Occasional		Moist fields and	1
*Trifolium pratense	red clover	Occasional		Grassy fields and	1
*Trifolium repens	common white clover	Common		Grassy roadsides and	1
Typha latifolia	broad-leaved cat-tail	Frequent		Moist openings, ponds,	1, 2b
Ulmus americana	American elm	Occasional		Moist woods and stream	1, 2a, 2b
Ulmus rubra	slippery elm	Occasional		Moist woods and stream	1, 2a
Urtica dioica var. procera	American stinging	Occasional		Moist fields and openings	1, 2a, 2b
*Verbascum blattaria	moth-mullein	Occasional		Disturbed fields and	1, 2b
*Verbascum thapsus	common mullein	Frequent		Disturbed fields	1, 2b
Verbena hastata	purple vervain	Frequent		Moist fields, stream	1
Verbena simplex	prairie vervain	Rare		A single stand in dry	1
Verbena urticifolia	white vervain	Occasional		Moist woods borders and	1
Verbesina alternifolia	wingstem	Frequent		Moist woods borders,	1, 2a
Vernonia gigantea	tall ironweed	Occasional		Dry to moist fields	1
*Veronica officinalis	common speedwell	Occasional		Dry openings on shale	1, 2a
*Veronica serpyllifolia	thyme-leaved	Occasional		Roadsides and about	1
Viburnum lentago	nannyberry	Frequent		Moist thickets and	1
Viola lanceolata	lance-leaved violet	Frequent	P	Ditches and moist	1
Viola sagittata	arrow-leaved violet	Frequent		Grassy fields and dry	1

Table I-1

Vascular Plant Species Observed On Site
Plum Brook Ordnance Works
Oxford and Perkins Townships, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Viola sororia	common blue violet	Common		Grassy fields, roadsides,	1, 2a
Vitis riparia	riverbank grape	Frequent		Woods borders, thickets,	1, 2a, 2b
Vitis vulpina	fox grape	Occasional		Woods borders and	1
Zanichellia palustris	horned pondweed	Rare		Artificial pond west of	1

[a]Common = Species which occur in large numbers throughout.
Frequent = Species regularly encountered, but occurring in lesser numbers than common ones.
Occasional = Species found in several places, but never present in large numbers.
Rare = Species found in few places and in low numbers.
[B]T = Ohio Threatened Species
P = Ohio Potentially Threatened Species
E = Ohio Endangered Species
[c]1 = Biological Inventory of Plum Brook Station (Ohio Department of Natural Resources, 1994).
2 = IT site reconnaissance June 15 through 17, 1998 (2a = recorded at West Area Red Water Ponds Subsite; 2b = recorded at Pentolite Road Red Water Ponds Subsite).
*Non-native species.

APPENDIX I.2

TABLE I-2, THREATENED AND ENDANGERED SPECIES SUMMARY TABLE

Table I-2

Threatened and Endangered Species Summary Table
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Rank	Approx. Distance from Subsites:		Habitat	Comments
		West Area Red Water Ponds	Pentolite Rd Red Water Ponds		
Grove sandwort (*Arenaria lateriflora*)	T	2-mi NE	3/4-mi NNE	Damp open woods, also dry woods and roadsides.	Slender stemmed annual herb, flowers late Apr - mid Aug, fruit May-Aug. 5 white entire petals. similar to plate 47 (Audubon).
Thin-leaved sedge (*Carex cephaloidea*)	E	1.5-mi NE	2/3-mi W	Moist open areas, fens, wet prairies, meadows, borders. 23 other sedge spp at PBOW.	Found at woods border along Pentolite road N. of reactor. Pgs 90-94 in Magee.
Field sedge (*Carex conoidea*)	T	3-mi SE and at ESBSNP	2-mi SSE and at ESBSNP	Moist open areas, fens, wet prairies, meadows, borders. 23 other sedge spp at PBOW.	Loosely tufted perennial from short rootstalk, fruit May - June. Grassy depression along Taft Rd. S. of N. Magazine Rd.
Least St. John's wort (*Hypericum gymnanthus*)	E	3-mi E and at ESBSNP	1.5-mi SE and at ESBSNP	Moist to wet sandy, muddy or peaty low grounds, in full sun.	Perennial herb to 9 dm, flowering late June - Sept, fruit July - Sept. 5 yellow petals. Mature flower or fruit needed for positive ID. Moist open ground along Patrol Rd. S of Fox Rd. Similar to *H. canadense* - pg. 170 in Magee. Plate 352 in Audubon for similar spp.

Table I-2

Threatened and Endangered Species Summary Table
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Rank	Approx. Distance from Subsites:		Habitat	Comments
		West Area Red Water Ponds	Pentolite Rd Red Water Ponds		
Ashy sunflower (*Helianthus mollis*)	T	3.5-mi E	2-mi SE	Well-drained sunny openings, dry prairie, RR edges, roadsides, woods borders and clearings.	Herbaceous perennial, overlapping yellow ray flowers, flowering Aug - Sept, cinereous pubescence and sessile clasping leaves. Grassy field S, SW of Fox and Patrol Rds. Plate 286 Audubon for similar spp.
Dwarf bulrush (*Lipocarpha micrantha*; syn *Hemicarpha micrantha*)	T	1-mi SE and at ESBSNP	2-mi SW and at ESBSNP	Open moist areas, usually in sandy substrates, fields, sand pits, lake margins, ditches.	Tufted annual, fertile culms 2-15 cm, fruiting July-Oct. Similar to Scirpus - see pgs. 85-87 in Magee.
Twisted yellow-eyed-grass (*Xyris torta*)	T	1 1/4-mi S (ESBSNP)	2 1/4-mi SW (ESBSNP)	Dry to moist openings on sandy or clayey soils, fields, ditches, seepage banks, pond margins, disturbed areas.	Rosette-forming hergaceous perennial from a bulbous base, flowering July - Aug. Non-flowering specimens difficult to ID. flowering scape 15-100 cm. Erect narrow twisted needle-like leaves, pg. 823 Audubon.

Table I-2

Threatened and Endangered Species Summary Table
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Rank	Approx. Distance from Subsites:		Habitat	Comments
		West Area Red Water Ponds	Pentolite Rd Red Water Ponds		
Flat-leaved rush (*Juncus platyphyllus)*	E	1 1/4-mi S (ESBSNP)	2 1/4-mi SW (ESBSNP)	Dry to moist, open to semi-open areas, sandy, acid soils, lakeshores, steambanks, mud flats, floodplains, wet meadows, roadsides.	Perennial herb 1.5 - 10 dm, in dense tussocks with grass-like leaves, small brownish flowers June - Sept, fruiting July - Oct, similar spp Plate 395 in Audubon. Mature fruits or flowers needed for positive ID.
Bushy aster (*Aster dumosus*)	T	1 1/4-mi S (ESBSNP)	2 1/4-mi SW (ESBSNP)	Dry to moist, sandy open sites, marshy ground, scrubby fields, thickets, disturbed habitats.	Perennial herb, to 1 m, Plate 100 in Audubon, flowering Aug - Oct, fruiting Sept - Nov. Mature flowers needed for ID.
Prairie false indigo (*Baptisia lactea*)	P	3-mi ESE	1 3/4-mi ESE	Wet to dry, open to semi-shaded, upland woods, prairies, along streams, along RR tracks	Perennial herb to 1.5 m, flowering May - June, fruiting July - Sept. White flowers, similar spp Plate 146 Audubon.
Broad-winged sedge (*Carex alata*)	P	3 3/4-mi-ESE	2 3/4-mi SE	Moist areas, in sun to semi-shade, meadows, woods borders, lake margins, bogs, fens.	Tufted perennial from a short blackish, fibrillose rootstalk, fertile culms 2 -12 dm, fruiting June - July. ID is difficult.

Table I-2

Threatened and Endangered Species Summary Table
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Rank	Approx. Distance from Subsites:		Habitat	Comments
		West Area Red Water Ponds	Pentolite Rd Red Water Ponds		
Round-fruited hedge-hyssop (*Gratiola virginiana*)	P	2 1/2-mi ESE	1 1/2-mi ESE	Wet areas, stream margins, pools, ditches, shade or semi-shade.	Herbaceous weak-stemmed annual, 104 dm, flowering May - Oct. Mature fruit or flower needed for positive ID.
Tall St. John's wort (*Hypericum majus*)	P	2 1/2-mi ESE	1 1/2-mi SSE	Sandy or mucky shores of lakes or streams, meadows, marshes.	Perennial herb, 8-32 cm, flowers and fruits July -Sept. Fruits and roots needed for positive ID. Plate 352 in Audubon for similar spp.
Virginia meadow beauty (*Rhexia virginica*)	P	1-mi SE (+ 2 other locs further away)	1 1/3-mi SE (+ 2 other locs further away)	Wet sands and peats.	Several pink flowers in broad, terminal clusters on 4-sided slightly winged stem. Flowering July -Sept, Audubon Plate 477.
Tall nut rush (*Scleria triglomerata*)	P	2.5-mi ESE	1.0-mi SE	Moist swale	Northern bunker area
Lance-leaved violet (*Viola lanceolata*)	P	1.5-mi SE (+ 7 other locs further away)	1 1/3-mi SSW (+ 7 other locs further away)	Open, moist sandy areas in pastures, meadows, prairie remnants, bog margins, acidic soils.	Stemless perennial herb to 1.5 dm, flowering early May - early June, fruiting May - June. Mature flowers, fruits needed for positive ID. Audubon Plate 597 for similar spp.

Table I-2

Threatened and Endangered Species Summary Table
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Rank	Approx. Distance from Subsites:		Habitat	Comments
		West Area Red Water Ponds	Pentolite Rd Red Water Ponds		
Sedge wren (*Cistothorus platensis*) also called short-billed marsh wren	E	Nest 1-mi WNW; 2 birds seen near subsite in June 1994.	Nest 0.3-mi SW of site and E and W of site; 8 birds seen near subsite in June 1994.	Wet meadows, grassy marshes, old grassy fields. Globular nests hidden at base of vegetation.	Six nesting sites ID's by ODNR DNAP. Buffy, streaked crown, streaked back, no white eye line. Plate 47 in Peterson. Unique song: *chap chap chap chapper-rrrr.* Nests July - Sept.
Winter wren (*Troglodytes troglodytes*)	E	-	-	Rare migrant seen at station, typically inhabitants of ground cover of northern U.S. coniferous and mixed forests, in Ohio only found in cool hemlock forests, usually along streams.	Very small round dark wren, brownish heavily barred belly and stubby tail (similar to house wren). Plate 47 in Peterson. Song: high tinkling warbles and trills or hard two-syllabled *kip kip.*
Cattle egret (*Bublucus ibis*)	T	-	-	Rare visitor observed in short grass areas of station, typically found in pastures.	Small white egret.
Black-crowned night heron (*Nycticorax nycticorax*)	T	8.5-mi NNW	8.5-mi NNW	Regular visitor at ponds, streams, and ditches of station, typically found near water and wetlands. Small nesting colony on small Sandusky Bay Island.	Chunky short-legged heron, adult is black-backed, pale gray or white below. Call is flat *guok* or *guark*, in evenings. Plate 21 in Peterson.

Table I-2

Threatened and Endangered Species Summary Table
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Rank	Approx. Distance from Subsites:		Habitat	Comments
		West Area Red Water Ponds	Pentolite Rd Red Water Ponds		
Trumpeter swan (*Cygnus buccinator*)	E	-	-	Rare migrant seen flying toward lake at the station.	Large swan.
Upland sandpiper (plover) (*Bartramia longicauda*)	T	2 1/4-mi SE	1 1/2-mi SSE	Rare in grassy areas of station, typically found in 1-2 ft. high grasses of fields and prairies.	Large, streaked buffy-brown shore-bird, 'pigeon-headed', voice: *kip-ip-ip-ip*. Plates 23, 30 in Peterson.
Indiana bat (*Myotis sodalis*)	E	-	-	Inhabit caves near streams and exfoliated bark such as shagbark hickory.	Similar appearance to little brown myotis.

ESBSNP = Erie Sand Barrens State Nature Preserve
T = Threatened (Ohio)
E = Endangered (Ohio)
P = Potentially Threatened (Ohio)
ODNR = Ohio Department of Natural Resources
DNAP = Division of Natural Areas and Preserves

APPENDIX I.3

LETTERS FROM BOTANICAL EXPERT

DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

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July 1, 1998

Mark Weisberg
IT Corporation
2790 Mosside Boulevard
Monroeville, Pennsylvania 15146

RE: *Vegetation Survey*—NASA Plum Brook Facility, Erie County, Ohio

Dear Mr. Weisberg:

Portions of the NASA Plum Brook Facility were surveyed for plant species on June 16, 1998. Special emphasis was placed on locating rare, threatened, and endangered species. Two areas were surveyed, known as the West Area and the Pentolite Road area. Each area was thoroughly surveyed and all plant species found were recorded. Specimens of the genus *Carex* were collected and identified by Stanley Stine of Kent, Ohio, a local authority on this difficult group of plants.

The entire Plum Brook facility was surveyed by the Ohio Department of Natural Resources (ODNR) in 1994. They identified a number of rare, threatened, and endangered plants on the site. Special emphasis was placed on locating these plants.

The following references were used to identify plants on the site:

Braun, E. Lucy. 1967. *The Monocotyledoneae: Cat-tails to Orchids* The Ohio State University Press, Columbus.

Braun, E. Lucy. 1989. *The Woody Plants of Ohio.* The Ohio State University Press, Columbus.

Cooperrider, Tom S. 1995. The Dicotyledoneae of Ohio, Part 2: Linaceae through Campanulaceae. The Ohio State University Press, Columbus.

Fisher, Richard T. 1988. *The Dicotyledoneae of Ohio, Part 3: Asteraceae* The Ohio State University Press, Columbus.

Newcomb, Lawrence. 1977. *Newcomb's Wildflower Guide.* Little, Brown & Co., Boston.

The enclosed table lists all plant species recorded during the June 16, 1998 field visit as well as species recorded during the ODNR 1994 survey. No rare, threatened, or endangered species were found in either of the study areas. A return visit should be made in the late summer for species which have later flowering times, especially members of the aster family. Several of the rare, threatened, and endangered species found in the ODNR survey have late summer flowering times.

Please call if you have any questions.

Sincerely,
Todd Crandall

Todd Crandall
Wetlands Biologist

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September 8, 1998

Mark Weisberg
IT Corporation
2790 Mosside Boulevard
Monroeville, Pennsylvania 15146

RE: *Vegetation Survey*—NASA Plum Brook Facility, Erie County, Ohio

Dear Mr. Weisberg:

Portions of the NASA Plum Brook Facility were surveyed for rare, threatened, and endangered plant species on September 2, 1998. Two areas were surveyed, known as the West Area and the Pentolite Road area. Species with late summer and early fall flowering times were surveyed. No rare, threatened, or endangered species were located. *Spiranthes cernua* (nodding ladies tresses) was found in thePentolite Road area. It was rare with just a few individuals noted. This is an orchid that is unusual but has no state or federal status as a rare, threatened, or endangered species.

Please call if you have any questions.

Sincerely,

Todd Crandall

Todd Crandall
Wetlands Biologist

APPENDIX J

ECOLOGICAL TOXICITY PROFILES

Appendix J

Ecological Toxicity Profiles For Plum Brook Ordnance Site

J.1.0 Introduction

A large variety of both inorganic and organic chemicals have been measured in environmental media at Plum Brook Ordnance Site at concentrations in excess of background measurements. Discussed in this appendix is toxicity information related to each of the chemicals of potential ecological concern that were identified as being risk drivers (i.e., contributing a large percentage of the total hazard index for a particular receptor, or exceeding surface water or sediment quality criteria standards for the protection of aquatic life). General toxicity information is presented for plants, wildlife, and freshwater aquatic biota. Much of the information was obtained from biological and toxicological databases, such as the Hazardous Substance Database (NLM, 1996), Registry of Toxic Effects of Chemical Substances (RTECS, 1998), Integrated Risk Information System (EPA, 1996) and from wildlife hazard reports published by the U.S. Fish and Wildlife Service (i.e., Eisler, 1993).

J.1.1 Inorganics

J.1.1.1 Aluminum

Plants

Aluminum appears to be essential for the growth of some plant species (Kabata-Pendias and Pendias, 1992). Concentrations in the foliage of crop plants are usually less than 300 milligrams (mg) per kilogram (kg) (dry weight) (Bollard, 1983). Higher concentrations of aluminum are usually detected in older rather than younger leaves (Bollard, 1983). Some species of plants, such as the cranberry (*Vaccinium macrocarpon*), are able to tolerate high concentrations of aluminum (Medappa and Dana, 1968, as cited in Foy, 1974). Generally, acid-soil plants (calcifuges) are more tolerant to aluminum than calcareous-soil plants (calcicoles) (Clymo, 1962; Grime and Hodgson, 1969, as cited in Foy, 1974). Because flower color in *Hydrangea macrophylla* is related to aluminum concentrations (blue flowers contain higher concentrations than pink flowers) (Asen et al., 1963, as cited in Foy, 1974), *Hydrandea* can serve as useful indicators of soluble aluminum concentrations in soil.

Difference in the toxicity of aluminum to plants is closely linked to the differential uptake and transport of calcium (Foy, 1974). Interactions of aluminum with potassium, silicon, and organic acids have also been reported (Foy, 1974). According to Foy (1974), aluminum toxicity in plants usually does not occur in soils with pH values above 5.5. Toxicity is, however, common and adverse at soil pH values below 5.0 (Foy, 1974). The addition of nitrogenous fertilizers to soil increases the toxicity of aluminum to plants by displacing exchangeable aluminum into soil solution and lowering soil pH (Foy, 1974). Tissue aluminum concentrations that may result in a 10 percent reduction in crop yield range from 40 to 280 mg/kg (dry weight) (Macnicol and Beckett, 1985). A soil concentration of 50 mg/kg (dry weight) has been proposed by Will and Suter (1994) as a benchmark screening value for aluminum phytotoxicity. Signs of aluminum toxicity in plants include overall stunting of growth, the presence of dark green leaves, purpling of stems, death of leaf tips, and coralloid and damaged root systems (Kabata-Pendias and Pendias, 1992).

Wildlife

Aluminum is not an essential element for animal growth and development. Limited data exist on the concentrations and effects of aluminum on wildlife. Most absorbed aluminum is eliminated through the kidney (Kovalchik et al., 1978, as cited in NLM, 1996).

Data do not exist on the effects of aluminum on wild mammals. Laboratory studies have shown inhalation of aluminum dust to induce infections and diseases of the lung (Browning, 1969, as cited in NLM, 1996). A derived chronic no observable adverse effect level (NOAEL) of 0.043 mg/kg per day (/d) has been reported for laboratory rats exposed to aluminum (EPA, 1996). Based on laboratory data on aluminum toxicity in laboratory mice, Opresko et al. (1994) estimated chronic oral NOAELS to be 2.138 mg/kg/d for the white-footed mouse and 0.369 mg/kg/d for the red fox. Sample et al (1996) suggests a NOAEL of 1.93 mg/kg per day for mice. The drinking water NOAELs for these species were estimated to be 7.127 and 4.374 mg/L, respectively.

There is a greater amount of information on the toxicity of aluminum to birds than on the toxicity of aluminum to mammals. Dietary ingestion of aluminum at concentrations of approximately 1,400 mg/kg produced declines in inorganic phosphorus levels in blood and resulted in the development of severe rickets in chickens (Browning, 1969, as cited in NLM, 1996). No adverse effects were observed in black ducks (*Anas rubripes*) fed diets containing 1,000 mg/kg aluminum as aluminum sulfate over a period of 12 days (Sparling, 1990). Diets with low calcium and phosphorus concentrations adversely affected the response of the ducks to aluminum (Sparling,

1990). Reduced consumption of diets containing 5,000 mg/kg aluminum has also been observed (Sparling, 1990). An estimated acute LD_{50} (lethal dose that will result in 50 percent deaths in the test population) of 111 mg/kg is reported for exposure of birds to aluminum (Schafer et al., 1983). Based on avian test data, extrapolated NOAELs for chronic exposure of avian species to aluminum sulfate are 45.17 mg/kg/d for the great blue heron and 57.9 mg/kg/d for the red-tailed hawk (Opresko et al., 1994). Sample et al. (1996) suggests a NOAEL for the ringed dove of 110 mg/kg per day. Drinking water NOAELs for these species were 1.02 and 1.018 g/L, respectively.

Aquatic Life

Bioconcentration of aluminum has been reported for several freshwater species. A bioconcentration factor for daphnids exposed to aluminum is 574 (Cowgill and Burns, 1975, as cited in Wren and Stephenson, 1991). Crayfish have been reported to have a bioconcentration factor for aluminum of 1305 (Malley et al., 1987, as cited in Wren and Stephenson, 1991). Forester (1980, as cited in Havlik and Marking, 1987) reported aluminum concentrations in the mollusc *Anodonta grandis* collected from acid-stressed lakes to be as high as 1,500 mg/kg.

Federal Water Quality Criteria exist for the protection of freshwater aquatic life from exposure to aluminum phosphide (EPA, 1996). The values for acute and chronic exposure to aluminum are 750 and 87 micrograms (µg) per liter (L), respectively (EPA, 1996). The lowest chronic values of aluminum reported in the literature for fish and *Daphnia* are 3,290 and 1,900 μg/L, respectively (Suter and Mabrey, 1994). The test EC_{20} (the concentration that will result in a specified effect on 20 percent of the test population) for fish can be used as a benchmark indicative of production within a population. It is the highest tested concentration causing less than 20 percent reduction in either the weight of young fish per initial female fish in a life cycle or partial life-cycle test or the weight of young per egg in an early life-stage test (Suter and Mabrey, 1994). The value for aluminum is 4,700 μg/L (Suter and Mabrey, 1994). A similar value can be determined for daphnids, which reflects the highest tested concentration causing less than 20 percent reduction in the product of growth, fecundity, and survivorship in a chronic test with a daphnid species. The EC_{20} benchmark for exposure of daphnids to aluminum is 540 μg/L (Suter and Mabrey, 1994).

J.1.1.2 Antimony

Plants

Data on the effects of antimony concentrations in soil to plant life are not readily available from the reviewed literature.

Animals

Effects from antimony exposure on benthic community composition have been detected at levels between 3.2 and 150 mg/kg (Long and Morgan, 1990). Data on antimony suggest an effects range-low (ER-L) of 2 mg/kg, and an effects range-medium (ER-M) of 25 mg/kg.

A derived no observable adverse effect level (NOAEL) of 0.125 mg/kg per day has been reported for laboratory mice exposed to antimony (Sample et al, 1996). For birds, data on the toxic effects of antimony were not readily available from the reviewed text.

Aquatic Life

The toxic effects of antimony to aquatic life are not readily available from reviewed literature.

J.1.1.3 Calcium

Calcium is a soft, silvery white metallic element found most widely in rocks, such as chalk, limestone, and marble. Calcium is an alkaline earth metal and is the fifth most abundant element in the earth's crust. Calcium is the most abundanat mineral element in the animal body, with ninety-nine percent of it occurring in bone and teeth (McDowell, 1992).

Plants

Calcium is present in the tissues of plants at varying concentrations, dependent on the species. However, data on the toxicity of calcium to plants was not readily available from literature reviewed.

Animals

Calcium is an essential nutrient for the proper development of animals. It is one of the most abundant mineral elements in the animal body. Deficiency of calcium in animal diets results in development of rickets (McDowell, 1992).

Data do not exist on the effects of calcium on wild animals. Laboratory studies have linked the deficiency of calcium in the diets of pigs, cattle, and poultry to the development of rickets. Studies suggest that dietary calcium is not toxic when single large doses are consumed by animals. Under normal conditions, it is absorbed according to need, and the excess is excreted; nonetheless, an excess of calcium in the diet can pose adverse health effects in tested species. A derived no observable adverse effect level (NOAEL) of 1,053 mg/kg per day has been derived from data reported by McDowell (1992) for laboratory rabbits exposed to calcium (Appendix N).

For birds, a NOAEL of 2,833 mg/kg per day has been derived from data reported by McDowell (1992) for poultry (Appendix N).

Aquatic Life

The effects of calcium to aquatic life are not readily available from reviewed literature.

J.1.1.4 Iron

Iron is silvery-white or gray and is somewhat magnetic. It is the second most abundant metal in the earth's crust, after aluminum, making up approximately 5% of the earth's crust. Iron is alloyed with other metals to form steel. Iron is a transition metal and is a component of every living organism (McDowell, 1992).

Plants

Data on the effects of iron concentrations in soil to plant life are not readily available from the reviewed literature.

Animals

Iron is an essential nutrient for the proper development of animals. It is essential for the normal formation of blood. Deficiencies of iron in the diet produces anemia.

Data do not exist on the effects of iron on wild animals. Iron toxicity is seldom a problem in domestic animals, but as with all other nutrients, a dietary excess can be detrimental. A derived no observable adverse effect level (NOAEL) of 26 mg/kg per day has been estimated based on data reported by McDowell (1992) for laboratory rabbits exposed to calcium (Appendix N). For birds, a NOAEL of 50 mg/kg per day was derived from data reported for poultry by McDowell (1992) (Appendix N).

Aquatic Life

The effects of iron to aquatic life are limited. A federal ambient water quality criterion for protection of aquatic biota is 1 milligram per liter (mg/L) for chronic exposure (EPA, 1986).

J.1.1.5 Magnesium

Magnesium is an alkaline earth metal and is one of the most plentiful elements in the earth's crust (2.1% by weight). Magnesium is a silver white metal found in sea water and in all plants and animals. All living organisms require magnesium (McDowell, 1992).

Plants

Data on the effects of magnesium concentrations in soil to plant life are not readily available from the reviewed literature.

Animals

Magnesium is an essential nutrient for the proper development of animals. Deficiencies of magnesium in the diet produces vasodialation, hyperirritability, convulsions, and death. Lactation tetany or grass tetany in cows is associated with magnesium deficiency.

Data do not exist on the effects of magnesium on wild animals. Tests have shown that toxic effects from magnesium can include lethargy, disturbance in locomotion, diarrhea, lowered feed intake performance, drowsiness, and death. A derived no observable adverse effect level (NOAEL) of 158 mg/kg per day has been estimated based on data reported by McDowell (1992) for laboratory rabbits exposed to calcium (Appendix N). For birds, a NOAEL of 150 mg/kg per day has been estimated based on data reported by McDowell (1992) for poultry (Appendix N).

Aquatic Life

The effects of magnesium to aquatic life are limited. A lowest effect concentration of 82 mg/L is reported for magnesium by Sutter and Mabrey (1994) for *Daphnia*.

J.1.1.6 Phosphorus

Phosphorus is the second most abundant mineral element in the animal body. Phosphorus is a highly reactive element and does not occur free in nature, because of this property. It is present in about 0.12 percent of the earth's crust. All living organisms require phosphorus (McDowell, 1992).

Plants

Data on the effects of phosphorus concentrations in soil to plant life are not readily available from the reviewed literature.

Animals

Phosphorus is an essential nutrient required for the proper development of animals. Deficiencies of phosphorus in the diet is related to the development of rickets (McDowell, 1992).

Data do not exist on the effects of phosphorus on wild animals. Phosphorus is not considered toxic when a single large dose is consumed by animals; however, prolonged consumption of

phosphorus-rich diets may cause severe metabolic problems. A derived no observable adverse effect level (NOAEL) of 526 mg/kg per day has been estimated based on data reported by McDowell (1992) for laboratory rabbits exposed to calcium (Appendix N). For birds, a NOAEL of 400 mg/kg per day was estimated based on data reported by McDowell (1992) for poultry (Appendix N).

J.1.2 Organic Compounds

J.1.2.1 Carbazole

Carbazole, also known as 9-azafluorene and dibenzopyrrole, is a coal conversion by-product (NLM, 1996). Very little data exist on this compound.

Plants

Data on carbazole concentrations in plants were not found in the literature. Phytotoxicity data on carbazole could also not be located.

Wildlife

Data on concentrations of carbazole in mammalian and avian wildlife species could not be found in the open literature.

There is limited evidence that suggests carbazole is carcinogenic in rats at an oral dose of 504 mg/kg over a six-week period (RTECS, 1996). The oral LD_{50} in rats exposed to carbazole is expected to be greater than 5,000 mg/kg (NLM, 1996). An oral LD_{50} in mice was reported at 200 mg/kg per day (RTECS, 1998). In rats and rabbits, the compound is metabolized to 3-hydroxycarbazole.

Aquatic Life

Aquatic toxicity data for carbazole were not found in the literature. Federal Water Quality Criteria do not exist for the protection of freshwater aquatic life from acute and chronic exposure to carbazole (EPA, 1986; EPA, 1992).

J.1.2.2 1,3-Dinitrobenzene

Little information is available for 1,3-dinitrobenzene. Information provided is for Nitrobenzene. Nitrobenzene is produced commercially as a precursor to aniline (NLM, 1996). It may enter the environment through air emissions and in wastewater (NLM, 1996). It may also form in the

atmosphere from photochemical reactions of benzene with nitrogen oxides (EPA, 1980i, as cited in NLM, 1996). Nitrobenzene is expected to leach into groundwater and to biodegrade (NLM, 1996). In aquatic environments, nitrobenzene is expected to degrade with a small fraction adsorbed to sediment (Davis et al., 1983, as cited in NLM, 1996).

Plants

Information on the concentration of nitrobenzene in wild flora or phytotoxicity data on nitrobenzene could not be found in the literature.

Wildlife

Specific data on the toxicity of nitrobenzene to wildlife do not exist. Laboratory studies have shown the main toxic effect of nitrobenzene is the formation of methemoglobin, with the risk of death from respiratory failure (Browning, 1965, as cited in NLM, 1996). A depression of the central nervous system and accompanied weight loss and marked cyanosis has been noted in rabbits exposed to nitrobenzene (Browning, 1965, as cited in NLM, 1996). An acute oral dose of 200 mg/kg has been shown to be fatal to rabbits (Browning, 1965, as cited in NLM, 1996). The oral LD_{50} value for rats exposed to nitrobenzene is 640 mg/kg (Budavari, 1989, as cited in NLM, 1996). An oral LD_{50} for rates exposed to 1,3-dinitrobenzene is 59.5 mg/kg per day (RTECS, 1998). The main metabolite of nitrobenzene in the urine of rabbits and guinea pigs has been found to be p-aminophenol (Browning, 1965, as cited in NLM, 1996). Nitrobenzene has been shown to be teratogenic in rats (EPA, 1984, as cited in NLM, 1996).

Aquatic Life

Data on concentrations of nitrobenzene in aquatic organisms could not be found in the literature. Bioconcentration of nitrobenzene in aquatic biota is not expected to be significant (NLM, 1996).

Data on the toxicity nitrobenzene to freshwater biota are limited primarily to fish studies. Forty-eight-hour LC_{50} values for bluegill sunfish (*Lepomis macrochirus*) and fathead minnows (*Pimephales promelas*) exposed to nitrobenzene are 42.6 and 156 mg/L, respectively (EPA, 1980i, and Holcombe et al., 1984, as cited in NLM, 1996). A concentration of 13 mg/L has been noted as the nominal 21-day no observed effect concentration for *Daphnia* exposed to nitrobenzene (Kuhn et al., 1989, as cited in NLM, 1996). A toxicity threshold of 1.9 mg/L has been reported for algae (*Microcystis quadricauda*) exposed to nitrobenzene (Verschueren, 1983, as cited in NLM, 1996). Federal Water Quality Criteria do not exist for the protection of freshwater aquatic life from exposure to nitrobenzene (EPA, 1996). A value of 27,000 μg/L, however, has been listed by EPA (1996) as the acute lowest effect level in freshwater systems.

J.1.2.3 4-Amino-2,6-Dinitrotoluene

Little information is available for 4-amino-2,6-Dinitrotoluene. Information provided is for dinitrotoluene (DNT). DNT compounds are used in organic synthesis, dyes, explosives, and in isocyanate production (NLM, 1996). 2,6 DNT is expected to be slightly mobile in soils (NLM, 1996). Biodegradation of 2,6-DNT is expected to occur in soils (NLM, 1996). In aquatic environments, 2,6-DNT will have a slight tendency to adsorb to sediments, suspended solids, and biota (NLM, 1996). Volatilization of 2,6-DNT and 2,4-DNT from water is relatively low; however, photolysis is a significant removal mechanism for the compound (NLM, 1996).

Plants

Concentrations of DNTs in field-collected plants and phytotoxicity data on plants exposed to dinitrotoluenes could not be located in the literature.

Wildlife

As with plants, data on concentrations of dinitrotoluenes in mammalian and avian wildlife species could not be found in the open literature. The liver and small intestine are the major sites of 2,6-DNT and 2,4-DNT metabolism (Schut et al., 1983, and Rickert et al., 1983, as cited in NLM, 1996).

Large differences exist in the toxicity of the various dinitrotoluene isomers in laboratory mammals (ACGIH, 1980, as cited in NLM, 1996). The 2,4-, 2,6- and 3,4- dinitrotoluene isomers have been found to be the most toxic DNT isomers to rats (ACGIH, 1980, as cited in NLM, 1996). Adverse reproductive effects have been documented in rats exposed to 2,4-DNT (NLM, 1996). Inhalation of fumes or dust containing 2,4-DNT may produce changes in blood chemistry (EPA, 1980g, as cited in NLM, 1996). Experimentally determined LD_{50} values for rats and mice orally exposed to 2,6-DNT are 117 and 621 mg/kg, respectively (NLM, 1996). LD_{50} values for rats, mice, and guinea pigs orally exposed to 2,4-DNT are 268; 790; and 1,300 mg/kg, respectively (NLM, 1996). No observable effects were observed in rats exposed to 2,4-DNT at 0.57 and 0.71 mg/kg/d (Ellis et al., 1978, as cited in NLM, 1996). 2,6-DNT and 2,4-DNT have been shown to be mutagenic (NLM, 1996). Laboratory studies have found 2,4-DNT to be carcinogenic (NLM, 1996). 2,6-DNT has been shown to be a potent hepatocarcinogen in laboratory rats (Dixit et al., 1986, as cited in NLM, 1996). Signs of 2,6-DNT poisoning that have been noted in laboratory mammals include decreased appetite, weight loss, and inhibition of muscular coordination (EPA, 1980g, as cited in NLM, 1996). Signs of 2,4-DNT toxicity in rats include changes in body weight and behavior, humpback, and jerky incoordination (Kozuka

et al., 1979, as cited in NLM, 1996). An LD_{50} value for rats exposed to 4-amino-2,6-DNT is 959 mg/kg (RTECS, 1998).

Aquatic Life

Limited data exist on concentrations of dinitrotoluenes in freshwater biota. A bioconcentration factor of 5,225 has been measured for algae exposed to 2,6-DNT in a model waste stabilization pond (Davis et al., 1981, as cited in NLM, 1996). The EPA has estimated a bioconcentration factor of 3.8 for aquatic organisms that contain about 7.6 percent lipid (EPA, 1980g, as cited in NLM, 1996).

Aquatic toxicity data for dinitrotoluenes are limited. Federal Water Quality Criteria do not exist for the protection of freshwater aquatic life from acute and chronic exposure to 2,6-DNT or 2,4-DNT (EPA, 1986; EPA, 1992). Concentrations of 2,4-DNT as low as 330 and 230 μg/L are toxic to freshwater aquatic life following acute and chronic exposure, respectively (EPA, 1986).

J.1.2.4 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAH) comprise a group of compounds containing two or more fused benzene rings. Although thousands of different PAHs are known to exist, 13 are of great environmental concern. These include acenaphthalene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene. PAHs are ubiquitous in nature, occurring from both natural and anthropogenic sources. PAHs present in surface waters are expected to undergo hydrolysis. In general, these compounds have low water solubilities and therefore partition into sediments (Sims and Overcash, 1983).

Plants

Some PAHs are synthesized by plants at very low concentrations (Sims and Overcash, 1983). Background concentrations of specific PAH compounds usually range from 22 to 88 μg/kg (dry weight) in tree leaves, 48 to 66 μg/kg (dry weight) in cereal crop plants, 0.05 to 50 μg/kg (dry weight) in leafy vegetables, 0.01 to 6 μg/kg (dry weight) in underground vegetables, and 0.02 to 0.04 μg/kg (dry weight) in fruits (Sims and Overcash, 1983). In general, PAH concentrations are usually greater in aboveground plant parts than in belowground parts and are greater on plant surfaces than within internal tissues (Edwards, 1983, as cited in Eisler, 1987b). Lower-molecular-weight PAHs are taken up from soil by plants more readily than higher-molecular-weight PAHs (Eisler, 1987b). Plant-to-soil concentration ratios for total PAHs have been

reported to range from 0.001 to 0.183 (Wang and Meresz, 1981, as cited in Edwards, 1989). According to Edwards (1983, as cited in Talmage and Walton, 1990), plant-to-soil concentration ratios for benzo(a)pyrene are usually low, ranging from 0.0001 to 0.33. Atmospheric deposition is believed to be the usual source of PAHs in plants, not uptake from soil (Sims and Overcash, 1983). The waxy surface of some plant leaves and fruits can concentrate PAHs through surface adsorption (EPA, 1980j, as cited in NLM, 1996). Mosses have been recommended as good indicators of regional PAH air pollution (Herrmann and Hubner, 1984, as cited in Eisler, 1987b). Some species of bacteria and fungi can degrade specific PAH compounds (Eisler, 1987b; Sims and Overcash, 1983).

Limited data exist on the phytotoxicity of PAHs to plants. Benzo(b)fluoranthene concentrations of 6,254 μg/kg in soil were reported to reduce stem growth in wheat but did not affect rye plants (Sims and Overcash, 1983). Dry-leaf mass was slightly reduced, and total dry yield was reduced by 11 percent in the wheat plants exposed to the elevated benzo(b)fluoranthene concentration. Benzo(a)pyrene and benzo(b)fluoranthene soil concentrations of up to 18,000 μg/kg do not appear to be severely toxic to higher plants (Sims and Overcash, 1983). There is some evidence that low concentrations of some PAHs may actually stimulate plant growth (Edwards, 1989).

Wildlife

Concentrations of PAH compounds in wild mammals and birds could not be found in the open literature. Exposure to PAHs can occur via inhalation, ingestion, or dermal exposure. Most of the PAHs taken in the body are not accumulated but are oxidized, and the metabolites are excreted (Sittig, 1985, as cited in NLM, 1996). In fact, most PAH compounds are detoxified and excreted from the body (Doull et al., 1986, as cited in NLM, 1996). PAHs are metabolized in vertebrates by a group of enzymes known as mixed-function oxidase in the liver. Some of the intermediate metabolites have been identified as mutagenic, carcinogenic, and teratogenic (Sims and Overcash, 1983).

In most cases, tissue damage from exposure to PAH compounds usually occurs at dose levels that would be expected to induce carcinomas (Eisler, 1987b). The toxic response to a PAH compound is a function of the specific compound, the dose, and the route of exposure. Unsubstituted aromatic PAHs with less than four condensed rings have not been shown to be tumorigenic (Eisler, 1987b). Many PAHs with from four to six rings are carcinogenic (Eisler, 1987b). Compounds such as 7,12-dimethylbenz(a)anthracene and benzo(a)pyrene can induce skin tumors following dermal exposure (Weisburger and Williams, 1980). One isomer of the benzo(a)pyrene metabolite 7,8-dihydrodiol 9,10-epoxide is a very potent carcinogen to newborn

mice (Slaga et al., 1978, as cited in Eisler, 1987b). Some PAH compounds may act in a synergistic or cocarcinogenic manner when combined (Eisler, 1987b).

Studies have not been conducted on the toxicity of PAH compounds to wildlife. A few laboratory studies on rodents have revealed acute oral toxicities of PAHs are greatest for benzo(a)pyrene, followed in decreasing order of toxicity by phenanthrene, naphthalene, and fluoranthene (Sims and Overcash, 1983). LD_{50} values range from 50 mg/kg body weight to 2,000 mg/kg body weight (Sims and Overcash, 1983). Chronic oral doses that result in the production of cancer are lowest for 7,12-dimethylbenz(a)anthracene at a dose of 4.0×10^{-5} to 2.5×10^{-4} mg/kg body weight (Eisler, 1987b). Benzo(a)pyrene concentrations of 0.002 mg/kg body weight and anthracene concentrations of 3,300 mg/kg body weight will also result in cancer following chronic oral exposure to the specific compound (Eisler, 1987b). Based on an estimated laboratory mouse oral NOAEL of 1.0 mg/kg/d for benzo(a)pyrene, Opresko et al. (1994) estimated wildlife NOAELs for benzo(a)pyrene of 1.11 mg/kg/d for the white-footed mouse, 0.296 mg/kg/d for the cottontail rabbit, and 0.191 mg/kg/d for the red fox. Calculated chronic NOAELs for mammalian wildlife exposed to benzo(a)pyrene in drinking water only range from 1.91 to 7.76 mg/L (Opresko et al., 1994).

Aquatic Life

Bioconcentration factors have been reported for aquatic biota exposed to PAHs under laboratory conditions (Eisler, 1987b). Bioconcentration factors for *Daphnia* exposed to specific PAH compounds for a period of at least 24 hours range from 131 for naphthalene to 134,248 for benzo(a)pyrene (Eisler, 1987b). Water to liver bioconcentration factors for freshwater fish exposed to benzo(a)pyrene for a minimum of eight days range from 182 for rainbow trout (*Salmo gairdneri*) to 1,375 for Northern pike (*Esox lucius*) (Eisler, 1987b). There is little evidence for bioaccumulation and biomagnification of PAHs in the aquatic environment (Eisler, 1987b).

The toxicity of PAH compounds to fish is also related to the solubility of the compound in water. Toxicity to aquatic biota also increases as the molecular weight of the PAH compound and the degree of alkyl substitutions on the aromatic ring increase (Eisler, 1987b). The toxicity of PAHs to aquatic organisms is very species-specific and related to the organisms' ability to metabolize and excrete the compound (Eisler, 1987b). Because many species of fish are able to metabolize benzo(a)pyrene to reactive intermediates that have mutagenic and carcinogenic properties, the presence of tumors in fish from PAH-contaminated environments is often related to exposure to PAHs (Eisler, 1987b). Other toxic responses that have been noted in aquatic biota exposed to PAHs include inhibited reproduction in daphnids, delayed emergence of larval midges, decreased

respiration and heart rate in mussels, inhibition of photosynthesis in algae and aquatic macrophytes, and liver enlargement in fish (Eisler, 1987b).

A few Federal Water Quality Criteria exist for the protection of freshwater aquatic life. These are an acute value of 3,980 μg/L for fluoroanthene, an acute value of 30 μg/L and chronic value of 6.3 μg/L for phenanthrene, and an acute value of 2,300 μg/L and a chronic value of 620 μg/L for naphthalene (EPA, 1996). Suter and Mabrey (1994), however, have derived acute and chronic advisory values for freshwater biota exposed to PAHs. These are presented in Table J-1. Also presented in Table J-1 are the lowest chronic values of specific PAHs reported in the literature for fish and daphnids (Suter and Mabrey, 1994). The test EC_{20} for fish can be used as a benchmark indicative of production within a population. It is the highest tested concentration of a specific PAH causing less than 20 percent reduction in either the weight of young fish per initial female fish in a life cycle or partial life-cycle test or the weight of young per egg in an early life-stage test (Suter and Mabrey, 1994). A similar value can be determined for daphnids, which reflects the highest tested concentration of a PAH causing less than 20 percent reduction in the product of growth, fecundity, and survivorship in a chronic test with a daphnid species (Suter and Mabrey, 1994) (Table J-1).

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Table J-1

Benchmarks Screening Values for Freshwater Biota Exposed to Polycyclic Aromatic Hydrocarbons Where No Federal Criteria Exist[a]

Plum Brook Ordnance Works, Sandusky, Ohio

PAH[b]	Advisory Value (µg/L)		Lowest Chronic Value (µg/L)		Lowest Test EC_{20} Value (µg/L)	
	Acute	Chronic	Fish	Daphnids	Fish	Daphnids
Acenaphthene	—	—	74	6,646	<197	—
Anthracene	0.024	0.0013	0.09	<2.1	0.35	>8.2
Benzo(a)anthracene	0.49	0.027	—	0.65	—	—
Benzo(a)pyrene	0.24	0.014	—	0.30	>2.99	—

[a]Benchmark screening values obtained from Suter and Mabrey, 1994.
[b]PAH = Polycyclic aromatic hydrocarbons.

APPENDIX K

ASSESSMENT RECEPTOR PROFILES

Appendix K
Assessment Receptor Profiles

Eastern Cottontail ***(Sylvilagus floridanus)***

These medium-size grazing herbivores are found over most of the eastern half of the United States and southern Canada, and have been widely introduced into the western U.S. (EPA, 1993). The eastern cottontail is unique to the genus because of the large variety of habitats that it occupies, including glades and woodlands, deserts, swamps, prairies, hardwood forests, rain forests, and boreal forests (EPA, 1993). Open grassy areas are generally are used for grazing at night, whereas dense, heavy cover typically is used for shelter during the day (EPA, 1993). During the summer seasons these rabbits consume herbaceous plants (*e.g.* grasses, clover, timothy, and alfalfa), whereas winter diet typically consists of woody vines, shrubs and trees (*e.g.*. birch, maple, and apple) (EPA, 1993). Home range is 3 to 20 acres, with larger ranges in the summer and smaller ranges in the winter (Burt and Grossenheider, 1980). Populations fluctuate from 1 to 4 cottontail per four acres to several per acre in winter conditions (Burt and Grossenheider, 1980). The eastern cottontail breeds from February through September and usually produces 3 to 4 litters per year of 1 to 9 young (usually 4 to 5), however this rabbit's death rate vies with its birth rate, and few rabbits live for more than one year (Whitaker, 1995). The average longevity is 1.25 years (EPA, 1993).

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Deer Mouse *(Peromyscus maniculatus)*

This medium-sized mouse is found in the eastern United States from the Hudson Bay to Pennsylvania, the southern Appalachians, central Arkansas and central Texas. In the west it is found from Mexico to the south Yukon and Northwest Territories (Whitaker, 1995). Deer mice habitat includes nearly every dry land habitat within its range, including forest, grasslands, or a mixture of the two (Burt and Grossenheider, 1980). Nocturnal and active year-round, these mice construct nests in the ground, trees, stumps, and buildings (Burt and Grossenheider, 1980). Omnivorous, the deer mouse feeds on nuts and seeds (e.g., jewel weed and black cherry pits), fruits, beetles, caterpillars, and other insects. Deer mice may cache their food during the fall and winter in the more northern parts of their range (EPA, 1993). Home range is 0.15 to 3 acres (Burt and Grossenheider, 1980; EPA, 1993). Density of populations is 4 to 12 mice per acre, and average life span is two years in the wild (Burt and Grossenheider, 1980). The breeding season is from February to November, depending on latitude. Three to five young are born in each of two to four litters per year (Burt and Grossenheider, 1980). They are greyish to reddish-brown with a white belly, with a distinctly short-haired, bicolor tail (Whitaker, 1995). Weight range is 14.8 (EPA, 1993) to 33 grams (Whitaker, 1995).

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Great Blue Heron *(Ardea herodias)*

The great blue heron is the largest member of its group in North America (99 to 132 centimeters) (EPA, 1993; Bull and Farrand, 1995). It ranges from coastal Alaska, and Nova Scotia south to Mexico (Bull and Farrand, 1995). Habitat of this heron includes both fresh and marine waters, including freshwater lakes and rivers, brackish marshes, lagoons, mangroves, and coastal wetlands, particularly where small fish are plentiful (EPA, 1993). Great blues tend to nest in dense colonies, or heronries. The location of the heronry is generally close to foraging grounds, and tall trees are preferred over shorter trees or bushes for nest sites. Fish are the preferred prey, but the heron will also eat crustaceans, amphibians, reptiles, insects, birds, and mammals. Foraging home range may be as great as 24 kilometers, and population densities along streams and rivers rang from 2.3 to 3.6 birds per kilometer (EPA, 1993). Once a year the female will lay 2 to 7 eggs (Bull and Farrand, 1995), and the first year mortality rate is approximately 64 percent (EPA, 1993).

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Red-Tailed Hawk ***(Buteo jamacensis)***

This carnivorous hawk is one of the most common and widespread members of the genus *Buteo* in the continental United States and Canada (Brown and Amadon, 1968). Red-tailed hawks live in a variety of habitats, such as farmlands, woodlands, mountains, and deserts, as long as there is open country interdispersed with woods, bluffs, or streamside trees. They are primarily carnivorous, feeding on (greater than 85 percent) small rodents, as well as fish. Other prey items include amphibians, reptiles, crayfish, and other birds (Adamcik et al., 1979; Ehrlich et al., 1988). Home range has been reported as approximately 66.8 acres, with a population density of 0.16 pairs per acre (Janes, 1984), although EPA (1993) reports an average territory size of 842 hectares (2,080 acres). Breeding population density is one nest per 0.009 acre or one individual per 0.004 acre. Body weight for male red-tails is 1,028.6 to 1,142.9 grams, and for females 1,371.4 to 1,600 grams (Brown and Amadon, 1968), although EPA (1993) reports an average body weight of 957 grams. They typically mate for life or until one of the pair dies, with pairs clinging to territories year after year (Austing, 1964).

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Raccoon *(Procyon lotor)*

Raccoons are native only in the Americas. Their range extends from the southern edge of the southern provinces of Canada and most of the United States, except for portions of the Rocky Mountain states, central Nevada, and Utah (Whitaker, 1995). The raccoon weighs from 3 to 15 kg (Merritt, 1987: EPA, 1993) and has a head and body length of 46 to 71 centimeters and a tail length of 20 to 30 centimeters (Burt and Grossenheider, 1980). The raccoon is nocturnal and solitary, except when breeding or caring for its young. During particularly cold spells, the raccoon may sleep for several days at a time but does not hibernate (Whitaker, 1995). The raccoon is found along lakes near wooded areas or rock cliffs (Burt and Grossenheider, 1980), but prefers wooded streams (Whitaker, 1995). The raccoon is highly omnivorous and is an opportunistic feeder, consuming virtually any animal or plant matter that is available (Merritt, 1987: EPA, 1993). Animal matter predominates the diet during the spring and early summer; plant matter predominates during late summer, autumn, and winter (Merritt, 1987: EPA, 1993). The home range of the raccoon extends up to 3.2 km across, but usually it is less than 1.6 km. Population densities range from one per acre (highest) to one per 15 acres (considered high) (Burt and Grossenheider, 1980). Captive raccoons live for approximately 14 years (Burt and Grossenheider, 1980). Average body weight is 5.1 kg (EPA, 1993).

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Short-tailed Shrew (*Blarina brevicauda*)

This shrew is the largest found in North America. It is solid grey above and below, with a short tail, and weighs between 15 and 29 grams (Whitaker, 1995). Total length of this shrew is 76 to 102 millimeters (Burt and Grossenheider, 1980). The range of this shrew extends from southeastern Canada and the northeastern U.S. to Nebraska, Missouri, Kentucky, and in the mountains to Alabama (Whitaker, 1995). Preferable habitat for the shrew includes forests, grasslands, marshes, and brushy areas. It will make a nest of dry leaves, grass, and hair beneath logs, stumps, rocks, or debris (Burt and Grossenheider, 1980). This underground tunneler may burrow as deep as six feet, and has a voracious appetite, eating one half of its own body weight per day of earthworms, other terrestrial vertebrates, and sometimes young mice (Whitaker, 1995). Mean population densities range from 5.7, in the winter, to 28 per acre in the summer (EPA, 1993). Their home range varies from 0.5 to 1 acre (Burt and Grossenheider, 1980). Longevity is typically around 20 months (EPA, 1993), with 5 to 8 young born to each of 2 to 3 litters (Burt and Grossenheider, 1980).

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White-tailed Deer *(Odocoileus virginianus)*

The white-tailed deer is a member of the Family Cervidae. They are large, even-toed, hoofed mammals with long legs. Their coat is predominantly light brown or chestnut colored, with the underparts being white. Deer are primarily herbivorous grazers and browsers, constantly moving from one food source to the next. The deer's diet changes seasonally. When available, farm crops such as winter wheat, corn, alfalfa, soy beans, and hay are important components of the species diet. Other top food items include wild crab apples, sumac, grasses, green briar, clover, jewelweed, acorns, and dogwood. In regions where the climate varies from season to season, deer may make annual migrations of 10 to 20 miles in the search for food. However, in Ohio, deer typically have rather small home ranges (2 to 3 square miles) and are reluctant to leave this range. The average weight for the species is 88 kilograms for males and 61 kilograms for females. Breeding season ranges from November through February, with the young offspring born in May and early June. Virtually all yearling and adult does conceive each year, and in Ohio usually carry twins. Triplets and quadruplets have also been recorded Gottschang (1981).

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Marsh Wren ***(Cistothorus palustris)***

The marsh wren is a small bird (4 to 4.5 inches in length) which inhabits freshwater cattail marshes and salt marshes. Nesting pairs are not likely to occupy other habitats and the species avoids the wet meadow and sedge meadow habitats preferred by sedge wrens. Marsh wrens breed throughout most of the northern half of the United States and in coastal areas as far south as Florida. The species eats mostly insects, and occasionally snails and other invertebrates. The average body weight is 0.01 kilograms, and the average home range for the species is 0.054 hectares. Because the species is polygamous, there may be more females than males inhabiting a breeding marsh. Densities as high as 120 birds per hectare have been recorded (US EPA, 1993). Marsh wrens' nests are globular structures placed at heights of 2 to 5 feet in dense vegetation. The males commonly build dummy nests in addition to the one where the eggs will be laid (Peterjohn and Rice, 1991).

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APPENDIX L

GLOSSARY OF TERMS (ECOLOGICAL)

Appendix L

Glossary of Terms

Bioconcentration. For aquatic organisms, bioconcentration is the uptake and retention of a substance by an aquatic organism from the surrounding water through gill membranes or other external body surfaces. Terrestrial bioconcentration focuses on uptake and retention of contaminants from the surrounding medium on the organism level (as by the earthworm, for example).

Bioaccumulation. This refers to the uptake and retention of a substance by an aquatic organism from its surrounding medium and food (EPA, 1995b). Terrestrial bioaccumulation, as with aquatic bioaccumulation, is defined as an organism's uptake and retention of a substance from its surrounding medium and food.

Biomagnification. This refers to the process by which tissue concentrations of bioaccumulated toxic substances increase as the substances pass up through two or more trophic levels. The definition of this term is similar for both terrestrial and aquatic organisms.

APPENDIX M

ECOLOGICAL RISK CHARACTERIZATION SPREADSHEETS

Plum Brook Ordnance Works
West Area Red Water Ponds

Chemical Data

Chemical Name	Surface Soil Conc. (mg/kg)	Total Soil Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Soil-to-Plant TF	Shallow-rooted Plant Conc. (mg/kgdw)	Deep-rooted Plant Conc. (mg/kgdw)	Soil-to-Invert. BAF	Invert. Conc. (mg/kgdw)	Food-to-Muscle TF
Organics										
Acetone	1.20E-02	1.20E-02		-2.40E-01	5.33E+01	6.40E-01	6.40E-01	1.16E+01	1.40E-01	1.04E-08
Anthracene	2.00E-01	2.00E-01		4.45E+00	1.04E-01	2.07E-02	2.07E-02	2.00E+01	4.00E+00	7.28E-04
Benzo(a)anthracene	2.00E-01	2.00E-01		5.61E+00	2.22E-02	4.43E-03	4.43E-03	2.28E+01	4.57E+00	1.15E-02
Benzo(b)fluoranthene	2.00E-01	2.00E-01		6.06E+00	1.22E-02	2.43E-03	2.43E-03	2.40E+01	4.81E+00	3.35E-02
Benzo(g,h,i)perylene	2.00E-01	2.00E-01		6.51E+00	6.69E-03	1.34E-03	1.34E-03	2.53E+01	5.07E+00	9.77E-02
Benzo(k)fluoranthene	2.00E-01	2.00E-01		6.06E+00	1.22E-02	2.43E-03	2.43E-03	2.40E+01	4.81E+00	3.35E-02
Bromomethane			2.10E-04	1.09E+00	9.08E+00	0.00E+00	0.00E+00	1.36E+01	0.00E+00	2.46E-07
Chrysene	2.00E-01	2.00E-01		5.61E+00	2.22E-02	4.43E-03	4.43E-03	2.28E+01	4.57E+00	1.15E-02
Di-n-octyl phthalate			7.80E-03	5.22E+00	3.72E-02	0.00E+00	0.00E+00	2.18E+01	0.00E+00	4.54E-03
Fluoranthene	2.00E-01	2.00E-01		4.90E+00	5.70E-02	1.14E-02	1.14E-02	2.10E+01	4.21E+00	2.12E-03
Indeno(1,2,3-cd)pyrene	2.00E-01	2.00E-01		6.51E+00	6.69E-03	1.34E-03	1.34E-03	2.53E+01	5.07E+00	9.77E-02
Phenanthrene	2.00E-01	2.00E-01		4.45E+00	1.04E-01	2.07E-02	2.07E-02	2.00E+01	4.00E+00	7.28E-04
Pyrene	2.00E-01	2.00E-01		4.90E+00	5.70E-02	1.14E-02	1.14E-02	2.10E+01	4.21E+00	2.12E-03
1,3-DNB	1.25E-01	1.25E-01	3.00E-04	1.49E+00	5.33E+00	6.66E-01	6.66E-01	1.42E+01	1.78E+00	6.37E-07
4-Amino-2,6-DNT	1.25E-01	1.25E-01		2.00E+00	2.70E+00	3.38E-01	3.38E-01	1.51E+01	1.88E+00	2.14E-06
4-Amino-2-nitrotoluene			6.00E-04	2.00E+00	2.70E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	2.14E-06
2,4-DNT	1.25E-01	1.25E-01		1.98E+00	2.78E+00	3.47E-01	3.47E-01	1.50E+01	1.88E+00	2.04E-06
2,6-DNT		1.30E-01	8.00E-04	2.28E+00	1.86E+00	0.00E+00	2.42E-01	1.56E+01	0.00E+00	4.17E-06
3,4-DNT		1.25E-01	6.00E-04	2.28E+00	1.86E+00	0.00E+00	2.33E-01	1.56E+01	0.00E+00	4.17E-06
Nitrobenzene				1.87E+00	3.21E+00	0.00E+00	0.00E+00	1.48E+01	0.00E+00	1.57E-06
3-Nitrotoluene			5.40E-02	2.43E+00	1.53E+00	0.00E+00	0.00E+00	1.58E+01	0.00E+00	5.96E-06
1,3,5-TNB	1.25E-01	1.25E-01		1.18E+00	8.05E+00	1.01E+00	1.01E+00	1.37E+01	1.71E+00	3.05E-07
2,4,6-TNT	1.25E-01	1.25E-01		2.00E+00	2.70E+00	3.38E-01	3.38E-01	1.51E+01	1.88E+00	2.14E-06
Inorganics										
Aluminum			1.38E+01	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Antimony				---	5.60E-04	0.00E+00	0.00E+00	1.00E+00	0.00E+00	4.00E-05
Beryllium	6.00E-01	6.00E-01		---	5.80E-03	3.48E-03	3.48E-03	1.00E+00	6.00E-01	1.00E-03
Calcium				---	1.90E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-03
Iron			2.11E+01	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Lead			7.70E-02	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Magnesium			5.07E+01	---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02
Manganese			1.60E+00	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Potassium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02
Sodium	2.99E+02	2.99E+02	1.07E+02	---	6.50E-02	1.94E+01	1.94E+01	1.00E+00	2.99E+02	8.00E-02
Vanadium			5.22E-02	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA

Plum Brook Ordnance Works
West Area Red Water Ponds

Toxicity Data

Chemical Name	Mammals NOAEL (mg/kg/d)	Mammals Test Species	Mammals Body Wt. (kg)	Birds NOAEL (mg/kg/d)	Birds Test Species	Birds Body Wt. (kg)
Organics						
Acetone	1.00E+01	rat	0.35	--	--	--
Anthracene	1.00E+00	mouse	0.03	--	--	--
Benzo(a)anthracene	1.00E+00	mouse	0.03	--	--	--
Benzo(b)fluoranthene	1.00E+00	mouse	0.03	--	--	--
Benzo(g,h,i)perylene	1.00E+00	mouse	0.03	--	--	--
Benzo(k)fluoranthene	1.00E+00	mouse	0.03	--	--	--
Bromomethane	2.14E+00	rat	0.35	--	--	--
Chrysene	1.00E+00	mouse	0.03	--	--	--
Di-n-octyl phthalate	4.70E+02	rat	0.35	--	--	--
Fluoranthene	1.25E+02	mouse	0.03	--	--	--
Indeno(1,2,3-cd)pyrene	1.00E+00	mouse	0.03	--	--	--
Phenanthrene	1.00E+00	mouse	0.03	--	--	--
Pyrene	7.50E+01	mouse	0.03	--	--	--
1,3-DNB	5.95E-01	rat	0.35	--	--	--
4-Amino-2,6-DNT	9.59E+00	rat	0.35	3.20E-02	unknown	1
4-Amino-2-nitrotoluene	6.86E+01	rat	0.35	3.20E-02	unknown	1
2,4-DNT	2.68E+00	rat	0.35	--	--	--
2,6-DNT	1.77E+00	rat	0.35	--	--	--
3,4-DNT	8.07E+00	rat	0.35	--	--	--
Nitrobenzene	2.30E-01	mouse	0.03	--	--	--
3-Nitrotoluene	1.07E+01	rat	0.35	--	--	--
1,3,5-TNB	2.75E+00	rat	0.35	--	--	--
2,4,6-TNT	7.95E+00	rat	0.35	--	--	--
Inorganics						
Aluminum	1.93E+00	mouse	0.03	1.10E+02	ringed dove	0.155
Antimony	1.25E-01	mouse	0.03	--	--	--
Beryllium	6.60E-01	rat	0.35	--	--	--
Calcium	1.05E+03	rabbit	3.8	2.83E+03	Jap. quail	0.072
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Lead	8.00E+00	rat	0.35	3.85E+00	Am. Kestrel	0.13
Magnesium	1.58E+02	rabbit	3.8	1.50E+02	poultry	1.6
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072
Potassium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Sodium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Vanadium	2.10E-01	rat	0.26	1.14E+01	mallard duck	1.17

Plum Brook Ordnance Site
West Area Red Water Ponds

Omnivorous Rodent: **Deer mouse *(Peromyscus manicalatus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Plant/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics																
Acetone	2.21E+01	8.00E+00	2.76E+00	1.00E+00	1.00E+00	4.62E-05	1.68E-05	7.38E-02	2.68E-02	1.03E-02	3.74E-03	3.05E-02	0.00E+00	0.00E+00	3.05E-02	1.03E-08
Anthracene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.39E-03	1.61E-02	2.95E-01	1.98E+00	2.00E+00	0.00E+00	0.00E+00	2.00E+00	2.54E-03
Benzo(a)anthracene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	5.11E-04	3.43E-03	3.37E-01	2.26E+00	2.27E+00	0.00E+00	0.00E+00	2.27E+00	4.55E-02
Benzo(b)fluoranthene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.81E-04	1.88E-03	3.55E-01	2.38E+00	2.39E+00	0.00E+00	0.00E+00	2.39E+00	1.40E-01
Benzo(g,h,i)perylene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	1.54E-04	1.03E-03	3.74E-01	2.51E+00	2.51E+00	0.00E+00	0.00E+00	2.51E+00	4.29E-01
Benzo(k)fluoranthene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.81E-04	1.88E-03	3.55E-01	2.38E+00	2.39E+00	0.00E+00	0.00E+00	2.39E+00	1.40E-01
Bromomethane	4.72E+00	8.00E+00	5.90E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E-05	5.29E-05	5.29E-05	6.99E-11
Chrysene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	5.11E-04	3.43E-03	3.37E-01	2.26E+00	2.27E+00	0.00E+00	0.00E+00	2.27E+00	4.55E-02
Di-n-octyl phthalate	1.04E+03	8.00E+00	1.30E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-03	8.95E-06	8.95E-06	8.17E-05
Fluoranthene	1.49E+02	8.00E+00	1.86E+01	1.00E+00	1.00E+00	7.70E-04	4.13E-05	1.32E-03	7.06E-05	3.11E-01	1.67E-02	1.68E-02	0.00E+00	0.00E+00	1.68E-02	7.77E-03
Indeno(1,2,3-cd)pyrene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	1.54E-04	1.03E-03	3.74E-01	2.51E+00	2.51E+00	0.00E+00	0.00E+00	2.51E+00	4.29E-01
Phenanthrene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.39E-03	1.61E-02	2.95E-01	1.98E+00	2.00E+00	0.00E+00	0.00E+00	2.00E+00	2.54E-03
Pyrene	6.95E+01	8.00E+00	1.12E+01	1.00E+00	1.00E+00	7.70E-04	6.89E-05	1.32E-03	1.18E-04	3.11E-01	2.78E-02	2.79E-02	0.00E+00	0.00E+00	2.79E-02	7.77E-03
1,3-DNB	1.31E+00	8.00E+00	1.64E-01	1.00E+00	1.00E+00	4.81E-04	2.94E-03	7.69E-02	4.69E-01	1.31E-01	7.99E-01	1.27E+00	4.46E-05	2.72E-04	1.27E+00	1.56E-06
4-Amino-2,6-DNT	2.11E+01	8.00E+00	2.64E+00	1.00E+00	1.00E+00	4.81E-04	1.82E-04	3.90E-02	1.46E-02	1.39E-01	5.26E-02	6.75E-02	0.00E+00	0.00E+00	6.75E-02	4.48E-06
4-Amino-2-nitrotoluene	1.51E+02	8.00E+00	1.89E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-05	4.72E-06	4.72E-06	2.24E-09
2,4-DNT	5.91E+00	8.00E+00	7.39E-01	1.00E+00	1.00E+00	4.81E-04	6.52E-04	4.01E-02	5.42E-02	1.39E-01	1.88E-01	2.43E-01	0.00E+00	0.00E+00	2.43E-01	4.29E-06
2,6-DNT	3.90E+00	8.00E+00	4.88E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-04	2.44E-04	2.44E-04	5.81E-09
3,4-DNT	1.78E+01	8.00E+00	2.22E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-05	4.01E-05	4.01E-05	4.36E-09
Nitrobenzene	2.74E-01	8.00E+00	3.43E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	2.36E+01	8.00E+00	2.95E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.03E-03	2.72E-03	2.72E-03	5.60E-07
1,3,5-TNB	6.06E+00	8.00E+00	7.58E-01	1.00E+00	1.00E+00	4.81E-04	6.35E-04	1.16E-01	1.53E-01	1.26E-01	1.67E-01	3.21E-01	0.00E+00	0.00E+00	3.21E-01	8.68E-07
2,4,6-TNT	1.75E+01	8.00E+00	2.19E+00	1.00E+00	1.00E+00	4.81E-04	2.20E-04	3.90E-02	1.78E-02	1.39E-01	6.34E-02	8.14E-02	0.00E+00	0.00E+00	8.14E-02	4.48E-06
Inorganics																
Aluminum	2.30E+00	8.00E+00	2.86E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E+00	7.13E+00	7.13E+00	0.00E+00
Antimony	1.49E-01	8.00E+00	1.86E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	1.46E+00	8.00E+00	1.82E-01	1.00E+00	1.00E+00	2.31E-03	1.27E-02	4.02E-04	2.21E-03	4.43E-02	2.43E-01	2.58E-01	0.00E+00	0.00E+00	2.58E-01	5.50E-04
Calcium	4.22E+03	8.00E+00	5.27E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.04E+02	8.00E+00	1.30E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E+00	2.41E-01	2.41E-01	0.00E+00
Lead	1.76E+01	8.00E+00	2.21E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-02	5.19E-03	5.19E-03	0.00E+00
Magnesium	6.32E+02	8.00E+00	7.91E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.54E+00	9.53E-02	9.53E-02	1.77E+00
Manganese	1.94E+02	8.00E+00	2.43E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.38E-01	9.80E-03	9.80E-03	0.00E+00
Potassium	8.32E+03	8.00E+00	7.90E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	6.32E+03	8.00E+00	7.90E+02	1.00E+00	1.00E+00	1.15E+00	1.46E-03	2.24E+00	2.83E-03	2.20E+01	2.79E-02	3.22E-02	1.59E+01	2.01E-02	5.23E-02	3.87E+01
Vanadium	4.30E-01	8.00E+00	5.37E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.76E-03	1.44E-01	1.44E-01	0.00E+00
TOTAL							**6.02E-02**		**7.86E-01**		**1.98E+01**	**2.07E+01**		**7.65E+00**	**2.83E+01**	

Body Weight (kg)	0.0148
Water Intake (L/d)	0.0022
Food Intake (kg(dw)/d)	0.0028
Soil Intake (kg/d)	0.000057
Plant Intake (kg(dw)/d) -- 61% of diet	0.001708
Invertebrate Intake (kg(dw)/d) -- 39% of diet	0.001092

Plum Brook Ordnance Works
West Area Red Water Ponds

Opportunistic Omnivore: **Raccoon *(Procyon lotor)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																	
Acetone	5.12E+00	8.00E+00	6.40E-01	1.00E+00	1.00E+00	2.82E-05	4.41E-05	1.37E-02	2.14E-02	2.14E-03	3.34E-03	2.61E-11	4.08E-11	2.48E-02	0.00E+00	0.00E+00	2.48E-02
Anthracene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	4.44E-04	1.28E-02	6.11E-02	1.77E+00	6.47E-06	1.87E-04	1.79E+00	0.00E+00	0.00E+00	1.79E+00
Benzo(a)anthracene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	9.49E-05	2.74E-03	6.98E-02	2.02E+00	1.16E-04	3.35E-03	2.04E+00	0.00E+00	0.00E+00	2.04E+00
Benzo(b)fluoranthene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	5.21E-05	1.51E-03	7.36E-02	2.12E+00	3.56E-04	1.03E-02	2.15E+00	0.00E+00	0.00E+00	2.15E+00
Benzo(g,h,i)perylene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	2.86E-05	8.27E-04	7.75E-02	2.24E+00	1.09E-03	3.16E-02	2.28E+00	0.00E+00	0.00E+00	2.28E+00
Benzo(k)fluoranthene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	5.21E-05	1.51E-03	7.36E-02	2.12E+00	3.56E-04	1.03E-02	2.15E+00	0.00E+00	0.00E+00	2.15E+00
Bromomethane	1.10E+00	8.00E+00	1.37E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-13	1.67E-12	1.67E-12	1.77E-05	1.29E-04	1.29E-04
Chrysene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	9.49E-05	2.74E-03	6.98E-02	2.02E+00	1.16E-04	3.35E-03	2.04E+00	0.00E+00	0.00E+00	2.04E+00
Di-n-octyl phthalate	2.41E+02	8.00E+00	3.01E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-07	5.23E-09	5.23E-09	6.58E-04	2.19E-05	2.19E-05
Fluoranthene	3.46E+01	8.00E+00	4.33E+00	1.00E+00	1.00E+00	4.71E-04	1.09E-04	2.44E-04	5.64E-05	6.44E-02	1.49E-02	1.98E-05	4.58E-06	1.50E-02	0.00E+00	0.00E+00	1.50E-02
Indeno(1,2,3-cd)pyrene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	2.86E-05	8.27E-04	7.75E-02	2.24E+00	1.09E-03	3.16E-02	2.28E+00	0.00E+00	0.00E+00	2.28E+00
Phenanthrene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	4.44E-04	1.28E-02	6.11E-02	1.77E+00	6.47E-06	1.87E-04	1.79E+00	0.00E+00	0.00E+00	1.79E+00
Pyrene	2.08E+01	8.00E+00	2.60E+00	1.00E+00	1.00E+00	4.71E-04	1.81E-04	2.44E-04	9.40E-05	6.44E-02	2.48E-02	1.98E-05	7.63E-06	2.51E-02	0.00E+00	0.00E+00	2.51E-02
1,3-DNB	3.05E-01	8.00E+00	3.81E-02	1.00E+00	1.00E+00	2.94E-04	7.73E-03	1.43E-02	3.75E-01	2.72E-02	7.14E-01	3.96E-09	1.04E-07	1.10E+00	2.53E-05	6.64E-04	1.10E+00
4-Amino-2,6-DNT	4.91E+00	8.00E+00	6.14E-01	1.00E+00	1.00E+00	2.94E-04	4.79E-04	7.24E-03	1.18E-02	2.88E-02	4.70E-02	1.14E-08	1.86E-08	5.92E-02	0.00E+00	0.00E+00	5.92E-02
4-Amino-2-nitrotoluene	3.51E+01	8.00E+00	4.39E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.71E-12	1.30E-12	1.30E-12	5.06E-05	1.15E-05	1.15E-05
2,4-DNT	1.37E+00	8.00E+00	1.71E-01	1.00E+00	1.00E+00	2.94E-04	1.72E-03	7.43E-03	4.33E-02	2.87E-02	1.68E-01	1.09E-08	6.38E-08	2.13E-01	0.00E+00	0.00E+00	2.13E-01
2,6-DNT	9.06E-01	8.00E+00	1.13E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-11	1.31E-10	1.31E-10	6.75E-05	5.96E-04	5.96E-04
3,4-DNT	4.13E+00	8.00E+00	5.16E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-11	2.15E-11	2.15E-11	5.06E-05	9.80E-05	9.80E-05
Nitrobenzene	6.37E-02	8.00E+00	7.96E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	5.49E+00	8.00E+00	6.86E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-09	2.08E-09	2.08E-09	4.55E-03	6.64E-03	6.64E-03
1,3,5-TNB	1.41E+00	8.00E+00	1.76E-01	1.00E+00	1.00E+00	2.94E-04	1.67E-03	2.16E-02	1.23E-01	2.62E-02	1.49E-01	2.21E-09	1.26E-08	2.73E-01	0.00E+00	0.00E+00	2.73E-01
2,4,6-TNT	4.07E+00	8.00E+00	5.09E-01	1.00E+00	1.00E+00	2.94E-04	5.78E-04	7.24E-03	1.42E-02	2.88E-02	5.66E-02	1.14E-08	2.24E-08	7.14E-02	0.00E+00	0.00E+00	7.14E-02
Inorganics																	
Aluminum	5.34E-01	8.00E+00	6.68E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E+00	1.74E+01	1.74E+01
Antimony	3.46E-02	8.00E+00	4.33E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	3.38E-01	8.00E+00	4.22E-02	1.00E+00	1.00E+00	1.41E-03	3.34E-02	7.45E-05	1.76E-03	9.18E-03	2.17E-01	1.40E-06	3.32E-05	2.53E-01	0.00E+00	0.00E+00	2.53E-01
Calcium	9.78E+02	8.00E+00	1.22E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.78E+00	5.89E-01	5.89E-01
Lead	4.09E+00	8.00E+00	5.12E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.49E-03	1.27E-02	1.27E-02
Magnesium	1.47E+02	8.00E+00	1.83E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E-03	2.45E-04	2.45E-04	4.27E+00	2.33E-01	2.33E-01
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-01	2.40E-02	2.40E-02
Potassium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	1.00E+00	7.02E-01	3.83E-03	4.15E-01	2.27E-03	4.57E+00	2.49E-02	9.87E-02	5.38E-04	3.15E-02	9.02E+00	4.92E-02	8.07E-02
Vanadium	9.98E-02	8.00E+00	1.25E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E-03	3.53E-01	3.53E-01
TOTAL							**1.59E-01**		**6.28E-01**		**1.77E+01**		**9.16E-02**	**1.86E+01**		**1.87E+01**	**3.73E+01**

Body Weight (kg)	5.1
Water intake (L/d)	0.43
Food intake (kg(dw)/d)	0.26
Soil intake (kg/d)	0.012
Mouse Intake (kg(dw)/d) -- 5 % of diet	0.013
Plant intake (kg(dw)/d) -- 42% of diet	0.1092
Invertebrate intake (kg(dw)/d) -- 30% of diet	0.078

Plum Brook Ordnance Works
West Area Red Water Ponds

Herbivorous Rodent: **Eastern Cottontail *(Sylvilagus floridanus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
Acetone	1.34E+01	8.00E+00	1.67E+00	1.00E+00	1.00E+00	6.36E-05	3.81E-05	5.42E-02	3.25E-02	3.25E-02	0.00E+00	0.00E+00	3.25E-02	1.96E-08
Anthracene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.76E-03	1.95E-02	3.12E-02	0.00E+00	0.00E+00	3.12E-02	7.11E-05
Benzo(a)anthracene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	3.76E-04	4.16E-03	1.59E-02	0.00E+00	0.00E+00	1.59E-02	5.72E-04
Benzo(b)fluoranthene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	2.06E-04	2.29E-03	1.40E-02	0.00E+00	0.00E+00	1.40E-02	1.47E-03
Benzo(g,h,i)perylene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.13E-04	1.26E-03	1.30E-02	0.00E+00	0.00E+00	1.30E-02	3.98E-03
Benzo(k)fluoranthene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	2.06E-04	2.29E-03	1.40E-02	0.00E+00	0.00E+00	1.40E-02	1.47E-03
Bromomethane	2.86E+00	8.00E+00	3.57E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E-05	5.71E-05	5.71E-05	1.74E-10
Chrysene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	3.76E-04	4.16E-03	1.59E-02	0.00E+00	0.00E+00	1.59E-02	5.72E-04
Di-n-octyl phthalate	6.28E+02	8.00E+00	7.85E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.58E-04	9.66E-06	9.66E-06	1.19E-04
Fluoranthene	9.03E+01	8.00E+00	1.13E+01	1.00E+00	1.00E+00	1.06E-03	9.39E-05	9.67E-04	8.56E-05	1.79E-04	0.00E+00	0.00E+00	1.79E-04	1.49E-04
Indeno(1,2,3-cd)pyrene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.13E-04	1.26E-03	1.30E-02	0.00E+00	0.00E+00	1.30E-02	3.98E-03
Phenanthrene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.76E-03	1.95E-02	3.12E-02	0.00E+00	0.00E+00	3.12E-02	7.11E-05
Pyrene	5.42E+01	8.00E+00	6.77E+00	1.00E+00	1.00E+00	1.06E-03	1.56E-04	9.67E-04	1.43E-04	2.99E-04	0.00E+00	0.00E+00	2.99E-04	1.49E-04
1,3-DNB	7.95E-01	8.00E+00	9.93E-02	1.00E+00	1.00E+00	6.63E-04	6.67E-03	5.65E-02	5.69E-01	5.76E-01	2.92E-05	2.93E-04	5.76E-01	1.26E-06
4-Amino-2,6-DNT	1.28E+01	8.00E+00	1.60E+00	1.00E+00	1.00E+00	6.63E-04	4.14E-04	2.87E-02	1.79E-02	1.83E-02	0.00E+00	0.00E+00	1.83E-02	2.18E-06
4-Amino-2-nitrotoluene	9.16E+01	8.00E+00	1.15E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.83E-05	5.09E-06	5.09E-06	4.33E-09
2,4-DNT	3.58E+00	8.00E+00	4.47E-01	1.00E+00	1.00E+00	6.63E-04	1.48E-03	2.94E-02	6.58E-02	6.73E-02	0.00E+00	0.00E+00	6.73E-02	2.13E-06
2,6-DNT	2.36E+00	8.00E+00	2.95E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.77E-05	2.63E-04	2.63E-04	1.12E-08
3,4-DNT	1.08E+01	8.00E+00	1.35E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.83E-05	4.33E-05	4.33E-05	8.43E-09
Nitrobenzene	1.66E-01	8.00E+00	2.08E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	1.43E+01	6.00E+00	1.79E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.25E-03	2.93E-03	2.93E-03	1.08E-06
1,3,5-TNB	3.67E+00	8.00E+00	4.59E-01	1.00E+00	1.00E+00	6.63E-04	1.44E-03	8.54E-02	1.86E-01	1.87E-01	0.00E+00	0.00E+00	1.87E-01	9.09E-07
2,4,6-TNT	1.06E+01	8.00E+00	1.33E+00	1.00E+00	1.00E+00	6.63E-04	4.99E-04	2.87E-02	2.16E-02	2.21E-02	0.00E+00	0.00E+00	2.21E-02	2.18E-06
Inorganics														
Aluminum	1.39E+00	8.00E+00	1.74E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E+00	7.69E+00	7.69E+00	0.00E+00
Antimony	9.03E-02	8.00E+00	1.13E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	8.81E-01	8.00E+00	1.10E-01	1.00E+00	1.00E+00	3.18E-03	2.89E-02	2.95E-04	2.68E-03	3.15E-02	0.00E+00	0.00E+00	3.15E-02	1.21E-04
Calcium	2.55E+03	4.00E+00	6.38E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	6.30E+01	4.00E+00	1.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E+00	1.30E-01	1.30E-01	0.00E+00
Lead	1.07E+01	8.00E+00	1.34E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E-03	5.60E-03	5.60E-03	0.00E+00
Magnesium	3.83E+02	4.00E+00	9.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E+00	5.14E-02	5.14E-02	3.42E+00
Manganese	1.18E+02	8.00E+00	1.47E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-01	1.06E-02	1.06E-02	0.00E+00
Potassium	3.83E+03	4.00E+00	9.57E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	3.83E+03	4.00E+00	9.57E+02	1.00E+00	1.00E+00	1.58E+00	1.65E-03	1.65E+00	1.72E-03	3.37E-03	1.04E+01	1.09E-02	1.42E-02	3.78E+01
Vanadium	2.60E-01	8.00E+00	3.25E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.07E-03	1.56E-01	1.56E-01	0.00E+00
TOTAL							**1.35E-01**		**9.52E-01**	**1.09E+00**		**8.06E+00**	**9.15E+00**	

Body Weight (kg)	1.132
Water Intake (L/d)	0.11
Food Intake (kg(dw)/d)	0.096
Soil Intake (kg/d)	0.006
Plant Intake (kg(dw)/d) -- 100% of diet	0.096

Plum Brook Ordnance Works
West Area Red Water Ponds

Insectivorous mammal: **Short-tailed shrew *(Blarina brevicauda)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
Acetone	3.51E+01	8.00E+00	4.39E+00	1.00E+00	1.00E+00	6.64E-04	1.51E-04	7.45E-02	1.70E-02	1.71E-02	0.00E+00	0.00E+00	1.71E-02	4.15E-09
Anthracene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.13E+00	8.97E+00	9.02E+00	0.00E+00	0.00E+00	9.02E+00	8.27E-03
Benzo(a)anthracene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.44E+00	1.03E+01	1.03E+01	0.00E+00	0.00E+00	1.03E+01	1.49E-01
Benzo(b)fluoranthene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.57E+00	1.08E+01	1.08E+01	0.00E+00	0.00E+00	1.08E+01	4.58E-01
Benzo(g,h,i)perylene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.70E+00	1.14E+01	1.14E+01	0.00E+00	0.00E+00	1.14E+01	1.41E+00
Benzo(k)fluoranthene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.57E+00	1.08E+01	1.08E+01	0.00E+00	0.00E+00	1.08E+01	4.58E-01
Bromomethane	7.52E+00	8.00E+00	9.40E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-05	3.43E-05	3.43E-05	4.21E-11
Chrysene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.44E+00	1.03E+01	1.03E+01	0.00E+00	0.00E+00	1.03E+01	1.49E-01
Di-n-octyl phthalate	1.65E+03	8.00E+00	2.06E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-03	5.80E-06	5.80E-06	2.88E-05
Fluoranthene	2.38E+02	8.00E+00	2.97E+01	1.00E+00	1.00E+00	1.11E-02	3.73E-04	2.24E+00	7.56E-02	7.60E-02	0.00E+00	0.00E+00	7.60E-02	2.54E-02
Indeno(1,2,3-cd)pyrene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.70E+00	1.14E+01	1.14E+01	0.00E+00	0.00E+00	1.14E+01	1.41E+00
Phenanthrene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.13E+00	8.97E+00	9.02E+00	0.00E+00	0.00E+00	9.02E+00	8.27E-03
Pyrene	1.43E+02	8.00E+00	1.78E+01	1.00E+00	1.00E+00	1.11E-02	6.21E-04	2.24E+00	1.26E-01	1.27E-01	0.00E+00	0.00E+00	1.27E-01	2.54E-02
1,3-DNB	2.09E+00	8.00E+00	2.61E-01	1.00E+00	1.00E+00	6.92E-03	2.65E-02	9.47E-01	3.63E+00	3.65E+00	4.60E-05	1.76E-04	3.65E+00	3.23E-06
4-Amino-2,6-DNT	3.37E+01	8.00E+00	4.21E+00	1.00E+00	1.00E+00	6.92E-03	1.64E-03	1.00E+00	2.39E-01	2.40E-01	0.00E+00	0.00E+00	2.40E-01	1.15E-05
4-Amino-2-nitrotoluene	2.41E+02	8.00E+00	3.01E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.20E-05	3.05E-06	3.05E-06	1.05E-09
2,4-DNT	9.41E+00	8.00E+00	1.18E+00	1.00E+00	1.00E+00	6.92E-03	5.88E-03	1.00E+00	8.52E-01	8.58E-01	0.00E+00	0.00E+00	8.58E-01	1.09E-05
2,6-DNT	6.22E+00	8.00E+00	7.77E-01	1.00E+00	1.00E+00	7.19E-03	9.26E-03	0.00E+00	0.00E+00	9.26E-03	1.23E-04	1.58E-04	9.41E-03	1.62E-07
3,4-DNT	2.83E+01	8.00E+00	3.54E+00	1.00E+00	1.00E+00	6.92E-03	1.95E-03	0.00E+00	0.00E+00	1.95E-03	9.20E-05	2.60E-05	1.98E-03	1.55E-07
Nitrobenzene	4.37E-01	8.00E+00	5.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	3.77E+01	8.00E+00	4.71E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.28E-03	1.76E-03	1.76E-03	2.62E-07
1,3,5-TNB	9.66E+00	8.00E+00	1.21E+00	1.00E+00	1.00E+00	6.92E-03	5.73E-03	9.14E-01	7.57E-01	7.63E-01	0.00E+00	0.00E+00	7.63E-01	1.49E-06
2,4,6-TNT	2.79E+01	8.00E+00	3.49E+00	1.00E+00	1.00E+00	6.92E-03	1.98E-03	1.00E+00	2.88E-01	2.90E-01	0.00E+00	0.00E+00	2.90E-01	1.15E-05
Inorganics														
Aluminum	3.67E+00	8.00E+00	4.58E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E+00	4.62E+00	4.62E+00	0.00E+00
Antimony	2.38E-01	8.00E+00	2.97E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	2.32E+00	8.00E+00	2.90E-01	1.00E+00	1.00E+00	3.32E-02	1.15E-01	3.20E-01	1.10E+00	1.22E+00	0.00E+00	0.00E+00	1.22E+00	1.88E-03
Calcium	6.71E+03	8.00E+00	8.39E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.66E+02	8.00E+00	2.07E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.24E+00	1.56E-01	1.56E-01	0.00E+00
Lead	2.81E+01	8.00E+00	3.51E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-02	3.36E-03	3.36E-03	0.00E+00
Magnesium	1.01E+03	8.00E+00	1.26E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.77E+00	6.17E-02	6.17E-02	8.25E-01
Manganese	3.09E+02	8.00E+00	3.86E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-01	6.35E-03	6.35E-03	0.00E+00
Potassium	1.01E+04	8.00E+00	1.26E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.01E+04	8.00E+00	1.26E+03	1.00E+00	1.00E+00	1.65E+01	1.31E-02	1.59E+02	1.27E-01	1.40E-01	1.64E+01	1.30E-02	1.53E-01	8.16E+01
Vanadium	6.85E-01	8.00E+00	8.56E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.00E-03	9.35E-02	9.35E-02	0.00E+00
TOTAL							**5.54E-01**		**9.00E+01**			**4.95E+00**	**9.55E+01**	

Body Weight (kg)	0.015
Water intake (L/d)	0.0023
Food intake (kg(dw)/d)	0.008
Soil intake (kg/d)	0.00083
Invertebrate intake (kg(dw)/d)--100% of diet	0.008

Plum Brook Ordnance Works
West Area Red Water Ponds

Herbivorous Mammal: **White-tailed deer *(Odocoileus virginianus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics													
Acetone	5.44E+00	8.00E+00	6.80E-01	1.00E-02	1.00E-02	7.87E-08	1.16E-07	2.10E-04	3.08E-04	3.09E-04	0.00E+00	0.00E+00	3.09E-04
Anthracene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	6.80E-06	1.85E-04	2.21E-04	0.00E+00	0.00E+00	2.21E-04
Benzo(a)anthracene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	1.45E-06	3.95E-05	7.51E-05	0.00E+00	0.00E+00	7.51E-05
Benzo(b)fluoranthene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	7.98E-07	2.17E-05	5.73E-05	0.00E+00	0.00E+00	5.73E-05
Benzo(g,h,i)perylene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	4.38E-07	1.19E-05	4.76E-05	0.00E+00	0.00E+00	4.76E-05
Benzo(k)fluoranthene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	7.98E-07	2.17E-05	5.73E-05	0.00E+00	0.00E+00	5.73E-05
Bromomethane	1.16E+00	8.00E+00	1.45E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.40E-06	5.77E-05	5.77E-05
Chrysene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	1.45E-06	3.95E-05	7.51E-05	0.00E+00	0.00E+00	7.51E-05
Di-n-octyl phthalate	2.56E+02	8.00E+00	3.20E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E-04	9.76E-06	9.76E-06
Fluoranthene	3.68E+01	8.00E+00	4.60E+00	1.00E-02	1.00E-02	1.31E-06	2.85E-07	3.74E-06	8.13E-07	1.10E-06	0.00E+00	0.00E+00	1.10E-06
Indeno(1,2,3-cd)pyrene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	4.38E-07	1.19E-05	4.76E-05	0.00E+00	0.00E+00	4.76E-05
Phenanthrene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	6.80E-06	1.85E-04	2.21E-04	0.00E+00	0.00E+00	2.21E-04
Pyrene	2.21E+01	8.00E+00	2.76E+00	1.00E-02	1.00E-02	1.31E-06	4.75E-07	3.74E-06	1.35E-06	1.83E-06	0.00E+00	0.00E+00	1.83E-06
1,3-DNB	3.24E-01	8.00E+00	4.05E-02	1.00E-02	1.00E-02	8.20E-07	2.03E-05	2.18E-04	5.40E-03	5.42E-03	1.20E-05	2.97E-04	5.72E-03
4-Amino-2,6-DNT	5.22E+00	8.00E+00	6.52E-01	1.00E-02	1.00E-02	8.20E-07	1.26E-06	1.11E-04	1.70E-04	1.71E-04	0.00E+00	0.00E+00	1.71E-04
4-Amino-2-nitrotoluene	3.73E+01	8.00E+00	4.66E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E-05	5.15E-08	5.15E-06
2,4-DNT	1.46E+00	8.00E+00	1.82E-01	1.00E-02	1.00E-02	8.20E-07	4.50E-06	1.14E-04	6.25E-04	6.29E-04	0.00E+00	0.00E+00	6.29E-04
2,6-DNT	9.63E-01	8.00E+00	1.20E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	7.94E-05	6.60E-04	6.60E-04	3.20E-05	2.68E-04	9.26E-04
3,4-DNT	4.39E+00	8.00E+00	5.49E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	7.63E-05	1.39E-04	1.39E-04	2.40E-05	4.37E-05	1.83E-04
Nitrobenzene	6.77E-02	8.00E+00	8.46E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	5.83E+00	8.00E+00	7.29E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-03	2.96E-03	2.96E-03
1,3,5-TNB	1.50E+00	8.00E+00	1.87E-01	1.00E-02	1.00E-02	8.20E-07	4.38E-06	3.30E-04	1.77E-03	1.77E-03	0.00E+00	0.00E+00	1.77E-03
2,4,6-TNT	4.32E+00	8.00E+00	5.40E-01	1.00E-02	1.00E-02	8.20E-07	1.52E-06	1.11E-04	2.05E-04	2.07E-04	0.00E+00	0.00E+00	2.07E-04
Inorganics													
Aluminum	5.68E-01	8.00E+00	7.10E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.52E-01	7.78E+00	7.78E+00
Antimony	3.68E-02	8.00E+00	4.60E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	3.59E-01	8.00E+00	4.49E-02	1.00E-02	1.00E-02	3.93E-06	8.77E-05	1.14E-06	2.54E-05	1.13E-04	0.00E+00	0.00E+00	1.13E-04
Calcium	1.04E+03	8.00E+00	1.30E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.57E+01	8.00E+00	3.21E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.44E-01	2.63E-01	2.63E-01
Lead	4.35E+00	8.00E+00	5.44E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-03	5.66E-03	5.66E-03
Magnesium	1.56E+02	8.00E+00	1.95E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E+00	1.04E-01	1.04E-01
Manganese	4.79E+01	8.00E+00	5.98E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E-02	1.07E-02	1.07E-02
Potassium	1.56E+03	8.00E+00	1.95E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.56E+03	8.00E+00	1.95E+02	1.00E-02	1.00E-02	1.96E-03	1.00E-05	6.37E-03	3.27E-05	4.27E-05	4.28E+00	2.20E-02	2.20E-02
Vanadium	1.06E-01	8.00E+00	1.33E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-03	1.58E-01	1.58E-01
TOTAL							**4.16E-04**		**9.85E-03**	**1.03E-02**		**8.34E+00**	**8.35E+00**

Body Weight (kg)	61
Water Intake (L/d)	4
Food Intake (kg(dw)/d)	2
Soil Intake (kg/d)	0.04
Plant Intake (kg(dw)/d) -- 100% of diet	2

Plum Brook Ordnance Works
West Area Red Water Ponds

Insectivorous Bird: **Marsh wren *(Cistothorus palustris)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
Acetone	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.28E-04	0.00E+00	1.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-09
Anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	3.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-03
Benzo(a)anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.34E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-01
Benzo(b)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.57E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.94E-01
Benzo(g,h,i)perylene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.81E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E+00
Benzo(k)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.57E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.94E-01
Bromomethane	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E-05	0.00E+00	0.00E+00	4.50E-11
Chrysene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.34E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-01
Di-n-octyl phthalate	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E-03	0.00E+00	0.00E+00	3.08E-05
Fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-02
Indeno(1,2,3-cd)pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.81E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E+00
Phenanthrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	3.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-03
Pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	4.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-02
1,3-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.69E+00	0.00E+00	0.00E+00	8.10E-05	0.00E+00	0.00E+00	3.47E-06
4-Amino-2,6-DNT	3.20E-02	8.00E+00	4.00E-03	1.00E+00	1.00E+00	2.38E-03	5.94E-01	1.79E+00	4.47E+02	4.48E+02	0.00E+00	0.00E+00	4.48E+02	1.24E-05
4-Amino-2-nitrotoluene	3.20E-02	8.00E+00	4.00E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.82E-04	4.05E-02	4.05E-02	1.12E-09
2,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.79E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-05
2,6-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-04	0.00E+00	0.00E+00	2.91E-09
3,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-04	0.00E+00	0.00E+00	2.18E-09
Nitrobenzene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-02	0.00E+00	0.00E+00	2.80E-07
1,3,5-TNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.83E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E-06
2,4,6-TNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.79E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-05
Inorganics														
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E+00	2.71E-01	2.71E-01	0.00E+00
Antimony	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	1.14E-02	0.00E+00	5.70E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-03
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	8.25E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.70E+00	9.12E-01	9.12E-01	0.00E+00
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	4.32E-02	4.32E-02	0.00E+00
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E+01	7.30E-01	7.30E-01	8.83E-01
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E-01	3.54E-03	3.54E-03	0.00E+00
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	1.00E+00	5.67E+00	4.54E-02	2.84E+02	2.27E+00	2.31E+00	2.89E+01	2.31E-01	2.55E+00	8.21E+01
Vanadium	1.14E+01	8.00E+00	1.43E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-02	9.89E-03	9.89E-03	0.00E+00
TOTAL							**6.39E-01**		**4.50E+02**	**4.50E+02**		**2.23E+00**	**4.52E+02**	

Body Weight (kg)	0.01
Water Intake (L/d)	0.0027
Food Intake (kg(dw)/d)	0.0095
Soil Intake (kg/d)	0.00019
Plant Intake (kg(dw)/d) -- 0% of diet	0
Invertebrate Intake (kg(dw)/d) – 100% of die	0.0095

Plum Brook Ordnance Works
West Area Red Water Ponds

Avian predator: **Red-tailed hawk (*Buteo jamaicensis*)**

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intak Hazard Quotient	Bird Intake (mg/kg-d)	Bird Intak Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Rabbit Intake (mg/kg-d)	Rabbit Intake Hazard Quotient	Shrew Intake (mg/kg-d)	Shrew Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																			
Acetone	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.51E-07	0.00E+00	1.12E-12	0.00E+00	2.71E-12	0.00E+00	5.19E-12	0.00E+00	1.10E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	2.24E-06	0.00E+00	6.72E-07	0.00E+00	1.88E-08	0.00E+00	2.19E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	4.03E-05	0.00E+00	1.20E-05	0.00E+00	1.51E-07	0.00E+00	3.95E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	1.24E-04	0.00E+00	3.70E-05	0.00E+00	3.89E-07	0.00E+00	1.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	3.80E-04	0.00E+00	1.13E-04	0.00E+00	1.05E-06	0.00E+00	3.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	1.24E-04	0.00E+00	3.70E-05	0.00E+00	3.89E-07	0.00E+00	1.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	1.13E-14	0.00E+00	2.38E-14	0.00E+00	4.61E-14	0.00E+00	1.11E-14	0.00E+00	0.00E+00	1.25E-07	0.00E+00	0.00E+00
Chrysene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	4.03E-05	0.00E+00	1.20E-05	0.00E+00	1.51E-07	0.00E+00	3.95E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	7.74E-09	0.00E+00	1.63E-08	0.00E+00	3.16E-08	0.00E+00	7.83E-09	0.00E+00	0.00E+00	4.65E-06	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	6.87E-06	0.00E+00	2.06E-06	0.00E+00	3.95E-08	0.00E+00	6.73E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	3.80E-04	0.00E+00	1.13E-04	0.00E+00	1.05E-06	0.00E+00	3.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	2.24E-06	0.00E+00	6.72E-07	0.00E+00	1.88E-08	0.00E+00	2.19E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	4.18E-06	0.00E+00	6.87E-06	0.00E+00	2.06E-06	0.00E+00	3.95E-08	0.00E+00	6.73E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	8.71E-10	0.00E+00	4.12E-10	0.00E+00	3.35E-10	0.00E+00	8.54E-10	0.00E+00	0.00E+00	1.79E-07	0.00E+00	0.00E+00
4-Amino-2,6-DNT	3.20E-02	8.00E+00	4.00E-03	1.00E-02	1.00E-02	2.61E-06	8.53E-04	3.11E-09	7.76E-07	1.19E-09	2.96E-07	5.77E-10	1.44E-07	3.05E-09	7.62E-07	6.55E-04	0.00E+00	0.00E+00	6.55E-04
4-Amino-2-nitrotoluene	3.20E-02	8.00E+00	4.00E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	2.81E-13	7.02E-11	5.93E-13	1.48E-10	1.15E-12	2.87E-10	2.77E-13	6.93E-11	5.74E-10	3.57E-07	8.93E-05	8.93E-05
2,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	2.95E-09	0.00E+00	1.14E-09	0.00E+00	5.65E-10	0.00E+00	2.90E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	7.29E-13	0.00E+00	1.54E-12	0.00E+00	2.98E-12	0.00E+00	4.29E-11	0.00E+00	0.00E+00	4.78E-07	0.00E+00	0.00E+00
3,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	5.46E-13	0.00E+00	1.15E-12	0.00E+00	2.23E-12	0.00E+00	4.11E-11	0.00E+00	0.00E+00	3.57E-07	0.00E+00	0.00E+00
Nitrobenzene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	7.03E-11	0.00E+00	1.48E-10	0.00E+00	2.87E-10	0.00E+00	6.93E-11	0.00E+00	0.00E+00	3.22E-05	0.00E+00	0.00E+00
1,3,5-TNB	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	4.02E-10	0.00E+00	2.30E-10	0.00E+00	2.41E-10	0.00E+00	3.94E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,6-TNT	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	3.11E-09	0.00E+00	1.19E-09	0.00E+00	5.77E-10	0.00E+00	3.05E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inorganics																			
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.22E-03	5.98E-04	5.98E-04
Antimony	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	1.25E-05	0.00E+00	4.70E-07	0.00E+00	1.46E-07	0.00E+00	3.19E-08	0.00E+00	4.96E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-02	2.01E-03	2.01E-03
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.59E-05	9.53E-05	9.53E-05
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	2.21E-04	1.18E-05	4.67E-04	2.49E-05	9.05E-04	4.82E-05	2.18E-04	1.17E-05	9.68E-05	3.02E-02	1.81E-03	1.71E-03
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.53E-04	7.80E-06	7.80E-06
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.00E+03	8.00E+00	1.25E+02	1.00E-02	1.00E-02	6.24E-03	4.99E-05	2.06E-02	1.65E-04	1.02E-02	8.20E-05	1.00E-02	8.01E-05	2.16E-02	1.73E-04	5.49E-04	6.37E-02	5.10E-04	1.06E-03
Vanadium	1.14E+01	8.00E+00	1.43E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E-05	2.18E-05	2.18E-05
TOTAL							**7.03E-04**		**1.77E-04**		**1.07E-04**		**1.28E-04**		**1.85E-04**	**1.30E-03**		**4.94E-03**	**6.24E-03**

Body Weight (kg)	0.957
Water Intake (L/d)	0.057
Food Intake (kg(dw)/d)	0.1
Soil Intake (kg/d)	0.002
Bird Intake (kg(dw)/d) -- 24% of diet	0.024
Mouse Intake (kg(dw)/d) -- 25.3% of diet	0.025333
Shrew Intake (kg(dw)/d) -- 25.3% of diet	0.025333
Rabbit Intake (kg(dw)/d) -- 25.3% of diet	0.025333

Chemical Data

Chemical Name	Sediment Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Kow (organics)	log Koc (organics) (mL/g)	Koc (organics) (mL/g)	Kd (inorganics) (mL/g)	Foc	Water-to-Fish/Invert BCF	Food Chain Multiplier	Water-to-Fish BAF	Fish Conc. (mg/kgww)	Fish Conc. (mg/kgdw)	Pore water Conc. (mg/L)	Solubility (mg/L)	< of the PoreH2O or Solubility	Invert. Conc. (mg/kgww)	Invert Conc. (mg/kgdw)	Food-to-Muscle TF
Organics																			
Acetone	1.10E-01		-2.40E-01	5.75E-01	-2.36E-01	5.81E-01	---	6.70E-02	5.75E-01	1.00E+00	5.75E-01	0.00E+00	0.00E+00	2.82E+00		2.82E+00	1.63E+00	6.50E+00	1.04E-08
Bromomethane		2.10E-04	1.09E+00	1.23E+01	1.07E+00	1.18E+01	---	6.70E-02	1.23E+01	1.00E+00	1.23E+01	2.58E-03	8.07E-03	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.46E-07
Carbazole			3.29E+00	1.95E+03	3.23E+00	1.72E+03	---	6.70E-02	1.95E+03	1.01E+00	1.97E+03	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.61E-05
Dibenzofuran			4.12E+00	1.32E+04	4.05E+00	1.12E+04	---	6.70E-02	1.32E+04	1.10E+00	1.44E+04	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	3.32E-04
Di-n-octyl phthalate		7.80E-03	5.22E+00	1.66E+05	5.13E+00	1.35E+05	---	6.70E-02	1.66E+05	4.05E+00	6.72E+05	5.24E+03	1.64E+04	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.54E-03
Methylene chloride	2.00E-02		1.26E+00	1.82E+01	1.24E+00	1.73E+01	---	6.70E-02	1.82E+01	1.00E+00	1.82E+01	0.00E+00	0.00E+00	1.72E-02		1.72E-02	3.13E-01	1.25E+00	3.69E-07
Methyl ethyl ketone	2.90E-02		2.80E-01	1.91E+00	2.76E-01	1.89E+00	---	6.70E-02	1.91E+00	1.01E+00	1.92E+00	0.00E+00	0.00E+00	2.30E-01		2.30E-01	4.37E-01	1.75E+00	3.58E-08
1,3-DNB	7.00E-01	3.00E-04	1.49E+00	3.09E+01	1.46E+00	2.92E+01	---	6.70E-02	3.09E+01	1.00E+00	3.09E+01	9.27E-03	2.90E-02	3.58E-01		3.58E-01	1.11E+01	4.43E+01	6.37E-07
2-Amino-4,6-DNT	3.00E-01		2.00E+00	1.00E+02	1.97E+00	9.25E+01	---	6.70E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	4.84E-02		4.84E-02	4.84E+00	1.94E+01	2.14E-06
4-Amino-2-NT		6.00E-04	2.00E+00	1.00E+02	1.97E+00	9.25E+01	---	6.70E-02	1.00E+02	1.00E+00	1.00E+02	6.00E-02	1.88E-01	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.14E-06
2,6-DNB			1.49E+00	3.09E+01	1.46E+00	2.92E+01	---	6.70E-02	3.09E+01	1.00E+00	3.09E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	6.37E-07
2,4-DNT	7.00E-01		1.98E+00	9.55E+01	1.95E+00	8.84E+01	---	6.70E-02	9.55E+01	1.00E+00	9.55E+01	0.00E+00	0.00E+00	1.18E-01		1.18E-01	1.13E+01	4.51E+01	2.04E-06
2,6-DNT	4.00E-01	8.00E-04	2.28E+00	1.91E+02	2.24E+00	1.74E+02	---	6.70E-02	1.91E+02	1.00E+00	1.91E+02	1.52E-01	4.76E-01	3.42E-02		3.42E-02	6.52E+00	2.61E+01	4.17E-06
3,4-DNT		6.00E-04	2.28E+00	1.91E+02	2.24E+00	1.74E+02	---	6.70E-02	1.91E+02	1.00E+00	1.91E+02	1.14E-01	3.57E-01	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.17E-06
3-NT		5.40E-02	2.43E+00	2.69E+02	2.39E+00	2.45E+02	---	6.70E-02	2.69E+02	1.00E+00	2.70E+02	1.46E+01	4.55E+01	0.00E+00		0.00E+00	0.00E+00	0.00E+00	5.96E-06
1,3,5-TNB	8.00E-01		1.18E+00	1.51E+01	1.16E+00	1.45E+01	---	6.70E-02	1.51E+01	1.00E+00	1.51E+01	0.00E+00	0.00E+00	8.26E-01		8.26E-01	1.25E+01	5.00E+01	3.05E-07
2,4,6-TNT			2.00E+00	1.00E+02	1.97E+00	9.25E+01	---	6.70E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.14E-06
Inorganics																			
Aluminum	9.60E+03	1.38E+01	---	---	---	---	1.50E+03	6.70E-02	1.00E+02	1.00E+00	1.00E+02	1.38E+03	4.31E+03	6.40E+00	9.80E-01	9.80E-01	9.80E+01	3.92E+02	NA
Arsenic	6.50E+00		---	---	---	---	2.00E+02	6.70E-02	4.40E+01	1.00E+00	4.40E+01	0.00E+00	0.00E+00	3.25E-02		3.25E-02	1.43E+00	5.72E+00	4.00E-03
Barium	6.50E+01		---	---	---	---	6.00E+01	6.70E-02	4.00E+00	1.00E+00	4.00E+00	0.00E+00	0.00E+00	1.08E+00		1.08E+00	4.33E+00	1.73E+01	2.00E-04
Calcium	7.47E+04		---	---	---	---	4.10E+00	6.70E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	1.82E+04	1.31E+03	1.31E+03	1.31E+05	5.24E+05	2.00E-03
Chromium	1.81E+01		---	---	---	---	8.50E+02	6.70E-02	2.00E+02	1.00E+00	2.00E+02	0.00E+00	0.00E+00	2.13E-02		2.13E-02	4.26E+00	1.70E+01	NA
Copper	2.45E+01		---	---	---	---	3.50E+01	6.70E-02	2.00E+02	1.00E+00	2.00E+02	0.00E+00	0.00E+00	7.00E-01		7.00E-01	1.40E+02	5.60E+02	NA
Iron	2.43E+04	2.11E+01	---	---	---	---	5.00E+03	6.70E-02	2.00E+02	1.00E+00	2.00E+02	4.22E+03	1.32E+04	4.86E+00	6.70E+01	4.86E+00	9.72E+02	3.89E+03	NA
Lead	1.88E+01	7.70E-02	---	---	---	---	4.00E+02	6.70E-02	3.00E+02	1.00E+00	3.00E+02	2.31E+01	7.22E+01	4.70E-02		4.70E-02	1.41E+01	5.64E+01	NA
Magnesium	6.77E+03	5.07E+01	---	---	---	---	4.60E+00	6.70E-02	1.00E+02	1.00E+00	1.00E+02	5.07E+03	1.58E+04	1.47E+03	6.20E+00	6.20E+00	6.20E+02	2.48E+03	2.00E-02
Manganese	2.99E+02	1.60E+00	---	---	---	---	1.00E+03	6.70E-02	4.00E+02	1.00E+00	4.00E+02	6.40E+02	2.00E+03	2.99E-01		2.99E-01	1.20E+02	4.78E+02	NA
Phosphorus	3.10E+00		---	---	---	---	3.50E+00	6.70E-02	5.00E+04	1.00E+00	5.00E+04	0.00E+00	0.00E+00	8.86E-01		8.86E-01	4.43E+04	1.77E+05	NA
Potassium	1.35E+03		---	---	---	---	5.60E+00	6.70E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	2.42E+02		2.42E+02	2.42E+04	9.66E+04	1.00E+00
Sodium		1.07E+02	---	---	---	---	NA	6.70E-02	2.00E+01	1.00E+00	2.00E+01	2.14E+03	6.69E+03	0.00E+00		0.00E+00	0.00E+00	0.00E+00	6.50E-02
Vanadium	2.50E+01	5.22E-02	---	---	---	---	1.00E+03	6.70E-02	1.00E+02	1.00E+00	1.00E+02	5.22E+00	1.63E+01	2.50E-02		2.50E-02	2.50E+00	1.00E+01	NA

Plum Brook Ordnance Works
West Area Red Water Ponds

Toxicity Data

Chemical Name	Mammals NOAEL (mg/kg/d)	Mammals Test Species	Mammals Body Wt. (kg)	Birds NOAEL (mg/kg/d)	Birds Test Species	Birds Body Wt. (kg)
Organics						
Acetone	1.00E+01	rat	0.35	--	--	--
Bromomethane	2.14E+00	rat	0.35	--	--	--
Carbazole	2.00E+00	mouse	0.03	--	--	--
Dibenzofuran	--	--	--	--	--	--
Di-n-octyl phthalate	4.70E+02	rat	0.35	--	--	--
Methylene chloride	5.85E+00	rat	0.35	--	--	--
Methyl ethyl ketone	1.77E+03	rat	0.35	--	--	--
1,3-DNB	5.95E-01	rat	0.35	--	--	--
2-Amino-4,6-DNT	1.39E+01	rat	0.35	3.20E-02	unknown	1
4-Amino-2-NT	6.86E+01	rat	0.35	3.20E-02	unknown	1
2,6-DNB	4.00E-01	rat	0.35	--	--	--
2,4-DNT	2.68E+00	rat	0.35	--	--	--
2,6-DNT	1.77E+00	rat	0.35	--	--	--
3,4-DNT	8.07E+00	rat	0.35	--	--	--
3-NT	1.07E+01	rat	0.35	--	--	--
1,3,5-TNB	2.75E+00	rat	0.35	--	--	--
2,4,6-TNT	7.95E+00	rat	0.35	--	--	--
Inorganics						
Aluminum	1.93E+00	mouse	0.03	1.10E+02	ringed dove	0.155
Arsenic	1.26E-01	mouse	0.03	2.46E+00	cowbird	0.049
Barium	5.10E+00	rat	0.435	2.08E+01	chicks	0.121
Calcium	1.05E+03	rabbit	3.8	2.83E+03	Jap. Quail	0.072
Chromium	2.74E+03	rat	0.35	1.00E+00	black duck	1.25
Copper	1.17E+01	mink	1	4.70E+01	chicks	0.534
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Lead	8.00E+00	rat	0.35	3.85E+00	Am. Kestrel	0.13
Magnesium	1.58E+02	rabbit	3.8	1.50E+02	poultry	1.6
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072
Phosphorus	5.26E+02	rabbit	3.8	4.00E+02	poultry	1.6
Potassium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Sodium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Vanadium	2.10E-01	rat	0.26	1.14E+01	mallard duck	1.17

Plum Brook Ordnance Works
West Area Red Water Ponds

Piscivorous Bird: **Great Blue Heron *(Ardea herodias)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Macroinvert Intake (mg/kg-d)	Macroinvert Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
Acetone	0.00E+00	8.00E+00	0.00E+00	1.00E+00	3.94E-04	NA	0.00E+00	NA	4.72E-02	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	1.41E-03	NA	0.00E+00	NA	0.00E+00	9.53E-06	0.00E+00	0.00E+00
Carbazole	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dibenzofuran	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	2.85E+03	NA	0.00E+00	NA	0.00E+00	3.54E-04	0.00E+00	0.00E+00
Methylene chloride	0.00E+00	8.00E+00	0.00E+00	1.00E+00	7.17E-05	NA	0.00E+00	NA	9.10E-03	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methyl ethyl ketone	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.04E-04	NA	0.00E+00	NA	1.27E-02	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	2.51E-03	NA	5.05E-03	NA	3.21E-01	NA	0.00E+00	1.36E-05	0.00E+00	0.00E+00
2-Amino-4,6-DNT	3.20E-02	8.00E+00	4.00E-03	1.00E+00	1.08E-03	2.69E-01	0.00E+00	0.00E+00	1.41E-01	3.51E+01	3.54E+01	0.00E+00	0.00E+00	3.54E+01
4-Amino-2-NT	3.20E-02	8.00E+00	4.00E-03	1.00E+00	0.00E+00	0.00E+00	3.27E-02	8.17E+00	0.00E+00	0.00E+00	8.17E+00	2.72E-05	6.81E-03	8.17E+00
2,6-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	2.51E-03	NA	0.00E+00	NA	3.28E-01	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.43E-03	NA	8.30E-02	NA	1.89E-01	NA	0.00E+00	3.63E-05	0.00E+00	0.00E+00
3,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	6.22E-02	NA	0.00E+00	NA	0.00E+00	2.72E-05	0.00E+00	0.00E+00
3-NT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	7.93E+00	NA	0.00E+00	NA	0.00E+00	2.45E-03	0.00E+00	0.00E+00
1,3,5-TNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	2.87E-03	NA	0.00E+00	NA	3.63E-01	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,6-TNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inorganics														
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E+00	3.44E+01	2.50E+00	7.51E+02	5.46E+01	2.85E+00	2.07E-01	5.74E+01	6.26E-01	4.55E-02	5.74E+01
Arsenic	2.46E+00	8.00E+00	3.08E-01	1.00E+00	2.33E-02	7.58E-02	0.00E+00	0.00E+00	4.15E-02	1.35E-01	2.11E-01	0.00E+00	0.00E+00	2.11E-01
Barium	2.08E+01	8.00E+00	2.60E+00	1.00E+00	2.33E-01	8.96E-02	0.00E+00	0.00E+00	1.26E-01	4.84E-02	1.38E-01	0.00E+00	0.00E+00	1.38E-01
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E+00	2.68E+02	7.56E-01	0.00E+00	0.00E+00	3.80E+03	1.07E+01	1.15E+01	0.00E+00	0.00E+00	1.15E+01
Chromium	1.00E+00	8.00E+00	1.25E-01	1.00E+00	6.49E-02	5.19E-01	0.00E+00	0.00E+00	1.24E-01	9.89E-01	1.51E+00	0.00E+00	0.00E+00	1.51E+00
Copper	4.70E+01	8.00E+00	5.88E+00	1.00E+00	8.78E-02	1.49E-02	0.00E+00	0.00E+00	4.07E+00	6.92E-01	7.07E-01	0.00E+00	0.00E+00	7.07E-01
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E+00	8.71E+01	1.39E+01	2.30E+03	3.68E+02	2.82E+01	4.52E+00	3.86E+02	9.57E-01	1.53E-01	3.86E+02
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E+00	6.74E-02	1.40E-01	1.26E+01	2.61E+01	4.09E-01	8.51E-01	2.71E+01	3.49E-03	7.26E-03	2.71E+01
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E+00	2.43E+01	1.29E+00	2.76E+03	1.47E+02	1.80E+01	9.60E-01	1.49E+02	2.30E+00	1.23E-01	1.50E+02
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	1.07E+00	8.78E-03	3.48E+02	2.85E+00	3.47E+00	2.84E-02	2.89E+00	7.26E-02	5.94E-04	2.89E+00
Phosphorus	4.00E+02	8.00E+00	5.00E+01	1.00E+00	1.11E-02	2.22E-04	0.00E+00	0.00E+00	1.29E+03	2.57E+01	2.57E+01	0.00E+00	0.00E+00	2.57E+01
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	4.85E+00	3.88E-02	0.00E+00	0.00E+00	7.02E+02	5.61E+00	5.65E+00	0.00E+00	0.00E+00	5.65E+00
Sodium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	0.00E+00	0.00E+00	1.17E+03	9.32E+00	0.00E+00	0.00E+00	9.32E+00	4.85E+00	3.88E-02	9.36E+00
Vanadium	1.14E+01	8.00E+00	1.43E+00	1.00E+00	8.96E-02	6.29E-02	2.84E+00	1.99E+00	7.26E-02	5.09E-02	2.11E+00	2.37E-03	1.66E-03	2.11E+00
TOTAL						**1.97E+01**		**6.18E+02**		**8.57E+01**	**7.23E+02**		**3.77E-01**	**7.24E+02**

Body Weight (kg)	2.204
Water intake (L/d)	0.1
Food intake (kg(dw)/d)	0.4
Sediment intake (kg/d)	0.0079
Fish intake (kg(dw)/d) -- 96% of diet	0.384
Macroinvert intake (kg(dw)/d) -- 4% of diet	0.016

Omnivorous mammal: **Raccoon *(Procyon lotor)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Aq. Invert. Intake (mg/kg-d)	Aq. Invert. Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
Acetone	5.12E+00	8.00E+00	6.40E-01	1.00E+00	2.59E-04	4.05E-04	6.96E-02	1.09E-01	0.00E+00	0.00E+00	1.09E-01	0.00E+00	0.00E+00	1.09E-01
Bromomethane	1.10E+00	8.00E+00	1.37E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.23E-06	6.01E-05	6.01E-05	8.85E-06	6.47E-05	1.25E-04
Carbazole	5.54E-01	8.00E+00	6.92E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dibenzofuran	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	2.41E+02	8.00E+00	3.01E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	5.56E-01	5.56E-01	3.29E-04	1.09E-05	5.56E-01
Methylene chloride	2.99E+00	8.00E+00	3.74E-01	1.00E+00	4.71E-05	1.26E-04	1.34E-02	3.59E-02	0.00E+00	0.00E+00	3.60E-02	0.00E+00	0.00E+00	3.60E-02
Methyl ethyl ketone	9.06E+02	8.00E+00	1.13E+02	1.00E+00	6.82E-05	6.02E-07	1.87E-02	1.65E-04	0.00E+00	0.00E+00	1.66E-04	0.00E+00	0.00E+00	1.66E-04
1,3-DNB	3.05E-01	8.00E+00	3.81E-02	1.00E+00	1.65E-03	4.33E-02	4.74E-01	1.25E+01	2.95E-05	7.76E-04	1.25E+01	1.26E-05	3.32E-04	1.25E+01
2-Amino-4,6-DNT	7.13E+00	8.00E+00	8.92E-01	1.00E+00	7.06E-04	7.91E-04	2.07E-01	2.32E-01	0.00E+00	0.00E+00	2.33E-01	0.00E+00	0.00E+00	2.33E-01
4-Amino-2-NT	3.51E+01	8.00E+00	4.39E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E-04	4.36E-05	4.36E-05	2.53E-05	5.76E-06	4.93E-05
2,6-DNB	2.05E-01	8.00E+00	2.56E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	1.37E+00	8.00E+00	1.71E-01	1.00E+00	1.65E-03	9.61E-03	4.83E-01	2.82E+00	0.00E+00	0.00E+00	2.83E+00	0.00E+00	0.00E+00	2.83E+00
2,6-DNT	9.06E-01	8.00E+00	1.13E-01	1.00E+00	9.41E-04	8.31E-03	2.79E-01	2.47E+00	4.86E-04	4.29E-03	2.48E+00	3.37E-05	2.98E-04	2.48E+00
3,4-DNT	4.13E+00	8.00E+00	5.16E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.64E-04	7.06E-04	7.06E-04	2.53E-05	4.90E-05	7.55E-04
3-NT	5.49E+00	8.00E+00	6.86E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E-02	6.77E-02	6.77E-02	2.28E-03	3.32E-03	7.10E-02
1,3,5-TNB	1.41E+00	8.00E+00	1.76E-01	1.00E+00	1.88E-03	1.07E-02	5.35E-01	3.04E+00	0.00E+00	0.00E+00	3.05E+00	0.00E+00	0.00E+00	3.05E+00
2,4,6-TNT	4.07E+00	8.00E+00	5.09E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inorganics														
Aluminum	5.34E-01	8.00E+00	6.68E-02	1.00E+00	2.26E+01	3.38E+02	4.20E+00	6.28E+01	4.40E+00	6.58E+01	4.67E+02	5.82E-01	8.71E+00	4.75E+02
Arsenic	3.49E-02	8.00E+00	4.36E-03	1.00E+00	1.53E-02	3.51E+00	6.12E-02	1.40E+01	0.00E+00	0.00E+00	1.75E+01	0.00E+00	0.00E+00	1.75E+01
Barium	2.76E+00	8.00E+00	3.45E-01	1.00E+00	1.53E-01	4.44E-01	1.86E-01	5.39E-01	0.00E+00	0.00E+00	9.83E-01	0.00E+00	0.00E+00	9.83E-01
Calcium	9.78E+02	8.00E+00	1.22E+02	1.00E+00	1.76E+02	1.44E+00	5.61E+03	4.59E+01	0.00E+00	0.00E+00	4.73E+01	0.00E+00	0.00E+00	4.73E+01
Chromium	1.40E+03	8.00E+00	1.75E+02	1.00E+00	4.26E-02	2.43E-04	1.82E-01	1.04E-03	0.00E+00	0.00E+00	1.28E-03	0.00E+00	0.00E+00	1.28E-03
Copper	7.79E+00	8.00E+00	9.73E-01	1.00E+00	5.76E-02	5.92E-02	6.00E+00	6.16E+00	0.00E+00	0.00E+00	6.22E+00	0.00E+00	0.00E+00	6.22E+00
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	5.72E+01	1.89E+01	4.16E+01	1.38E+01	1.34E+01	4.45E+00	3.72E+01	8.90E-01	2.95E-01	3.75E+01
Lead	4.09E+00	8.00E+00	5.12E-01	1.00E+00	4.42E-02	8.64E-02	6.04E-01	1.18E+00	7.36E-02	1.44E-01	1.41E+00	3.25E-03	6.34E-03	1.42E+00
Magnesium	1.47E+02	8.00E+00	1.83E+01	1.00E+00	1.59E+01	8.68E-01	2.66E+01	1.45E+00	1.62E+01	8.80E-01	3.20E+00	2.14E+00	1.16E-01	3.31E+00
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	7.04E-01	1.25E-01	5.12E+00	9.10E-01	2.04E+00	3.62E-01	1.40E+00	6.75E-02	1.20E-02	1.41E+00
Phosphorus	4.89E+02	8.00E+00	6.11E+01	1.00E+00	7.29E-03	1.19E-04	1.90E+03	3.10E+01	0.00E+00	0.00E+00	3.10E+01	0.00E+00	0.00E+00	3.10E+01
Potassium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	3.18E+00	1.74E-02	1.03E+03	5.64E+00	0.00E+00	0.00E+00	5.66E+00	0.00E+00	0.00E+00	5.66E+00
Sodium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.82E+00	3.72E-02	3.72E-02	4.51E+00	2.46E-02	6.18E-02
Vanadium	9.98E-02	8.00E+00	1.25E-02	1.00E+00	5.88E-02	4.72E+00	1.07E-01	8.58E+00	1.66E-02	1.33E+00	1.46E+01	2.20E-03	1.76E-01	1.48E+01
TOTAL						**3.68E+02**		**2.13E+02**		**7.37E+01**	**6.55E+02**		**9.34E+00**	**6.65E+02**

Body Weight (kg)	5.1
Water intake (L/d)	0.215
Food intake (kg(dw)/d)	0.26
Sediment intake (kg/d)	0.012
Aquatic Invert. Intake (kg(dw)/d -- 21% of diet	0.0546
Fish intake (kg(dw)/d) -- 2% of diet	0.0052

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Chemical Data

Chemical Name	Surface Soil Conc. (mg/kg)	Total Soil Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Soil-to-Plant TF	Shallow-rooted Plant Conc. (mg/kgdw)	Deep-rooted Plant Conc. (mg/kgdw)	Soil-to-Invert. BAF	Invert. Conc. (mg/kgdw)	Food-to-Muscle TF
Organics										
Acetone		1.25E-02		-2.40E-01	5.33E+01	0.00E+00	6.66E-01	1.16E+01	0.00E+00	1.04E-08
Anthracene				4.45E+00	1.04E-01	0.00E+00	0.00E+00	2.00E+01	0.00E+00	7.28E-04
Benzo(a)anthracene				5.61E+00	2.22E-02	0.00E+00	0.00E+00	2.28E+01	0.00E+00	1.15E-02
Benzo(b)fluoranthene				6.06E+00	1.22E-02	0.00E+00	0.00E+00	2.40E+01	0.00E+00	3.35E-02
Benzo(g,h,i)perylene				6.51E+00	6.69E-03	0.00E+00	0.00E+00	2.53E+01	0.00E+00	9.77E-02
Benzo(k)fluoranthene				6.06E+00	1.22E-02	0.00E+00	0.00E+00	2.40E+01	0.00E+00	3.35E-02
Bromomethane			1.10E-04	1.09E+00	9.08E+00	0.00E+00	0.00E+00	1.36E+01	0.00E+00	2.46E-07
Chrysene				5.61E+00	2.22E-02	0.00E+00	0.00E+00	2.28E+01	0.00E+00	1.15E-02
Di-n-octyl phthalate				5.22E+00	3.72E-02	0.00E+00	0.00E+00	2.18E+01	0.00E+00	4.54E-03
Fluoranthene				4.90E+00	5.70E-02	0.00E+00	0.00E+00	2.10E+01	0.00E+00	2.12E-03
Indeno(1,2,3-cd)pyrene				6.51E+00	6.69E-03	0.00E+00	0.00E+00	2.53E+01	0.00E+00	9.77E-02
Phenanthrene				4.45E+00	1.04E-01	0.00E+00	0.00E+00	2.00E+01	0.00E+00	7.28E-04
Pyrene				4.90E+00	5.70E-02	0.00E+00	0.00E+00	2.10E+01	0.00E+00	2.12E-03
1,3-DNB	1.25E-01	1.25E-01		1.49E+00	5.33E+00	6.66E-01	6.66E-01	1.42E+01	1.78E+00	6.37E-07
4-Amino-2,6-DNT	1.25E-01	1.25E-01		2.00E+00	2.70E+00	3.38E-01	3.38E-01	1.51E+01	1.88E+00	2.14E-06
4-Amino-2-nitrotoluene				2.00E+00	2.70E+00	0.00E+00	0.00E+00	1.51E+01	0.00E+00	2.14E-06
2,4-DNT	1.25E-01	1.25E-01		1.98E+00	2.78E+00	3.47E-01	3.47E-01	1.50E+01	1.88E+00	2.04E-06
2,6-DNT	1.30E-01	1.30E-01		2.28E+00	1.86E+00	2.42E-01	2.42E-01	1.56E+01	2.02E+00	4.17E-06
3,4-DNT	1.25E-01	1.25E-01		2.28E+00	1.86E+00	2.33E-01	2.33E-01	1.56E+01	1.95E+00	4.17E-06
Nitrobenzene		1.30E-01		1.87E+00	3.21E+00	0.00E+00	4.18E-01	1.48E+01	0.00E+00	1.57E-06
3-Nitrotoluene				2.43E+00	1.53E+00	0.00E+00	0.00E+00	1.58E+01	0.00E+00	5.96E-06
1,3,5-TNB	1.25E-01	1.25E-01		1.18E+00	8.05E+00	1.01E+00	1.01E+00	1.37E+01	1.71E+00	3.05E-07
2,4,6-TNT	1.25E-01	1.25E-01		2.00E+00	2.70E+00	3.38E-01	3.38E-01	1.51E+01	1.88E+00	2.14E-06
Inorganics										
Aluminum			3.04E+00	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Antimony		3.40E+00		---	5.60E-04	0.00E+00	1.90E-03	1.00E+00	0.00E+00	4.00E-05
Beryllium				---	5.80E-03	0.00E+00	0.00E+00	1.00E+00	0.00E+00	1.00E-03
Calcium				---	1.90E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-03
Iron			5.79E+00	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Lead			8.70E-03	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Magnesium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02
Manganese			4.04E-01	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Potassium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02
Sodium	2.97E+02	3.10E+02		---	6.50E-02	1.93E+01	2.02E+01	1.00E+00	2.97E+02	8.00E-02
Vanadium				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Toxicity Data

Chemical Name	Mammals NOAEL (mg/kg/d)	Mammals Test Species	Mammals Body Wt. (kg)	Birds NOAEL (mg/kg/d)	Birds Test Species	Birds Body Wt. (kg)
Organics						
Acetone	1.00E+01	rat	0.35	--	--	--
Anthracene	1.00E+00	mouse	0.03	--	--	--
Benzo(a)anthracene	1.00E+00	mouse	0.03	--	--	--
Benzo(b)fluoranthene	1.00E+00	mouse	0.03	--	--	--
Benzo(g,h,i)perylene	1.00E+00	mouse	0.03	--	--	--
Benzo(k)fluoranthene	1.00E+00	mouse	0.03	--	--	--
Bromomethane	2.14E+00	rat	0.35	--	--	--
Chrysene	1.00E+00	mouse	0.03	--	--	--
Di-n-octyl phthalate	4.70E+02	rat	0.35	--	--	--
Fluoranthene	1.25E+02	mouse	0.03	--	--	--
Indeno(1,2,3-cd)pyrene	1.00E+00	mouse	0.03	--	--	--
Phenanthrene	1.00E+00	mouse	0.03	--	--	--
Pyrene	7.50E+01	mouse	0.03	--	--	--
1,3-DNB	5.95E-01	rat	0.35	--	--	--
4-Amino-2,6-DNT	9.59E+00	rat	0.35	3.20E-02	unknown	1
4-Amino-2-nitrotoluene	6.86E+01	rat	0.35	3.20E-02	unknown	1
2,4-DNT	2.68E+00	rat	0.35	--	--	--
2,6-DNT	1.77E+00	rat	0.35	--	--	--
3,4-DNT	8.07E+00	rat	0.35	--	--	--
Nitrobenzene	2.30E-01	mouse	0.03	--	--	--
3-Nitrotoluene	1.07E+01	rat	0.35	--	--	--
1,3,5-TNB	2.75E+00	rat	0.35	--	--	--
2,4,6-TNT	7.95E+00	rat	0.35	--	--	--
Inorganics						
Aluminum	1.93E+00	mouse	0.03	1.10E+02	ringed dove	0.155
Antimony	1.25E-01	mouse	0.03	--	--	--
Beryllium	6.60E-01	rat	0.35	--	--	--
Calcium	1.05E+03	rabbit	3.8	2.83E+03	Jap. quail	0.072
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Lead	8.00E+00	rat	0.35	3.85E+00	Am. Kestrel	0.13
Magnesium	1.58E+02	rabbit	3.8	1.50E+02	poultry	1.6
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072
Potassium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Sodium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Vanadium	2.10E-01	rat	0.26	1.14E+01	mallard duck	1.17

Plum Brook Ordnance Site
Pentolite Road Red Water Ponds

Omnivorous Rodent: **Deer mouse *(Peromyscus manicalatus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Plant/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics																
Acetone	2.21E+01	8.00E+00	2.76E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	4.72E+00	8.00E+00	5.90E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E-05	2.77E-05	2.77E-05	4.71E-11
Chrysene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	1.04E+03	8.00E+00	1.30E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	1.49E+02	8.00E+00	1.86E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	8.95E+01	8.00E+00	1.12E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	1.31E+00	8.00E+00	1.64E-01	1.00E+00	1.00E+00	4.81E-04	2.94E-03	7.69E-02	4.69E-01	1.31E-01	7.99E-01	1.27E+00	0.00E+00	0.00E+00	1.27E+00	1.56E-08
4-Amino-2,6-DNT	2.11E+01	8.00E+00	2.64E+00	1.00E+00	1.00E+00	4.81E-04	1.82E-04	3.90E-02	1.48E-02	1.39E-01	5.26E-02	6.75E-02	0.00E+00	0.00E+00	6.75E-02	4.48E-06
4-Amino-2-nitrotoluene	1.51E+02	8.00E+00	1.89E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	5.91E+00	8.00E+00	7.39E-01	1.00E+00	1.00E+00	4.81E-04	6.52E-04	4.01E-02	5.42E-02	1.39E-01	1.88E-01	2.43E-01	0.00E+00	0.00E+00	2.43E-01	4.29E-06
2,6-DNT	3.90E+00	8.00E+00	4.88E-01	1.00E+00	1.00E+00	5.01E-04	1.03E-03	2.79E-02	5.73E-02	1.49E-01	3.06E-01	3.84E-01	0.00E+00	0.00E+00	3.84E-01	8.68E-08
3,4-DNT	1.78E+01	8.00E+00	2.22E+00	1.00E+00	1.00E+00	4.81E-04	2.16E-04	2.89E-02	1.21E-02	1.44E-01	8.45E-02	7.88E-02	0.00E+00	0.00E+00	7.88E-02	8.35E-06
Nitrobenzene	2.74E-01	8.00E+00	3.43E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	2.36E+01	8.00E+00	2.95E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	6.08E+00	8.00E+00	7.58E-01	1.00E+00	1.00E+00	4.81E-04	6.35E-04	1.16E-01	1.53E-01	1.26E-01	1.67E-01	3.21E-01	0.00E+00	0.00E+00	3.21E-01	8.88E-07
2,4,6-TNT	1.75E+01	8.00E+00	2.19E+00	1.00E+00	1.00E+00	4.81E-04	2.20E-04	3.90E-02	1.78E-02	1.39E-01	6.34E-02	8.14E-02	0.00E+00	0.00E+00	8.14E-02	4.48E-06
Inorganics																
Aluminum	2.30E+00	8.00E+00	2.88E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.52E-01	1.57E+00	1.57E+00	0.00E+00
Antimony	1.49E-01	8.00E+00	1.86E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	1.46E+00	8.00E+00	1.82E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	4.22E+03	8.00E+00	5.27E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.04E+02	8.00E+00	1.30E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.61E-01	6.62E-02	6.62E-02	0.00E+00
Lead	1.78E+01	8.00E+00	2.21E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-03	5.88E-04	5.88E-04	0.00E+00
Magnesium	6.32E+02	8.00E+00	7.91E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	1.94E+02	8.00E+00	2.43E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.01E-02	2.48E-03	2.48E-03	0.00E+00
Potassium	6.32E+03	8.00E+00	7.90E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	6.32E+03	8.00E+00	7.90E+02	1.00E+00	1.00E+00	1.14E+00	1.45E-03	2.23E+00	2.82E-03	2.19E+01	2.77E-02	3.20E-02	0.00E+00	0.00E+00	3.20E-02	2.37E+01
Vanadium	4.30E-01	8.00E+00	5.37E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**7.31E-03**		**7.81E-01**		**1.67E+00**	**2.46E+00**		**1.64E+00**	**4.10E+00**	

Body Weight (kg)	0.0148
Water Intake (L/d)	0.0022
Food Intake (kg(dw)/d)	0.0028
Soil Intake (kg/d)	0.000057
Plant Intake (kg(dw)/d) -- 81% of diet	0.001708
Invertebrate Intake (kg(dw)/d) -- 39% of diet	0.001092

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Opportunistic Omnivore: **Raccoon *(Procyon lotor)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																	
Acetone	5.12E+00	8.00E+00	6.40E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	1.10E+00	8.00E+00	1.37E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-13	8.77E-13	8.77E-13	9.27E-06	6.77E-05	6.77E-05
Chrysene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	2.41E+02	8.00E+00	3.01E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	3.46E+01	8.00E+00	4.33E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	2.08E+01	8.00E+00	2.60E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	3.05E-01	8.00E+00	3.81E-02	1.00E+00	1.00E+00	2.94E-04	7.73E-03	1.43E-02	3.75E-01	2.72E-02	7.14E-01	3.96E-09	1.04E-07	1.10E+00	0.00E+00	0.00E+00	1.10E+00
4-Amino-2,6-DNT	4.91E+00	8.00E+00	6.14E-01	1.00E+00	1.00E+00	2.94E-04	4.79E-04	7.24E-03	1.18E-02	2.88E-02	4.70E-02	1.14E-08	1.86E-08	5.92E-02	0.00E+00	0.00E+00	5.92E-02
4-Amino-2-nitrotoluene	3.51E+01	8.00E+00	4.39E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	1.37E+00	8.00E+00	1.71E-01	1.00E+00	1.00E+00	2.94E-04	1.72E-03	7.43E-03	4.33E-02	2.87E-02	1.68E-01	1.09E-08	6.38E-08	2.13E-01	0.00E+00	0.00E+00	2.13E-01
2,6-DNT	9.06E-01	8.00E+00	1.13E-01	1.00E+00	1.00E+00	3.06E-04	2.70E-03	5.19E-03	4.58E-02	3.09E-02	2.73E-01	2.21E-08	1.95E-07	3.22E-01	0.00E+00	0.00E+00	3.22E-01
3,4-DNT	4.13E+00	8.00E+00	5.16E-01	1.00E+00	1.00E+00	2.94E-04	5.70E-04	4.99E-03	9.66E-03	2.98E-02	5.76E-02	2.13E-08	4.12E-08	6.79E-02	0.00E+00	0.00E+00	6.79E-02
Nitrobenzene	6.37E-02	8.00E+00	7.96E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	5.49E+00	8.00E+00	6.86E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	1.41E+00	8.00E+00	1.76E-01	1.00E+00	1.00E+00	2.94E-04	1.67E-03	2.16E-02	1.23E-01	2.62E-02	1.49E-01	2.21E-09	1.26E-08	2.73E-01	0.00E+00	0.00E+00	2.73E-01
2,4,6-TNT	4.07E+00	8.00E+00	5.09E-01	1.00E+00	1.00E+00	2.94E-04	5.78E-04	7.24E-03	1.42E-02	2.88E-02	5.66E-02	1.14E-08	2.24E-08	7.14E-02	0.00E+00	0.00E+00	7.14E-02
Inorganics																	
Aluminum	5.34E-01	8.00E+00	6.68E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E-01	3.84E+00	3.84E+00
Antimony	3.46E-02	8.00E+00	4.33E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	3.38E-01	8.00E+00	4.22E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	9.78E+02	8.00E+00	1.22E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.88E-01	1.62E-01	1.62E-01
Lead	4.09E+00	8.00E+00	5.12E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.34E-04	1.43E-03	1.43E-03
Magnesium	1.47E+02	8.00E+00	1.83E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.41E-02	6.05E-03	6.05E-03
Potassium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	1.00E+00	6.99E-01	3.81E-03	4.13E-01	2.25E-03	4.54E+00	2.48E-02	6.04E-02	3.29E-04	3.12E-02	0.00E+00	0.00E+00	3.12E-02
Vanadium	9.98E-02	8.00E+00	1.25E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**1.93E-02**		**6.24E-01**		**1.49E+00**		**3.30E-04**	**2.13E+00**		**4.01E+00**	**6.14E+00**

Body Weight (kg)	5.1
Water intake (L/d)	0.43
Food intake (kg(dw)/d)	0.26
Soil intake (kg/d)	0.012
Mouse Intake (kg(dw)/d) – 5 % of diet	0.013
Plant intake (kg(dw)/d) -- 42% of diet	0.1092
Invertebrate intake (kg(dw)/d) -- 30% of diet	0.078

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Herbivorous Rodent: **Eastern Cottontail *(Sylvilagus floridanus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
Acetone	1.34E+01	8.00E+00	1.67E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	2.86E+00	8.00E+00	3.57E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-05	2.99E-05	2.99E-05	9.12E-11
Chrysene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	6.28E+02	8.00E+00	7.85E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	9.03E+01	8.00E+00	1.13E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	5.42E+01	8.00E+00	6.77E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	7.95E-01	8.00E+00	9.93E-02	1.00E+00	1.00E+00	6.63E-04	6.67E-03	5.65E-02	5.69E-01	5.76E-01	0.00E+00	0.00E+00	5.76E-01	1.26E-06
4-Amino-2,6-DNT	1.28E+01	8.00E+00	1.60E+00	1.00E+00	1.00E+00	6.63E-04	4.14E-04	2.87E-02	1.79E-02	1.83E-02	0.00E+00	0.00E+00	1.83E-02	2.18E-06
4-Amino-2-nitrotoluene	9.16E+01	8.00E+00	1.15E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	3.58E+00	8.00E+00	4.47E-01	1.00E+00	1.00E+00	6.63E-04	1.48E-03	2.94E-02	6.58E-02	6.73E-02	0.00E+00	0.00E+00	6.73E-02	2.13E-06
2,6-DNT	2.36E+00	8.00E+00	2.95E-01	1.00E+00	1.00E+00	6.89E-04	2.33E-03	2.05E-02	6.95E-02	7.18E-02	0.00E+00	0.00E+00	7.18E-02	3.07E-06
3,4-DNT	1.08E+01	8.00E+00	1.35E+00	1.00E+00	1.00E+00	6.63E-04	4.92E-04	1.97E-02	1.47E-02	1.51E-02	0.00E+00	0.00E+00	1.51E-02	2.95E-06
Nitrobenzene	1.66E-01	8.00E+00	2.08E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	1.43E+01	8.00E+00	1.79E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	3.67E+00	8.00E+00	4.59E-01	1.00E+00	1.00E+00	6.63E-04	1.44E-03	8.54E-02	1.86E-01	1.87E-01	0.00E+00	0.00E+00	1.87E-01	9.09E-07
2,4,6-TNT	1.06E+01	8.00E+00	1.33E+00	1.00E+00	1.00E+00	6.63E-04	4.99E-04	2.87E-02	2.16E-02	2.21E-02	0.00E+00	0.00E+00	2.21E-02	2.18E-06
Inorganics														
Aluminum	1.39E+00	8.00E+00	1.74E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95E-01	1.69E+00	1.69E+00	0.00E+00
Antimony	9.03E-02	8.00E+00	1.13E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	8.81E-01	8.00E+00	1.10E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	2.55E+03	4.00E+00	6.38E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	6.30E+01	4.00E+00	1.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.63E-01	3.57E-02	3.57E-02	0.00E+00
Lead	1.07E+01	8.00E+00	1.34E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.45E-04	6.33E-04	6.33E-04	0.00E+00
Magnesium	3.83E+02	4.00E+00	9.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	1.18E+02	8.00E+00	1.47E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-02	2.67E-03	2.67E-03	0.00E+00
Potassium	3.83E+03	4.00E+00	9.57E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	3.83E+03	4.00E+00	9.57E+02	1.00E+00	1.00E+00	1.57E+00	1.64E-03	1.64E+00	1.71E-03	3.36E-03	0.00E+00	0.00E+00	3.36E-03	8.91E+00
Vanadium	2.60E-01	8.00E+00	3.25E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**1.50E-02**		**9.46E-01**	**9.61E-01**		**1.73E+00**	**2.69E+00**	

Body Weight (kg)	1.132
Water Intake (L/d)	0.11
Food Intake (kg(dw)/d)	0.096
Soil Intake (kg/d)	0.006
Plant Intake (kg(dw)/d) -- 100% of diet	0.096

Insectivorous mammal: **Short-tailed shrew *(Blarina brevicauda)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
Acetone	3.51E+01	8.00E+00	4.39E+00	1.00E+00	1.00E+00	6.92E-04	1.58E-04	0.00E+00	0.00E+00	1.58E-04	0.00E+00	0.00E+00	1.58E-04	3.82E-11
Anthracene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	7.52E+00	8.00E+00	9.40E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-05	1.80E-05	1.80E-05	2.20E-11
Chrysene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	1.65E+03	8.00E+00	2.06E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	2.38E+02	8.00E+00	2.97E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	1.43E+02	8.00E+00	1.78E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	2.09E+00	8.00E+00	2.61E-01	1.00E+00	1.00E+00	6.92E-03	2.65E-02	9.47E-01	3.63E+00	3.65E+00	0.00E+00	0.00E+00	3.65E+00	3.23E-06
4-Amino-2,6-DNT	3.37E+01	8.00E+00	4.21E+00	1.00E+00	1.00E+00	6.92E-03	1.64E-03	1.00E+00	2.39E-01	2.40E-01	0.00E+00	0.00E+00	2.40E-01	1.15E-05
4-Amino-2-nitrotoluene	2.41E+02	8.00E+00	3.01E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	9.41E+00	8.00E+00	1.18E+00	1.00E+00	1.00E+00	6.92E-03	5.88E-03	1.00E+00	8.52E-01	8.58E-01	0.00E+00	0.00E+00	8.58E-01	1.09E-05
2,6-DNT	6.22E+00	8.00E+00	7.77E-01	1.00E+00	1.00E+00	7.19E-03	9.26E-03	1.08E+00	1.39E+00	1.40E+00	0.00E+00	0.00E+00	1.40E+00	2.41E-05
3,4-DNT	2.83E+01	8.00E+00	3.54E+00	1.00E+00	1.00E+00	6.92E-03	1.95E-03	1.04E+00	2.93E-01	2.95E-01	0.00E+00	0.00E+00	2.95E-01	2.31E-05
Nitrobenzene	4.37E-01	8.00E+00	5.46E-02	1.00E+00	1.00E+00	7.19E-03	1.32E-01	0.00E+00	0.00E+00	1.32E-01	0.00E+00	0.00E+00	1.32E-01	6.01E-08
3-Nitrotoluene	3.77E+01	8.00E+00	4.71E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	9.66E+00	8.00E+00	1.21E+00	1.00E+00	1.00E+00	6.92E-03	5.73E-03	9.14E-01	7.57E-01	7.63E-01	0.00E+00	0.00E+00	7.63E-01	1.49E-06
2,4,6-TNT	2.79E+01	8.00E+00	3.49E+00	1.00E+00	1.00E+00	6.92E-03	1.98E-03	1.00E+00	2.88E-01	2.90E-01	0.00E+00	0.00E+00	2.90E-01	1.15E-05
Inorganics														
Aluminum	3.67E+00	8.00E+00	4.58E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.66E-01	1.02E+00	1.02E+00	0.00E+00
Antimony	2.38E-01	8.00E+00	2.97E-02	1.00E+00	1.00E+00	1.88E-01	6.34E+00	0.00E+00	0.00E+00	6.34E+00	0.00E+00	0.00E+00	6.34E+00	3.99E-05
Beryllium	2.32E+00	8.00E+00	2.90E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	6.71E+03	8.00E+00	8.39E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.66E+02	8.00E+00	2.07E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.88E-01	4.28E-02	4.28E-02	0.00E+00
Lead	2.81E+01	8.00E+00	3.51E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-03	3.80E-04	3.80E-04	0.00E+00
Magnesium	1.01E+03	8.00E+00	1.26E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	3.09E+02	8.00E+00	3.86E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.19E-02	1.60E-03	1.60E-03	0.00E+00
Potassium	1.01E+04	8.00E+00	1.26E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.01E+04	8.00E+00	1.26E+03	1.00E+00	1.00E+00	1.72E+01	1.36E-02	1.58E+02	1.26E-01	1.40E-01	0.00E+00	0.00E+00	1.40E-01	7.46E+01
Vanadium	6.85E-01	8.00E+00	8.56E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**6.53E+00**		**7.57E+00**			**1.06E+00**	**1.52E+01**	

Body Weight (kg)	0.015
Water intake (L/d)	0.0023
Food intake (kg(dw)/d)	0.008
Soil intake (kg/d)	0.00083
Invertebrate intake (kg(dw)/d)--100% of diet	0.008

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Herbivorous Mammal: **White-tailed deer *(Odocoileus virginianus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics													
Acetone	5.44E+00	8.00E+00	6.80E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	2.18E-04	3.21E-04	3.21E-04	0.00E+00	0.00E+00	3.21E-04
Anthracene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	1.16E+00	8.00E+00	1.45E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.40E-06	3.02E-05	3.02E-05
Chrysene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	2.56E+02	8.00E+00	3.20E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	3.68E+01	8.00E+00	4.60E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	2.21E+01	8.00E+00	2.76E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	3.24E-01	8.00E+00	4.05E-02	1.00E-02	1.00E-02	8.20E-07	2.03E-05	2.18E-04	5.40E-03	5.42E-03	0.00E+00	0.00E+00	5.42E-03
4-Amino-2,6-DNT	5.22E+00	8.00E+00	6.52E-01	1.00E-02	1.00E-02	8.20E-07	1.26E-06	1.11E-04	1.70E-04	1.71E-04	0.00E+00	0.00E+00	1.71E-04
4-Amino-2-nitrotoluene	3.73E+01	8.00E+00	4.66E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	1.46E+00	8.00E+00	1.82E-01	1.00E-02	1.00E-02	8.20E-07	4.50E-06	1.14E-04	6.25E-04	6.29E-04	0.00E+00	0.00E+00	6.29E-04
2,6-DNT	9.63E-01	8.00E+00	1.20E-01	1.00E-02	1.00E-02	8.52E-07	7.08E-06	7.94E-05	6.60E-04	6.67E-04	0.00E+00	0.00E+00	6.67E-04
3,4-DNT	4.39E+00	8.00E+00	5.49E-01	1.00E-02	1.00E-02	8.20E-07	1.49E-06	7.63E-05	1.39E-04	1.41E-04	0.00E+00	0.00E+00	1.41E-04
Nitrobenzene	6.77E-02	8.00E+00	8.46E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	1.37E-04	1.62E-02	1.62E-02	0.00E+00	0.00E+00	1.62E-02
3-Nitrotoluene	5.83E+00	8.00E+00	7.29E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	1.50E+00	8.00E+00	1.87E-01	1.00E-02	1.00E-02	8.20E-07	4.38E-06	3.30E-04	1.77E-03	1.77E-03	0.00E+00	0.00E+00	1.77E-03
2,4,6-TNT	4.32E+00	8.00E+00	5.40E-01	1.00E-02	1.00E-02	8.20E-07	1.52E-06	1.11E-04	2.05E-04	2.07E-04	0.00E+00	0.00E+00	2.07E-04
Inorganics													
Aluminum	5.68E-01	8.00E+00	7.10E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E-01	1.71E+00	1.71E+00
Antimony	3.68E-02	8.00E+00	4.60E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	6.24E-07	1.36E-04	1.36E-04	0.00E+00	0.00E+00	1.36E-04
Beryllium	3.59E-01	8.00E+00	4.49E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	1.04E+03	8.00E+00	1.30E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.57E+01	8.00E+00	3.21E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E-01	7.22E-02	7.22E-02
Lead	4.35E+00	8.00E+00	5.44E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.48E-04	6.40E-04	6.40E-04
Magnesium	1.56E+02	8.00E+00	1.95E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	4.79E+01	8.00E+00	5.98E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-02	2.70E-03	2.70E-03
Potassium	1.56E+03	8.00E+00	1.95E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.56E+03	8.00E+00	1.95E+02	1.00E-02	1.00E-02	1.95E-03	9.99E-06	6.61E-03	3.39E-05	4.39E-05	0.00E+00	0.00E+00	4.39E-05
Vanadium	1.06E-01	8.00E+00	1.33E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**5.05E-05**		**2.57E-02**	**2.57E-02**		**1.79E+00**	**1.81E+00**

Body Weight (kg)	61
Water Intake (L/d)	4
Food Intake (kg(dw)/d)	2
Soil Intake (kg/d)	0.04
Plant Intake (kg(dw)/d) -- 100% of diet	2

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Insectivorous Bird: **Marsh wren *(Cistothorus palustris)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
Acetone	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.97E-05	0.00E+00	0.00E+00	2.36E-11
Chrysene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.69E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.47E-06
4-Amino-2,6-DNT	3.20E-02	8.00E+00	4.00E-03	1.00E+00	1.00E+00	2.38E-03	5.94E-01	1.79E+00	4.47E+02	4.48E+02	0.00E+00	0.00E+00	4.48E+02	1.24E-05
4-Amino-2-nitrotoluene	3.20E-02	8.00E+00	4.00E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.79E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-05
2,6-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.47E-03	0.00E+00	1.92E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.59E-05
3,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.85E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.49E-05
Nitrobenzene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.63E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-06
2,4,6-TNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	2.38E-03	0.00E+00	1.79E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-05
Inorganics														
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.21E-01	5.97E-02	5.97E-02	0.00E+00
Antimony	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E+00	2.50E-01	2.50E-01	0.00E+00
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.35E-03	4.88E-03	4.88E-03	0.00E+00
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-01	8.93E-04	8.93E-04	0.00E+00
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	1.00E+00	5.64E+00	4.51E-02	2.82E+02	2.26E+00	2.30E+00	0.00E+00	0.00E+00	2.30E+00	7.43E+01
Vanadium	1.14E+01	8.00E+00	1.43E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**6.39E-01**		**4.50E+02**	**4.50E+02**		**3.16E-01**	**4.51E+02**	

Body Weight (kg)	0.01
Water Intake (L/d)	0.0027
Food Intake (kg(dw)/d)	0.0095
Soil Intake (kg/d)	0.00019
Plant Intake (kg(dw)/d) -- 0% of diet	0
Invertebrate Intake (kg(dw)/d) -- 100% of die	0.0095

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Avian predator: **Red-tailed hawk (*Buteo jamaicensis*)**

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intak Hazard Quotient	Bird Intake (mg/kg-d)	Bird Intak Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Rabbit Intake (mg/kg-d)	Rabbit Intake Hazard Quotient	Shrew Intake (mg/kg-d)	Shrew Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																			
Acetone	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	5.91E-15	0.00E+00	1.25E-14	0.00E+00	2.41E-14	0.00E+00	5.83E-15	0.00E+00	0.00E+00	6.55E-08	0.00E+00	0.00E+00
Chrysene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenanthrene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	8.71E-10	0.00E+00	4.12E-10	0.00E+00	3.34E-10	0.00E+00	8.54E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	3.20E-02	8.00E+00	4.00E-03	1.00E-02	1.00E-02	2.61E-06	8.53E-04	3.11E-09	7.76E-07	1.19E-09	2.96E-07	5.77E-10	1.44E-07	3.05E-09	7.62E-07	6.55E-04	0.00E+00	0.00E+00	6.55E-04
4-Amino-2-nitrotoluene	3.20E-02	8.00E+00	4.00E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	2.95E-09	0.00E+00	1.14E-09	0.00E+00	5.85E-10	0.00E+00	2.90E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNT	0.00E+00	6.00E+00	0.00E+00	1.00E-02	1.00E-02	2.72E-06	0.00E+00	6.49E-09	0.00E+00	2.30E-09	0.00E+00	8.13E-10	0.00E+00	6.37E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3,4-DNT	0.00E+00	6.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	6.24E-09	0.00E+00	2.21E-09	0.00E+00	7.82E-10	0.00E+00	6.12E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-Nitrotoluene	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.61E-06	0.00E+00	4.02E-10	0.00E+00	2.30E-10	0.00E+00	2.41E-10	0.00E+00	3.94E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,6-TNT	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	2.81E-06	0.00E+00	3.11E-09	0.00E+00	1.19E-09	0.00E+00	5.77E-10	0.00E+00	3.05E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inorganics																			
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-03	1.32E-04	1.32E-04
Antimony	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Beryllium	0.00E+00	8.00E+00	0.00E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.45E-03	5.52E-04	5.52E-04
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.18E-06	1.08E-05	1.08E-05
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.41E-04	1.97E-06	1.97E-06
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sodium	1.00E+03	8.00E+00	1.25E+02	1.00E-02	1.00E-02	6.21E-03	4.97E-05	1.86E-02	1.49E-04	6.27E-03	5.02E-05	2.36E-03	1.89E-05	1.97E-02	1.58E-04	4.26E-04	0.00E+00	0.00E+00	4.26E-04
Vanadium	1.14E+01	8.00E+00	1.43E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**7.03E-04**		**1.50E-04**		**5.05E-05**		**1.90E-05**		**1.59E-04**	**1.08E-03**		**6.96E-04**	**1.78E-03**

Body Weight (kg)	0.957
Water Intake (L/d)	0.057
Food Intake (kg(dw)/d)	0.1
Soil Intake (kg/d)	0.002
Bird Intake (kg(dw)/d) -- 24% of diet	0.024
Mouse Intake (kg(dw)/d) -- 25.3% of diet	0.025333
Shrew Intake (kg(dw)/d) -- 25.3% of diet	0.025333
Rabbit Intake (kg(dw)/d) -- 25.3% of diet	0.025333

Chemical Data

Chemical Name	Sediment Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Kow (organics)	log Koc (organics) (mL/g)	Koc (organics) (mL/g)	Kd (inorganics) (mL/g)	Foc	Water-to-Fish/Invert BCF	Food Chain Multiplier	Water-to-Fish BAF	Fish Conc. (mg/kgww)	Fish Conc. (mg/kgdw)	Pore water Conc. (mg/L)	Solubility (mg/L)	< of the PoreH2O or Solubility	Invert. Conc. (mg/kgww)	Invert Conc. (mg/kgdw)	Food-to-Muscle TF
Organics																			
Acetone	6.90E-02		-2.40E-01	5.75E-01	-2.36E-01	5.81E-01	---	1.10E-02	5.75E-01	1.00E+00	5.75E-01	0.00E+00	0.00E+00	1.08E+01		1.08E+01	6.21E+00	2.48E+01	1.04E-08
Bromomethane		1.10E-04	1.09E+00	1.23E+01	1.07E+00	1.18E+01	---	1.10E-02	1.23E+01	1.00E+00	1.23E+01	1.35E-03	4.23E-03	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.46E-07
Carbazole	1.80E-01		3.29E+00	1.95E+03	3.23E+00	1.72E+03	---	1.10E-02	1.95E+03	1.01E+00	1.97E+03	0.00E+00	0.00E+00	9.54E-03		9.54E-03	1.86E+01	7.44E+01	4.61E-05
Dibenzofuran	6.00E-02		4.12E+00	1.32E+04	4.05E+00	1.12E+04	---	1.10E-02	1.32E+04	1.10E+00	1.44E+04	0.00E+00	0.00E+00	4.86E-04		4.86E-04	6.40E+00	2.56E+01	3.32E-04
Di-n-octyl phthalate			5.22E+00	1.66E+05	5.13E+00	1.35E+05	---	1.10E-02	1.66E+05	4.05E+00	6.72E+05	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.54E-03
Methylene chloride			1.26E+00	1.82E+01	1.24E+00	1.73E+01	---	1.10E-02	1.82E+01	1.00E+00	1.82E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	3.69E-07
Methyl ethyl ketone	1.50E-02		2.80E-01	1.91E+00	2.76E-01	1.89E+00	---	1.10E-02	1.91E+00	1.01E+00	1.92E+00	0.00E+00	0.00E+00	7.23E-01		7.23E-01	1.38E+00	5.51E+00	3.58E-08
1,3-DNB			1.49E+00	3.09E+01	1.46E+00	2.92E+01	---	1.10E-02	3.09E+01	1.00E+00	3.09E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	6.37E-07
2-Amino-4,6-DNT			2.00E+00	1.00E+02	1.97E+00	9.25E+01	---	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.14E-06
4-Amino-2-NT			2.00E+00	1.00E+02	1.97E+00	9.25E+01	---	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.14E-06
2,6-DNB			1.49E+00	3.09E+01	1.46E+00	2.92E+01	---	1.10E-02	3.09E+01	1.00E+00	3.09E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	6.37E-07
2,4-DNT			1.98E+00	9.55E+01	1.95E+00	8.84E+01	---	1.10E-02	9.55E+01	1.00E+00	9.55E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.04E-06
2,6-DNT			2.28E+00	1.91E+02	2.24E+00	1.74E+02	---	1.10E-02	1.91E+02	1.00E+00	1.91E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.17E-06
3,4-DNT			2.28E+00	1.91E+02	2.24E+00	1.74E+02	---	1.10E-02	1.91E+02	1.00E+00	1.91E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.17E-06
3-NT			2.43E+00	2.69E+02	2.39E+00	2.45E+02	---	1.10E-02	2.69E+02	1.00E+00	2.70E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	5.96E-06
1,3,5-TNB			1.18E+00	1.51E+01	1.16E+00	1.45E+01	---	1.10E-02	1.51E+01	1.00E+00	1.51E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	3.05E-07
2,4,6-TNT			2.00E+00	1.00E+02	1.97E+00	9.25E+01	---	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.14E-06
Inorganics																			
Aluminum		3.04E+00	---	---	---	---	1.50E+03	1.10E-02	1.00E+02	1.00E+00	1.00E+02	3.04E+02	9.50E+02	0.00E+00	9.80E-01	0.00E+00	0.00E+00	0.00E+00	NA
Arsenic			---	---	---	---	2.00E+02	1.10E-02	4.40E+01	1.00E+00	4.40E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	4.00E-03
Barium			---	---	---	---	6.00E+01	1.10E-02	4.00E+00	1.00E+00	4.00E+00	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	2.00E-04
Calcium			---	---	---	---	4.10E+00	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	0.00E+00	1.31E+03	0.00E+00	0.00E+00	0.00E+00	2.00E-03
Chromium			---	---	---	---	8.50E+02	1.10E-02	2.00E+02	1.00E+00	2.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	NA
Copper			---	---	---	---	3.50E+01	1.10E-02	2.00E+02	1.00E+00	2.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	NA
Iron		5.79E+00	---	---	---	---	5.00E+03	1.10E-02	2.00E+02	1.00E+00	2.00E+02	1.16E+03	3.62E+03	0.00E+00	6.70E+01	0.00E+00	0.00E+00	0.00E+00	NA
Lead		8.70E-03	---	---	---	---	4.00E+02	1.10E-02	3.00E+02	1.00E+00	3.00E+02	2.61E+00	8.16E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	NA
Magnesium	1.93E+04		---	---	---	---	4.60E+00	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	4.20E+03	6.20E+00	6.20E+00	6.20E+02	2.48E+03	2.00E-02
Manganese		4.04E-01	---	---	---	---	1.00E+03	1.10E-02	4.00E+02	1.00E+00	4.00E+02	1.62E+02	5.05E+02	0.00E+00		0.00E+00	0.00E+00	0.00E+00	NA
Phosphorus			---	---	---	---	3.50E+00	1.10E-02	5.00E+04	1.00E+00	5.00E+04	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	NA
Potassium	1.04E+03		---	---	---	---	5.60E+00	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	1.86E+02		1.86E+02	1.86E+04	7.43E+04	1.00E+00
Sodium			---	---	---	---	NA	1.10E-02	2.00E+01	1.00E+00	2.00E+01	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	6.50E-02
Vanadium			---	---	---	---	1.00E+03	1.10E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00	0.00E+00	NA

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Toxicity Data

Chemical Name	Mammals NOAEL (mg/kg/d)	Mammals Test Species	Mammals Body Wt. (kg)	Birds NOAEL (mg/kg/d)	Birds Test Species	Birds Body Wt. (kg)
Organics						
Acetone	1.00E+01	rat	0.35	--	--	--
Bromomethane	2.14E+00	rat	0.35	--	--	--
Carbazole	2.00E+00	mouse	0.03	--	--	--
Dibenzofuran	--	--	--	--	--	--
Di-n-octyl phthalate	4.70E+02	rat	0.35	--	--	--
Methylene chloride	5.85E+00	rat	0.35	--	--	--
Methyl ethyl ketone	1.77E+03	rat	0.35	--	--	--
1,3-DNB	5.95E-01	rat	0.35	--	--	--
2-Amino-4,6-DNT	1.39E+01	rat	0.35	3.20E-02	unknown	1
4-Amino-2-NT	6.86E+01	rat	0.35	3.20E-02	unknown	1
2,6-DNB	4.00E-01	rat	0.35	--	--	--
2,4-DNT	2.68E+00	rat	0.35	--	--	--
2,6-DNT	1.77E+00	rat	0.35	--	--	--
3,4-DNT	8.07E+00	rat	0.35	--	--	--
3-NT	1.07E+01	rat	0.35	--	--	--
1,3,5-TNB	2.75E+00	rat	0.35	--	--	--
2,4,6-TNT	7.95E+00	rat	0.35	--	--	--
Inorganics						
Aluminum	1.93E+00	mouse	0.03	1.10E+02	ringed dove	0.155
Arsenic	1.26E-01	mouse	0.03	2.46E+00	cowbird	0.049
Barium	5.10E+00	rat	0.435	2.08E+01	chicks	0.121
Calcium	1.05E+03	rabbit	3.8	2.83E+03	Jap. Quail	0.072
Chromium	2.74E+03	rat	0.35	1.00E+00	black duck	1.25
Copper	1.17E+01	mink	1	4.70E+01	chicks	0.534
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Lead	8.00E+00	rat	0.35	3.85E+00	Am. Kestrel	0.13
Magnesium	1.58E+02	rabbit	3.8	1.50E+02	poultry	1.6
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072
Phosphorus	5.26E+02	rabbit	3.8	4.00E+02	poultry	1.6
Potassium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Sodium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6
Vanadium	2.10E-01	rat	0.26	1.14E+01	mallard duck	1.17

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Piscivorous Bird: **Great Blue Heron *(Ardea herodias)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Macroinvert Intake (mg/kg-d)	Macroinvert Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
Acetone	0.00E+00	8.00E+00	0.00E+00	1.00E+00	2.47E-04	NA	0.00E+00	NA	1.80E-01	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bromomethane	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	7.37E-04	NA	0.00E+00	NA	0.00E+00	4.99E-06	0.00E+00	0.00E+00
Carbazole	0.00E+00	8.00E+00	0.00E+00	1.00E+00	6.45E-04	NA	0.00E+00	NA	5.40E-01	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dibenzofuran	0.00E+00	8.00E+00	0.00E+00	1.00E+00	2.15E-04	NA	0.00E+00	NA	1.86E-01	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methylene chloride	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methyl ethyl ketone	0.00E+00	8.00E+00	0.00E+00	1.00E+00	5.38E-05	NA	0.00E+00	NA	4.00E-02	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2-Amino-4,6-DNT	3.20E-02	8.00E+00	4.00E-03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2-NT	3.20E-02	8.00E+00	4.00E-03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3,4-DNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-NT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,6-TNT	0.00E+00	8.00E+00	0.00E+00	1.00E+00	0.00E+00	NA	0.00E+00	NA	0.00E+00	NA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inorganics														
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E+00	0.00E+00	0.00E+00	1.66E+02	1.20E+01	0.00E+00	0.00E+00	1.20E+01	1.38E-01	1.00E-02	1.20E+01
Arsenic	2.46E+00	8.00E+00	3.08E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Barium	2.08E+01	8.00E+00	2.60E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromium	1.00E+00	8.00E+00	1.25E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	4.70E+01	8.00E+00	5.88E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E+00	0.00E+00	0.00E+00	6.30E+02	1.01E+02	0.00E+00	0.00E+00	1.01E+02	2.63E-01	4.20E-02	1.01E+02
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E+00	0.00E+00	0.00E+00	1.42E+00	2.95E+00	0.00E+00	0.00E+00	2.95E+00	3.95E-04	8.20E-04	2.95E+00
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E+00	6.92E+01	3.69E+00	0.00E+00	0.00E+00	1.80E+01	9.60E-01	4.65E+00	0.00E+00	0.00E+00	4.65E+00
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	0.00E+00	0.00E+00	8.80E+01	7.20E-01	0.00E+00	0.00E+00	7.20E-01	1.83E-02	1.50E-04	7.21E-01
Phosphorus	4.00E+02	8.00E+00	5.00E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	3.73E+00	2.98E-02	0.00E+00	0.00E+00	5.39E+02	4.31E+00	4.34E+00	0.00E+00	0.00E+00	4.34E+00
Sodium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vanadium	1.14E+01	8.00E+00	1.43E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL						**3.72E+00**		**1.17E+02**		**5.27E+00**	**1.26E+02**		**5.30E-02**	**1.26E+02**

Body Weight (kg)	2.204
Water intake (L/d)	0.1
Food intake (kg(dw)/d)	0.4
Sediment intake (kg/d)	0.0079
Fish intake (kg(dw)/d) -- 96% of diet	0.384
Macroinvert intake (kg(dw)/d) -- 4% of diet	0.016

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Omnivorous mammal: **Raccoon *(Procyon lotor)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Aq. Invert. Intake (mg/kg-d)	Aq. Invert. Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
Acetone	5.12E+00	8.00E+00	6.40E-01	1.00E+00	1.62E-04	2.54E-04	2.66E-01	4.16E-01	0.00E+00	0.00E+00	4.16E-01	0.00E+00	0.00E+00	4.16E-01
Bromomethane	1.10E+00	8.00E+00	1.37E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.31E-06	3.15E-05	3.15E-05	4.64E-06	3.39E-05	6.54E-05
Carbazole	5.54E-01	8.00E+00	6.92E-02	1.00E+00	4.24E-04	6.12E-03	7.97E-01	1.15E+01	0.00E+00	0.00E+00	1.15E+01	0.00E+00	0.00E+00	1.15E+01
Dibenzofuran	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.41E-04	NA	2.74E-01	NA	0.00E+00	NA	NA	0.00E+00	0.00E+00	0.00E+00
Di-n-octyl phthalate	2.41E+02	8.00E+00	3.01E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methylene chloride	2.99E+00	8.00E+00	3.74E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methyl ethyl ketone	9.06E+02	8.00E+00	1.13E+02	1.00E+00	3.53E-05	3.11E-07	5.90E-02	5.21E-04	0.00E+00	0.00E+00	5.21E-04	0.00E+00	0.00E+00	5.21E-04
1,3-DNB	3.05E-01	8.00E+00	3.81E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2-Amino-4,6-DNT	7.13E+00	8.00E+00	8.92E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2-NT	3.51E+01	8.00E+00	4.39E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNB	2.05E-01	8.00E+00	2.56E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4-DNT	1.37E+00	8.00E+00	1.71E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,6-DNT	9.06E-01	8.00E+00	1.13E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3,4-DNT	4.13E+00	8.00E+00	5.16E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3-NT	5.49E+00	8.00E+00	6.86E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	1.41E+00	8.00E+00	1.76E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,6-TNT	4.07E+00	8.00E+00	5.09E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inorganics														
Aluminum	5.34E-01	8.00E+00	6.68E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-01	1.45E+01	1.45E+01	1.28E-01	1.92E+00	1.64E+01
Arsenic	3.49E-02	8.00E+00	4.36E-03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Barium	2.76E+00	8.00E+00	3.45E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	9.78E+02	8.00E+00	1.22E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromium	1.40E+03	8.00E+00	1.75E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	7.79E+00	8.00E+00	9.73E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.69E+00	1.22E+00	1.22E+00	2.44E-01	8.08E-02	1.30E+00
Lead	4.09E+00	8.00E+00	5.12E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.32E-03	1.62E-02	1.62E-02	3.67E-04	7.17E-04	1.70E-02
Magnesium	1.47E+02	8.00E+00	1.83E+01	1.00E+00	4.54E+01	2.47E+00	2.66E+01	1.45E+00	0.00E+00	0.00E+00	3.92E+00	0.00E+00	0.00E+00	3.92E+00
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-01	9.15E-02	9.15E-02	1.70E-02	3.03E-03	9.45E-02
Phosphorus	4.89E+02	8.00E+00	6.11E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	2.45E+00	1.33E-02	7.95E+02	4.34E+00	0.00E+00	0.00E+00	4.35E+00	0.00E+00	0.00E+00	4.35E+00
Sodium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Vanadium	9.98E-02	8.00E+00	1.25E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL						**2.49E+00**		**1.77E+01**		**1.58E+01**	**3.60E+01**		**2.00E+00**	**3.80E+01**

Body Weight (kg)	5.1
Water intake (L/d)	0.215
Food intake (kg(dw)/d)	0.26
Sediment intake (kg/d)	0.012
Aquatic Invert. Intake (kg(dw)/d -- 21% of diet	0.0546
Fish intake (kg(dw)/d) -- 2% of diet	0.0052

APPENDIX N

APPLICATION OF ESSENTIAL NUTRIENTS IN ECOLOGICAL RISK ASSESSMENT

APPENDIX N

APPLICATION OF ESSENTIAL NUTRIENTS IN ECOLOGICAL RISK ASSESSMENT

N.1.0 Introduction

All forms of living matter require inorganic elements, or minerals, for their normal life processes. All animal tissues and feeds contain inorganic or mineral elements in widely varying amounts and proportions. Minerals that are needed in relatively large amounts are referred to as major or macrominerals; those that are needed in very small amounts are referred to as trace minerals or microminerals. These terms represent quantity designations of the amounts required in an animal's diet and their generally low or trace concentrations in tissues. The major minerals are required in concentrations of greater than 100 parts per million (ppm) and are often reported as a percentage of diet, while trace elements are required at less than 100 ppm and are sometimes reported at the ppb level. Table 1 presents twenty-four elements known to be required by at least some animal species (McDowell, 1992).

The listing of some of the trace elements as essential is difficult and sometimes tentative, and rests on experiments with one or more species. In these experiments, diets adequate in all nutrients except the mineral in question produced clinical signs that were prevented or overcome by adding that mineral to the diets (McDowell, 1992).

Unlike other nutrients mineral elements cannot be synthesized by living organisms. Minerals act as (1) structural components of body organs and tissues, (2) constituents of body fluids and tissues as electrolytes, and (3) catalysts in enzyme and hormone systems. The most obvious function of mineral elements in the body is to provide structural support (skeleton) for the body. Ca, P, Mg, F, and Si in bones and teeth all contribute to mechanical stability. Birds use Ca to produce egg shells, and P and S are found in muscle proteins. Minerals are interrelated and balanced against each other, and most often cannot be considered as single elements with independent and self-sufficient roles in the organized bodily processes. The definite relationship of Ca and P in the formation of bones and teeth and the interrelationships of Fe, Cu, and Co (in vitamin B_{12}) in hemoglobin synthesis and red blood cell formation are examples. Sodium, K, Ca, P, and Cl serve individually and collectively in the body fluids. A number of trace elements (i.e.,

Cu, Zn, Fe, and Se) in addition to certain vitamins (i.e., A, D, E, B_6, and folacin) and other nutrients, are strongly related to adequate immune response (McDowell, 1992).

N.2.0 Mineral Requirements

A series of "safe" dietary levels of potentially toxic elements has been established on the extent to which other elements that affect their absorption and retention are present (McDowell, 1992). Table 2 presents some of these "safe" dietary levels or mineral requirements for selected species.

To determine whether concentrations of these minerals in the environment exceed safe dietary levels, the mineral requirements were converted to dietary doses using the following equation:

$$\text{Dose (mg/kg-day)} = \text{Diet (mg/kg)} \times \text{FI (kg/day)} \times 1/\text{BW (kg)}$$

where:

Diet (mg/kg) = Mineral requirement for each nutrient;
FI (kg/day) = Food ingestion rate; and
BW (kg/day) = Body weight.

Variables for the species are shown in Table 3.

Table 4 presents the mineral requirements calculated as dietary doses for selected species presented in Table 3.

N.3.0 Maximum Tolerance Levels

Information concerning the toxicity or tolerance of minerals is incomplete. According to available information, the toxic level of most major minerals is about 10 times the recommended level for young, growing livestock. The toxic levels of trace minerals appear to be highly variable, ranging between 10 and 1,500 times the recommended level. The National Research Council (NRC) publishes maximum tolerance levels for domestic animals. The maximum tolerance level is defined as that dietary level that, when fed for a limited period, will not impair animal performance and should not produce unsafe residues in human food derived from animals. The levels listed in Table 5 were derived from toxicity data on the designated species. Tolerance levels vary with the species, adaptation, duration of receiving the toxicants, age, physical condition of the animal, and many other factors (McDowell, 1992).

Using the same procedure described in Section 2.0, the maximum tolerance levels are converted into dietary doses to determine whether concentrations of these minerals in the environment exceed safe dietary levels. Variables for the domestic animals are shown in Table 6.

Table 7 presents the calculated dietary doses for selected species presented in Table 6.

N.4.0 Data Use

Mineral requirements or maximum tolerance levels will be used in ecological risk assessments, as appropriate.

N.5.0 References

IT, 1999. Best professional judgment for cat's (*Felis domesticus*) body weight being 10 lbs.

Oak Ridge National Laboratory (ORNL) 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*. B.E. Sample, D.M. Opresko, G.W. Suter II. ES/ER/TM-86/R3. June 1996.

U.S. Environmental Protection Agency (USEPA). 1993. *Wildlife Exposure Factors Handbook.* EPA/600/R-93/187a, December.

McDowell, L.R. 1992. *Minerals in Animal and Human Nutrition.* Academic Press, Inc. San Diego.

Note: This appendix is based on work initially completed by Ms. Margareg Roy of Radian Corporation (1988).

Table N-1

General Macro and Microminerals
Plum Brook Ordnance Works, Sandusky, Ohio

Major or Macrominerals	Trace or Microminerals		
Calcium (Ca)	Arsenic (As)*	Iodine (I)	Nickel (Ni)*
Chlorine (Cl)	Boron (B)*	Iron (Fe)	Selenium (Se)
Magnesium (Mg)	Chromium (Cr)	Lead (Pb)*	Silicon (Si)*
Phosphorus (P)	Cobalt (Co)	Lithium (Li)*	Tin (Sn)*
Potassium (K)	Copper (Cu)	Manganese (Mn)	Vanadium (V)*
Sodium (Na)	Fluorine (F)	Molybdenum (Mo)	Zinc (Zn)
Sulfur (S)			

* These elements have not been shown to be essential for livestock or humans consuming typical diets.

Table N-2

Mineral Requirements for Selected Species
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Mineral (mg/kg of feed)									
	Ca	Mg	K	Na	Cu	Fe	Mn	P	Se	Zn
Japanese Quail	25,000	500	4,000	1,500	6	100	70	5,000	0.2	50
Rat	5,000	400	3,600	500	5	35	50	4,000	0.10	0.25
Mouse	4,000	500	2000	---	4.5	25	44	4,000	---	30
Cat	8,000	400	4,000	500	5	80	5	6,000	0.1	50
Mink	6,000	440	3,000	---	6	80	44	5,500	0.1	66

Table N-3

Food Ingestion and Body Weights
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Food Ingestion (FI) (kg/day)	Body Weight (Kg)
Japanese Quail	0.017 derived from $FI(kg/day) = 0.0582*BW(kg)^{0.651}$ [b]	0.15[a]
Rat	0.08[a]	0.35[a]
Mouse	0.0055[a]	0.03[a]
Cat	0.24 derived from $FI(kg/day)=0.0687*BW(kg)^{0.822}$ [b]	4.5 derived from 10lbs*0.4535923 conversion factor.[c]
Mink	0.137[a]	1.0[a]

[a]ORNL, 1996.
[b]USEPA, 1993.
[c]IT, 1999.

Table N-4

Mineral Requirements as a Dietary Dose for Selected Species
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Mineral Dose (mg/kg-day)									
	Ca	Mg	K	Na	Cu	Fe	Mn	P	Se	Zn
Japanese Quail	2,833	56.7	453	170	0.7	11.3	7.9	567	0.02	5.7
Rat	1,143	91.4	823	114	1.1	8	11.4	914	0.02	0.06
Mouse	733	92	367	---	0.8	4.6	8.1	733	---	5.5
Cat	427	21	213	26.7	0.3	4.3	0.3	320	0.01	2.7
Mink	822	60	411	---	0.8	11	6	753	0.01	9

Table N-5

Maximum Tolerance Levels for Domestic Animals
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Maximum Tolerance Levels of Dietary Minerals (ppm)									
	Ca[a]	Mg	K	Na (as NaCl)	Cu	Fe	Mn	P	Se	Zn
Poultry	40,000[b] 12,000[c]	(3,000)	(20,000)	20,000	300	1,000	2,000	8,000	20,000	1,000
Rabbits	20,000	(3,000)	(30,000)	(30,000)	200	(500)	(400)	10,000	(20,000)	(500)

Source: McDowell, 1992.
The levels in parentheses were derived by interspecific species extrapolation.

[a]Ratio of calcium to phosphorus is important.
[b]Laying hen.
[c]Other poultry.

Table N-6

Food Ingestion and Body Weights for Domestic Animals
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Food Ingestion (FI) (kg/day)	Body Weight (Kg)
Poultry	0.08 derived from $FI(kg/day) = 0.0582*BW(kg)^{0.651}$ [a]	1.6 (mean weight of male and female chicken) [b]
Rabbits	0.2 derived from $FI(kg/day)=0.0687*BW(kg)^{0.822}$ [a]	3.8 [b]

[a]USEPA, 1993.
[b]ORNL, 1996.

Table N-7

Maximum Tolerance Level as a Dietary Dose for Domestic Animals
Plum Brook Ordnance Works, Sandusky, Ohio

Species	Dietary Doses (mg/kg-day)									
	Ca	Mg	K	Na (as NaCl)	Cu	Fe	Mn	P	Se	Zn
Poultry	600	150	1,000	1,000	15	50	100	400	1,000	50
Rabbits	1,053	158	1,579	1,579	11	26	21	526	1,053	26

APPENDIX C

RED WATER POND AREAS BASELINE ECOLOGICAL RISK ASSESSMENT IT CORPORATION, NOVEMBER 2001 (ELECTRONIC DELIVERABLE ONLY)

Red Water Pond Areas
Baseline Ecological Risk Assessment

Former Plum Brook Ordnance Works
Sandusky, Ohio

Prepared for:

U.S. Army Corps of Engineers, Nashville District
P. O. Box 1070
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IT Project No. 807053

Revision 1

November 2001

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List of Acronyms

BCF	biological concentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BNA	base neutral/acid extractable compounds
BTEX	benzene, toluene, ethyl benzene, and xylene
COPEC	constituents of potential ecological concern
CT	central tendency
D&M	Dames & Moore
DERP	Defense Environmental Restoration Program
DNB	dinitrobenzene
DNT	dinitrotoluene
DOD	Department of Defense
DQO	data quality objectives
EA	EA Engineering, Science, and Technology, Inc.
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund
FUDS	former used defense sites
GRC	John Glenn Research Center
GSA	General Services Administration
GWI	groundwater investigation
HI	hazard index
HQ	hazard quotient
IT	IT Corporation
LOAEL	lowest observed adverse effect level
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MK	Morrison-Knudson Corporation
msl	mean sea level
NASA	National Aeronautics and Space Administration
NOAEL	no observed adverse effect level
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon

List of Acronyms (Continued)

PBOW	Plum Brook Ordnance Works
PBS	Plum Brook Station
PCB	polychlorinated biphenyls
ppb	parts per billion
ppm	parts per million
PRRWP	Pentolite Road Red Water Pond
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RME	reasonable maximum exposure
RTV	reference toxicity value
RWP	Red Water Ponds
SAP	sampling and analysis plan
SAIC	Science Applications International Corporation
SLERA	screening-level ecological risk assessment
SMDP	scientific management decision point
SOW	statement of work
SRT	Standard Reference Toxicant
STL	Severn Trent Laboratory
SVOC	semivolatile organic compounds
TNB	1,3,5-triniotrobenzene
TNT	trinitrotoluene
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compounds
WARWP	West Area Red Water Pond

Executive Summary

This report presents an assessment of potential ecological hazards related to Department of Defense (DOD) activities at the former Plum Brook Ordnance Works (PBOW) located near Sandusky, Ohio. The objective of this Baseline Ecological Risk Assessment (BERA) is to produce a supplement to the Phase I Screening-Level Ecological Risk Assessment (SLERA), prepared by IT Corporation (IT) in 2000, to provide additional site-specific information to risk managers to allow them to decide if revised estimated ecological hazards to potentially exposed receptors are acceptable.

The PBOW was operated from 1941 to 1945 as a manufacturing plant for trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Some of the areas used by the DOD were decontaminated in the 1950s and 1960s in accordance with DOD standards at that time; other areas have been decommissioned, but not decontaminated. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station (PBS) of the John Glenn Research Center at Lewis Field (GRC). The NASA GRC is located in Cleveland, Ohio.

Two sites within the Red Water Ponds (RWP) areas of PBOW are the focus of this BERA: the West Area Red Water Pond (WARWP) and the Pentolite Road Red Water Pond (PRRWP).

Following the Ohio Environmental Protection Agency (OEPA) approved work plan, prepared by IT in 2000, sampling activities for soil, surface water, sediment, and fish and aquatic organism tissue occurred in September 2000. Samples were analyzed for critical chemical analytical parameters (identified in the SLERA), as well as used to perform bioaccumulation studies and toxicity studies. Chemical and biological toxicity results were used to prepare the BERA. Major components of the BERA are (1) refined food chain models for terrestrial and aquatic receptors that use site-specific biological concentration factors (BCF) and other site-specific factors; and (2) a detailed evaluation and discussion of aquatic and terrestrial toxicity test results.

Two different approaches are used for the refined food chain model in order to provide risk managers with a risk range to aid in decision making. The two approaches include a reasonable maximum exposure (RME) scenario and a central tendency (CT) exposure scenario. The RME scenario estimates the upper-end of the risk range by using 95 percent upper confidence limit (UCL) exposure point concentrations, site-specific BCFs calculated in a conservative fashion to overestimate uptake, no observed adverse effect level (NOAEL) toxicity values, and

conservative intraclass toxicity extrapolation factors. The CT exposure scenario estimates a more realistic (less conservative) risk value by using arithmetic mean exposure point concentrations, site-specific BCFs calculated using a more realistic (less conservative) approach, lowest observed adverse effect level (LOAEL) toxicity values, and an intraclass toxicity extrapolation factor of one.

Results of the refined food chain models suggest that ecological hazards for the receptors estimated using the more realistic CT approach are all considerably less than 1, U.S. Environmental Protection Agency (EPA) hazard threshold of concern. Hazard indices were found to range from 0.002 up to 0.4 for both the great blue heron and raccoon. Hazards estimated using the more conservative RME food chain model approach are above 1 for several receptors, with the highest hazard indices (26 for the great blue heron and 21 for the raccoon) due primarily to elevated concentrations of iron in WARWP sediment. Due to the highly conservative approach used in the RME food chain model, it is very unlikely that these elevated hazards would be expected to result in actual adverse effects in the real world.

Results of the site-specific toxicity testing demonstrated some biologically significant toxicity in a few of the surface water, sediment, and soil samples, summarized as follows:

- 10 percent of the surface water samples showed significant minnow toxicity
- 10 percent of the surface water samples showed significant water flea toxicity
- None of the sediment samples showed significant amphipod crustacean toxicity
- 17 percent of the soil samples showed significant earthworm toxicity.

Potential causes of the measured surface water toxicity, based on the available data evaluating using correlation statistics and graphical evaluations, could not be reliably determined. For sediment, elevated arsenic levels, and perhaps iron, were implicated as a potential cause of reduced survival, using correlation results and a graphical evaluation, however, the reduced survival measured was not biologically significant. The potential cause of the measured soil toxicity was convincingly shown to be related to soil polycyclic aromatic hydrocarbon (PAH) concentrations.

It is important to note that the toxicity measured in the site media samples is generally relatively minor, compared with the laboratory controls. Survival or reproduction was reduced by not more than 25 to 30 percent, compared with the laboratory controls. It should also be noted that OEPA uses a significant difference of 20 percent as a level of importance.

It is possible that these relatively minor reductions in survival and reproduction may have insignificant adverse effects at the population or community levels of biological organization.

A weight of evidence summary was based on the two lines of evidence presented in this BERA – namely the refined food chain model and the site surface water, sediment, and soil toxicity studies. It is important to note that the results of the refined food chain model, using the more realistic CT approach, demonstrated no adverse effects. The weight of evidence summary findings are:

- Elevated PAH concentrations in WARWP soils are an ecological concern due to: (1) measured earthworm toxicity; and (2) predicted RME food-chain impacts to the shrew via biological uptake by prey items such as earthworms.

- Elevated iron concentrations in WARWP sediments are also an ecological concern due to the observation that: (1) concentrations were determined to be potentially deleterious to herons and raccoons using the RME food chain model; and (2) the iron concentration used in the RME food chain model is similar to an iron sediment concentration that is associated with reduced survival of sediment amphipods. It should be noted that the amphipod reduced survival that was measured may be due to other sediment factors, as overall iron concentrations were not significantly correlated with sediment toxicity.

- Environmental media at PRRWP do not appear to pose significant unacceptable risks to ecological receptors.

It is important to note that the extent of elevated PAH concentrations in WARWP soil, and the extent of elevated iron concentrations in WARWP sediments appear to be very localized. In addition, the PAH hot spot location is situated in a grassy area commonly used for vehicular access to the WARWP area, and by site visitors and drillers, and is not known to be a historical industrial process location.

In light of current site activities (burning for habitat management), CT hazard index outcomes, biological toxicity text results, and uncertainty analysis discussions, remedial activity based on the results of the BERA is not recommended at this time.

1.0 Introduction

The U.S. Army is conducting studies of the environmental impact of suspected hazardous waste sites at properties previously owned by the U.S. Department of Defense (DOD). The U.S. Army Corps of Engineers (USACE) is pursuing this work under the Defense Environmental Restoration Program (DERP) for formerly used defense sites (FUDS). The former Plum Brook Ordnance Works (PBOW) located in the city of Sandusky, Erie County, Ohio is a DERP FUDS project and is being managed and technically overseen by the Nashville and Huntington Districts of USACE. Figure 1-1 shows the geographic location of the former PBOW site. IT Corporation (IT) performed a baseline ecological risk assessment (BERA) of soil, surface water and sediment at two Red Water Pond (RWP) Areas (the West Area Red Water Ponds [WARWP] and the Pentolite Road Red Water Ponds [PRWWP]). This work was performed under Delivery Order 002 of Contract Number DACA62-00-D-002.

It should be noted that intermediate numerical values presented in some tables or text of this report may temporarily overstate the accuracy of the values, as three or more significant figures may be presented. However, final BERA hazard estimates are generally limited to only one or two significant figures, in order to present final numerical results with the appropriate number of significant figures.

1.1 Scope of Work and Project Objectives

As specified in the scope of work (SOW) (USACE, 2000), the BERA activities included preparation of site-specific work plans, soil, surface water, sediment sampling and biological sampling, evaluation of analytical results from samples collected during the field investigation, preparation and submittal of the BERA report characterizing activities, conclusions, and recommendations for further actions. Figure 1-2 identifies both areas investigated in relation to other site features.

The two RWP areas of PBOW are the focus of this BERA: the WARWP and the PRRWP. It should be noted that although the 8-step process presented in the Ecological Risk Assessment Guidance for Superfund (ERAGS) (U.S. Environmental Protection Agency [EPA, 1997]) is generally followed in this BERA, ERAGS was not the primary guidance document used for the preparation of the screening-level ecological risk assessment (SLERA); therefore, there are some differences between ERAGS and the SLERA. The SLERA was based primarily on the Tri-Service Procedural Guidelines for Ecological Risk Assessments (Wentsel, et al., 1996).

1.2 Site History and Potential for Contamination

The 9,009-acre PBOW site was built in early 1941 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives began on December 16, 1941 and continued until 1945. It is estimated that more than 1 billion pounds of explosives were manufactured during the 4-year operating period.

After plant operations ceased in 1945, decontamination of TNT, acid, pentolite, and DNT processing lines began; decontamination of the lines was completed during the last quarter of 1945. The property was initially transferred to the Ordnance Department, then to the War Assets Administration after it was certified decontaminated by the U.S. Army. In 1949, PBOW was transferred to the General Services Administration (GSA).

The National Aeronautics and Space Administration (NASA) acquired PBOW on March 15, 1963 and is presently utilizing the site. On April 18, 1978, NASA declared approximately 2,152 acres of land as excess. The Perkins Township Board of Education acquired 46 acres of the excess and uses this area as a bus transportation center. GSA retains the remaining acreage and currently has a use agreement with the Ohio National Guard for 604 acres of the land. NASA presently controls approximately 6,400 acres and is using the site to conduct space research as a satellite operation of NASA's John Glenn Research Center (GRC) at Lewis Field. The NASA GRC is located in Cleveland, Ohio. The details of these land transactions are listed in the site management plan and can be found at the NASA Plum Brook Station (PBS).

Potential contaminants in the groundwater at PBOW, based on review of historical use of the site and findings of previous investigations, may include nitroaromatic compounds (explosive residuals), volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides/polychlorinated biphenyls (PCB), cyanide, and dissolved metals.

1.3 Summary of Previous Environmental Studies

The following sections summarize results from previous investigations at the two RWP Areas. Identified sample locations may be referenced on figures in Chapter 2.0 of the *Risk Assessment and Direct-Push Investigation of the Red Water Ponds* (IT, 2000a).

1.3.1 West Area Red Water Ponds

In 1984, Battelle Laboratories collected a surface soil sample from the spoils area at the WARWP area. Concentrations of nitroaromatics were detected in the low-parts per million

(ppm) range using a now obsolete analytical method (International Consultants Incorporated [ICI], 1995).

Prior to 1985, a number of studies were conducted on the surface water and sediment from the RWP Areas. In the western pond at the WARWP area, 34 bottom sediment samples were collected in a grid pattern by Ohio National Guard environmental health personnel and screened for TNT and DNT derivatives. The highest values of TNT and DNT found in the sediment were less than 1 ppm. In 1989, IT conducted an investigation to confirm or deny the presence of residual chemical contamination from PBOW operations. Six surface soil samples were collected from 0 to 2 feet below ground surface (bgs) from borings IT-MW02, IT-SB07, IT-SB09, IT-SB10, IT-SB11, and IT-SB12 located at the WARWP area. No VOCs or SVOCs were detected. Four nitroaromatic compounds (1,3-dinitrobenzene [DNB], 1,3,5-trinitrobenzene [TNB], 2,4-DNT, and 2,4,6-TNT) were detected, with the highest concentrations (greater than 600 micrograms per kilogram [µg/kg]) detected at IT-SB12. Manganese was also detected at a concentration exceeding that of the background sample. Monitoring well IT-MW02 was installed downgradient from the WARWP area. A groundwater sample was collected for analysis of VOCs, SVOCs, nitroaromatic compounds, nitrates, sulfates, pH, and metals. Analytical results indicated concentrations of some VOCs and SVOCs were detected in the low (less than 20 micrograms per liter [µg/L]) parts per billion (ppb) range. Nitroaromatics (up to 160 µg/L), chromium (0.12 µg/L), manganese (3.0 µg/L), and sulfate (950 µg/L) were also detected.

In 1991, Science Applications International Corporation (SAIC) conducted a preliminary assessment to evaluate past waste management and hazardous material handling processes. Based on this assessment, SAIC determined that hazardous substances had been released to the environment at the WARWP area.

In 1993, a site inspection was conducted by Morrison-Knudsen Ferguson Corporation (MK) to assess the threat posed by the site on human health and the environment, and to determine the need for additional investigations. MK analyzed sediment and surface water from Pipe Creek near the WARWP area for VOCs, SVOCs, and nitroaromatics. The surface water had no detectable contaminants, but the sediment had a few VOCs and SVOCs in the low-ppb range. No nitroaromatics were detected (ICI, 1995). Four monitoring wells (MK-MW09, MK-MW10, MK-MW11, and MK-MW12) were installed in the vicinity of the WARWP area (MK, 1994). Groundwater was collected from the four new wells and IT-MW02 for analyses of VOCs, SVOCs, nitroaromatic compounds, nitrates, sulfates, and metals. VOCs, SVOCs, and nitroaromatics were not detected in any groundwater samples (ICI, 1995).

In 1994, Dames & Moore, Inc. (D&M) conducted an investigation to evaluate groundwater occurrence and flow conditions in the overburden and bedrock water-bearing zones; assess groundwater quality in the overburden water-bearing zone; and investigate the baseline groundwater quality of the bedrock water-bearing zone to evaluate the necessity of additional work at PBOW (D&M, 1997). Two bedrock wells (BED-MW14 and BED-MW19) and two overburden wells (WA-MW01 and WA-MW02) were installed in the vicinity of the WARWP area. Hydrogeologic data indicated that groundwater flow in the overburden exhibited a strong downward vertical component and the presence of groundwater was strongly seasonally dependent. The general groundwater flow in both water-bearing zones was determined to be to the north toward Lake Erie. Groundwater samples were analyzed for VOCs, base neutral/acid extractable compounds (BNA), nitroaromatics, and metals. Significant concentrations of nitroaromatics were determined to be present adjacent to the ponds in both the overburden and the bedrock aquifers. VOCs and BNAs were also present in the bedrock wells. Some metals (antimony, manganese, and nickel) were also detected at concentrations exceeding their maximum contaminant levels (D&M, 1997).

In 1996, IT conducted a groundwater investigation (GWI) focusing on the western portion of the facility; the investigation consisted of installing three overburden monitoring wells, redeveloping existing monitoring wells, and collecting groundwater samples for laboratory analysis. In addition, one monitoring well (IT-MW10) and one temporary piezometer (IT-MW07) were installed in the vicinity of the RWP Area. It was determined that the overburden material had been impacted by nitroaromatic compounds in the central portion of the WARWP area and that inorganic compounds were present at concentrations exceeding the risk-based screening concentrations throughout the area (IT, 1997). It was recommended that further evaluation of the metals in the groundwater be performed to determine whether they were derived from an on-site source of contamination or were related to background conditions. IT determined that the bedrock water-bearing zone had detectable concentrations of nitroaromatics and other organic compounds north of the WARWP area, but based on analyses, the water from the bedrock aquifer did not have detectable concentrations and would not cause any detrimental effects to exposed individuals for these constituents in the central portion of the area. Inorganic compounds were also present north of this area. It is concluded that further evaluation would be needed to determine the nature and extent of contamination in these areas, after background levels are established for metals in groundwater.

During a November 1997 groundwater sampling event, IT discovered that two of the overburden wells at the WARWP area (IT-MW02 and WA-MW02) and one bedrock well (PB-BED-MW14)

had red-colored water, suggesting the presence of nitroaromatics. The latest (May, 1998) analytical results for these wells indicate elevated concentrations of nitroaromatics. The analytical results of these samples were documented in a separate report (IT, 1999).

In June and November 1998, IT performed a direct-push investigation and risk assessment for soil, groundwater, surface water and sediment at the WARWP. Human health risk from potential chemical carcinogens at both the WARWP and the PRRWP are either at or below Ohio Environmental Protection Agency (OEPA) acceptable limits, for the residential, groundskeeper, and construction worker exposure scenarios. Similarly, human health risk from potential noncarcinogenic chemical hazards at both these sites are below the OEPA acceptable limit. The following recommendation was made as a result of the findings of the human health risk assessment:

- Following completion of bedrock water quality characterization at the two RWP Areas, human health risk from the bedrock groundwater should be evaluated at the two sites.

Recommendations of the ecological risk assessment (ERA) are summarized in Section 2.1 of the current document.

1.3.2 Pentolite Road Red Water Ponds

In 1989, IT conducted an evaluation to determine whether residual chemical contamination was present (IT, 1991). A shallow monitoring well (IT-MW05) was installed on the northern edge of the RWPs, in the suspected downgradient direction. Soil borings IT-SB13 through IT-SB18 were also drilled, and soil samples were collected. 2,4-DNT and 2,6-DNT were detected in the soil at concentrations of at least 0.740 ppm and sodium concentrations in samples from six of the borings exhibited concentrations significantly above the measured background levels (ICI, 1995).

A site inspection was conducted by MK from June through July 1993 to assess the threat posed to human health and the environment and to determine the need for any additional investigation. MK collected and analyzed surface and sediment samples from a drainage ditch along Pentolite Road north of the PRRWP area. Samples were analyzed for VOCs, SVOCs, and nitroaromatic compounds. No samples from the Pentolite Road ditch showed detectable levels of contaminants (MK, 1994).

From May to June of 1994, D&M conducted a GWI to evaluate groundwater conditions in several areas at PBOW. The SOW included an assessment of groundwater quality in the

overburden and bedrock water-bearing zones at the PRRWP area. Overburden monitoring wells PR-MW7, PR-MW8, and PR-MW9 and bedrock monitoring wells BED-15 and BED-16 were installed. The investigation found that the groundwater flow in the overburden exhibited a strong downward vertical component, and the presence of groundwater in the overburden was seasonally dependent. Groundwater sample results indicated that nitroaromatics were present in the overburden water-bearing zone, while lower levels of nitroaromatics were present in the bedrock water-bearing zone (D&M, 1997).

From the sitewide GWI performed by IT in September through October of 1996, it was determined that the overburden water-bearing zone in the PRRWP area had detectable concentrations of nitroaromatic compounds. The bedrock water-bearing zone was also determined to have detectable concentrations of benzene, toluene, ethyl benzene, and total xylenes (BTEX), SVOCs, and nitroaromatic compounds (IT, 1997).

During the November 1997 groundwater sampling event, IT discovered that three of the overburden wells at the PRRWP area (PR-MW07, PR-MW08, and PR-MW09) had red-colored water, suggesting the presence of nitroaromatics. The analytical results from the latest samples (May, 1998) exhibited elevated concentrations of nitroaromatic compounds. The analytical results of these samples are reported in a separate report (IT, 1999) addressing the GWI.

In June and November 1998, IT performed a direct push investigation and risk assessment for soil, groundwater, surface water and sediment at the WARWP. Human health risk from potential chemical carcinogens at both the WARWP and the PRRWP are either at or below OEPA acceptable limits, for the residential, groundskeeper, and construction worker exposure scenarios. Similarly, human health risk from potential noncarcinogenic chemical hazards at both these sites are below the OEPA acceptable limit. The following recommendation was made as a result of the findings of the human health risk assessment:

- Following completion of bedrock water quality characterization at the two RWP Areas, human health risk from the bedrock groundwater should be evaluated at the two sites.

Recommendations of the ERA are summarized in Section 2.1 of the current document.

1.4 Summary of Existing Site Conditions

The former PBOW site is currently owned by the NASA and is operated as the PBS of the NASA GRC in Cleveland, Ohio. Most of the aerospace testing facilities built in the 1960s at the site are on standby or inactive status. The site is located approximately 4 miles south of

Sandusky, Ohio and is specifically located in the Perkins, Oxford, Huron, and Milan Townships. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the west by County Road 43, and on the east by U.S. Highway 250. The areas surrounding PBOW is mostly agricultural and residential.

The topography of PBOW site is characterized by a fairly flat ground surface that slopes gradually northward toward Lake Erie at an average gradient of less than 2 percent. Elevations at the site range from 675 feet above mean sea level (msl) along the southeast edge of the site to about 625 feet msl in the northern portion of the installation at Bogart Road. Eleven streams exist within the site and flow toward Lake Erie. Plum Brook, Ransom Brook, and Pipe Creek are the three major streams and are being monitored by NASA PBS. Both Plum Brook and Ransom Brook, as well as some of the other streams within the site are ephemeral, intermittent, or seasonal. The climate in north central Ohio is a typical continental climate showing significant influence by Lake Erie. Mean annual precipitation is 33.90 inches. The average monthly precipitation is approximately 1.65 inches for February and 3.70 inches for the month of July.

Devonian and Silurian carbonate and clastic rocks, generally dipping to the southeast, characterize bedrock geology at PBOW. The thickness of glacial till or lacustrine deposits range from approximately 5 feet or less for most of the site to approximately 20 feet in the northern border of the site. In many locations, bedrock is exposed on the ground surface. According to the PBOW preliminary assessment (SAIC, 1991) some karst features are present in the carbonate rocks forming the water-bearing formation underneath the soil cover.

2.0 SLERA and Problem Formulation

This chapter presents the results of the SLERA and a problem formulation.

2.1 SLERA Results

In the SLERA (IT, 2000a), ecological hazards were estimated using both historical and 1999 analytical data collected from both RWP areas at the PBOW. Results of the SLERA are briefly discussed in the following paragraphs.

A variety of habitats exist at the RWP, summarized in Section 6.2.1 of the SLERA (IT, 2000a). Habitat pictures, presented in Figures 6-1 through 6-8 of the SLERA, represent typical site conditions in mid-June 1998).

Potential impacts to terrestrial plants were evaluated by comparing source term concentrations of constituents of potential ecological concern (COPEC) calculated for soil at the RWP areas with available benchmark concentrations. None of the available benchmark concentration values were exceeded by source term concentrations at either area. It should be noted that a previous review comment on the SLERA requested additional information on this topic, as some bare soil areas were noted during the site reconnaissance performed in June 1998. The small bare soil area photographed at the WARWP was located near historic sample location DP-23, which was one of the samples used to assess soil geotechnical conditions at the site. This location is adjacent to historic sample location DP-13 and the current BERA soil Sample No. AD0001. As will be discussed later in this report, concentrations of polycyclic aromatic hydrocarbon (PAH) were elevated in Sample No. AD0001. Additional bare soil areas were noted at the PRRWP site during the 1998 reconnaissance, and photographs are presented in the SLERA (IT, 2000a). Based on a review of organic chemical concentrations detected in surface soils (Figure 4-4 of IT, 2000a), a few organic were found to have elevated concentrations (e.g., 4-amino-2,6-dinitrotoluene was found up to 2.7 milligrams per kilogram (mg/kg) at sample location DP-11). Based on this information, bare soils at PRRWP cannot be attributed to COPEC concentrations. As noted in the SLERA, a possible explanation of the bare areas includes heavy deer activity, because many of the bare soil areas were completely covered with deer tracks.

Potential impacts to aquatic biota were evaluated by comparing surface water and sediment COPEC concentrations at the RWP areas with available benchmarks for the protection of aquatic life. Concentrations of aluminum, iron, lead, manganese, and vanadium measured in surface water at the WARWP exceeded acceptable benchmarks to protect aquatic biota. The COPEC

concentration data for sediments at the WARWP exceeded toxicity benchmarks for arsenic, copper, and iron designed to protect aquatic biota. Surface water COPEC concentrations of aluminum, iron, and manganese at the PRRWP also exceeded some of the benchmark concentrations.

Potential risks to terrestrial and aquatic wildlife at the RWPs were evaluated by calculating hazard quotients (HQ) for all COPECs and exposure pathways for each receptor of concern. The HQs were then summed to obtain a hazard index (HI). The summed HQ calculated for each receptor was compared with DOD guidelines (Wentsel, et al., 1996). According to these guidelines, the higher the HQ the greater the potential risk posed by site related contaminants. If the HQ was less than 1, then there is no probable risk. If the HQ was between 1 and 10 then there is a very low potential for ecological effects. If the HQ was between 10 and 100, then significant potential for ecological effects exists. If the HQ was above 100, then very significant potential for ecological effects is present due to site contamination. It should be noted that the OEPA believes any HQs greater than 1 are a potential concern.

For the WARWP, summed HQs for terrestrial receptors (rounded to two significant figures) were 28 for the deer mouse; 9.1 for the cottontail rabbit; 96 for the shrew; 450 for the marsh wren; 38 for the raccoon; 8.3 for the white-tailed deer; and 0.0062 for the red-tailed hawk. Summed HQs for aquatic receptors were 720 for the great blue heron and 670 for the raccoon. Since the raccoon is exposed to both terrestrial and aquatic media, summed HQs were presented for both environments.

For the PRRWP, summed HQs for terrestrial receptors (rounded to two significant figures) were 4.1 for the deer mouse; 2.7 for the cottontail rabbit; 15 for the shrew; 410 for the marsh wren; 6.1 for the raccoon; 1.8 for the white- tailed deer; and 0.0018 for the red-tailed hawk. Summed HQs for aquatic receptors were 130 for the great blue heron and 38 for the raccoon. Again, since the raccoon is exposed to both terrestrial and aquatic media, summed HQs were presented for both environments.

Hazard drivers (i.e., those chemical constituents contributing the most to the elevated total HIs) were as follows, by medium:

- Soil: nitroaromatics (DNT compounds), PAH, and antimony
- Surface Water: aluminum, magnesium, lead, and iron

- Sediment: nitroaromatics (DNT compounds), PAH carbazole, and the inorganics aluminum, iron, magnesium, phosphorus, potassium, and calcium.

Based on results of the SLERA, a decision was reached on ERAGS scientific management decision point (SMDP) No. 1 to prepare a supplement to the SLERA, in the form of a BERA, to address in further detail the potential ecological hazards associated with the RWPs. The following recommendations were made, based on (1) the findings of the SLERA (IT, 2000a) and (2) discussions with USACE:

- Establish additional background concentrations for metals in surface water, sediment, and surface soil

- Conduct terrestrial earthworm and aquatic worm bioaccumulation studies to estimate uptake and bioavailability of chemical constituents from surface soil and sediment, respectively

- Conduct fish uptake studies to estimate bioaccumulation and bioavailability of metals from surface water

- Conduct a literature search to obtain a more accurate avian toxicity benchmark (i.e., no observable adverse effects level (NOAEL) for the nitroaromatic 4-amino-2,6-DNT and other hazard drivers).

2.2 Problem Formulation

Based on the available data, IT prepared a problem formulation for the RWP sites. The problem formulation, presented as follows, is Step 3 of the eight-step ERAGS process (EPA, 1997), and includes assessment endpoints, conceptual site model information, exposure pathways, and risk questions and hypotheses.

As determined in the SLERA (IT, 2000a), the potential exists for adverse ecological effects to ecological entities at the site due to the presence of viable habitat, ecological receptors, exposure pathways, and chemical stressors. HIs significantly above 1 (e.g., up to 720) were estimated for representative ecological receptors using the HQ method in the SLERA (IT, 2000a) (equivalent to Steps 1 and 2 of the ERAGS eight-step process). In addition, potential surface water and sediment hazards to aquatic biota as a result of RWP media COPEC concentrations were identified, as a result of comparisons of site data with surface water and sediment criteria for the protection of aquatic life.

2.2.1 Assessment Endpoints

The protection of ecological resources, such as habitats and species of plants and animals is a principal motivation for conducting ERAs. Key aspects of ecological protection are presented as policy goals. These are general goals established by legislation or agency policy that are based on societal concern for the protection of certain environmental resources. To determine whether these protection goals are met at the site, assessment and measurement endpoints have been formulated to define the specific ecological values to be protected and to define the degree to which each may be protected.

Given the diversity of the biological world and the multiple values placed on it by society, there is no universally applicable list of assessment endpoints. Suggested criteria that may be considered in selecting assessment endpoints suitable for a specific ecological risk assessment are: (1) ecological relevance, (2) susceptibility to the contaminant(s), (3) accessibility to prediction and/or measurement, and (4) definable in clear, operational terms (Suter, 1993). Selected assessment endpoints should reflect environmental values that are protected by law, are critical resources, or have relevance to ecological functions that may be impaired. Both the entity and attribute should be identified for each selected assessment endpoint.

Assessment endpoints are inferred from effects to one or more measurement endpoints. Measurement endpoints (discussed in Chapter 3.0 as part of the BERA Study Design) are a measurable response to a stressor that is related to the valued attribute of the chosen assessment endpoint. It serves as a surrogate attribute of the ecological entity of interest (or of a closely related ecological entity) that can be used to draw a predictive conclusion about the potential for effects to the assessment endpoint. Information collected during previous site reconnaissance activities (IT, 2000a) was used to assist in the selection of assessment (and measurement) endpoints. Assessment endpoints for the BERA, formal expressions of the environmental values to be protected (Suter, 1993), are presented below.

- Protection of long-term survival and reproductive capabilities for omnivorous mammal populations
- Protection of long-term survival and reproductive capabilities for small insectivorous mammal populations
- Protection of long-term survival and reproductive capabilities for insectivorous bird populations
- Protection of long-term survival and reproductive capabilities for benthic invertebrate populations

- Protection of long-term survival and reproductive capabilities for aquatic vertebrate (fin fish) populations

- Protection of long-term survival and reproductive capabilities for semi-aquatic omnivorous mammal populations

- Protection of long-term survival and reproductive capabilities for piscivorous bird populations.

2.2.2 Conceptual Model and Exposure Pathways

An important component of the problem formulation includes an exposure pathways analysis. Exposure pathways consist of four primary components: source and mechanism of contaminant release, transport medium, potential receptors, and exposure route. A chemical may also be transferred between several intermediate media before reaching a potential receptor. All of these components are important for the RWPs. The exposure pathways considered for the representative terrestrial and aquatic receptors at the RWP sites are presented in conceptual site model diagrams (Figures 2-1 and 2-2).

Exposure to different categories of environmental media is addressed in this pathways analysis, as discussed in the following subsections. It should be noted that some of the components of these pathways (e.g., soil COPEC plant toxicity) were adequately addressed in the SLERA and do not need to be reevaluated .

Soil Exposure Pathway. Soil exposure pathways are potentially important for terrestrial plants and animals at the sites. For non-burrowing animal exposure, soil samples obtained from a depth of 0 to 1 foot are generally considered, as this would be the point of exposure. Note: The agency-approved work plan for the SLERA defined surface soil as 0 to 1 foot, however, due to depth compositing of 0 to 2 feet and 0 to 3 feet in the historic dataset, all soils from the 0 to 3 foot depth interval are considered as surface soil. For burrowing animals such as the shrew, soil samples obtained from a depth of 0 to 6 feet are considered. For uncertainties associated with the 0 to 6 foot depth interval, see the Uncertainty Analysis (Section 6.6).

For deep-rooted plant exposure, soil samples taken from 0 to 6 feet are considered because some feeder roots are located within this depth. In the SLERA the white-tailed deer was assumed to ingest leaves of trees translocating COPECs from subsoils.

Sediment Exposure Pathway. Sediment generally consists of soil or other material settled out of suspension in surface water or native soils underlying flowing or standing water bodies.

Potential contaminant sources for sediment include buried or stored waste, and contaminated surface water, groundwater, and soil. The release mechanisms include surface water runoff, groundwater discharge, and airborne deposition. Potential receptors of chemicals in contaminated sediment include aquatic flora and fauna. Direct exposure routes for impacted sediment include contact by benthic-dwelling organisms such as catfish, uptake by aquatic flora, and ingestion by aquatic fauna. Indirect exposure pathways from sediment include consumption of bioaccumulated contaminants by consumers in the food chain.

Surface Water Exposure Pathway. Surface water represents a potential transport medium for COPECs. Potential sources for contaminated surface water include: buried or stored waste, stored or spilled fuel, contaminated soil and groundwater, and deposition of airborne contaminants. The release mechanisms include surface runoff, leaching, and groundwater seepage. Potential receptors of contaminated surface water include terrestrial and aquatic fauna and aquatic flora. Exposure routes for contaminated surface water include ingestion by terrestrial fauna, and uptake and absorption by aquatic flora and fauna. Consumption of bioaccumulated constituents constitutes a potential indirect exposure pathway for faunal receptors. Chemical bioavailability of some metals and other chemicals is controlled by water hardness, pH, and total suspended solids.

2.2.3 Risk Questions and Hypotheses

This problem formulation has demonstrated that the estimated ecological hazards at PBOW RWPs are unacceptable based on the conservative assumptions used in the SLERA, and further ecological assessment is required to obtain more site-specific and chemical-specific data to refine the estimated ecological hazards. This further assessment has been accomplished using the study design presented in Chapter 3.0 to address the issues raised in the problem formulation stated herein.

Risk questions and hypotheses for the BERA are stated as null hypotheses as follows:

- The potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential chemical stressors, due to low COPEC frequency of detection and/or no significant difference between COPEC concentrations in site media and background samples.

- The potential for significant biological uptake of COPECs from surface soil, sediment, or surface water is minimal or nonexistent due to limited bioavailability as demonstrated by site-specific laboratory bioaccumulation tests.

- The potential for significant toxicity of COPECs in surface water, soil, and/or sediment is minimal or nonexistent as demonstrated by laboratory chronic toxicity tests.

- The potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent as demonstrated by a refined food chain model executed using site-specific bioaccumulation factors, more realistic exposure assumptions, and/or more realistic toxicity reference values.

If one or more of these null hypotheses is accepted based on the results of the BERA, and a weight-of-evidence evaluation has determined that significant ecological risks may not be occurring at the RWP sites, a recommendation of no further action may be warranted.

3.0 BERA Study Design and DQO Process

The BERA study design and data quality objectives (DQO) process is cited in this chapter, including a summary of the selected measurement endpoints. The measurement endpoint is a measurable response to a stressor that is related to the valued attribute of the chosen assessment endpoint. Measurement endpoints (along with the selected assessment endpoints) are presented in Table 3-1.

The *Work Plan, Phase 2 Ecological Risk Assessment, Red Water Ponds* was prepared by IT (2000b), and was subsequently approved by OEPA. The work plan discussed the details of the BERA study design and DQO process. The work plan was of sufficient quality for stakeholders to agree on ERAGS SMDP Nos. 2 and 3, that are composed of (1) the conceptual site model, assessment endpoints, exposure pathways, and risk hypotheses; and (2) measurement endpoints, study design, and data interpretation and analysis.

The sampling and analysis plan of the study design, presented in the approved work plan (IT, 2000b), included the following components:

- Data needs
- Analytical procedures
- Sampling techniques
- Quality assurance/quality control
- Land surveying
- Decontamination procedures
- Sample preservation, packing, and shipping
- Investigation-derived waste management plan.

The DQO process, which was implemented during the preparation of the work plan (IT, 2000b) evaluated data requirements needed to support the decision-making process and selected the best action to satisfy these requirements. Incorporated components of the DQO, described in the EPA publication 9355.9-01 *Data Quality Objectives Process for Superfund* (EPA, 1993), are discussed in detail in Section 3.3 of the sampling and analysis plan (SAP) (IT, 1996a). Determining factors for procedures necessary to satisfy investigative objectives and to establish the basis of future actions at PBOW are presented in Figure 3-2 of the SAP (IT, 1996a).

Soil, surface water, fish and other aquatic tissue, and sediment samples were collected and analyzed to meet the objectives of the BERA. Quality assurance/quality control (QA/QC) samples were collected for all sample types, as appropriate. All samples were analyzed by EPA-

approved methods and complied with EPA-definitive data requirements. In addition to meeting the quality needs of the BERA, data analyzed at this level of quality were appropriate for all phases of the characterization and risk assessment. Laboratory requirements of precision, accuracy, and completeness for confirmation samples generated during the BERA are provided in Chapter 12.0 of the quality assurance project plan (QAPP) (IT, 1996b).

All samples collected by IT field personnel were documented through the use of sample collection logs and analysis request/chain-of-custody record forms (Figure 6-2 of the SAP [IT, 1996a]) following field custody procedures specified in Section 5.1 of the QAPP (IT, 1996b).

Soil, Surface Water and Sediment. Soil, surface water, and sediment samples were collected and analyzed to meet the objectives of the BERA. QA/QC samples were collected for all sample types, as appropriate. All samples were analyzed by EPA-approved methods and complied with EPA-definitive data requirements. Laboratory requirements of precision, accuracy, and completeness for confirmation samples generated during the investigation are provided in Chapter 12.0 of the QAPP (IT, 1996b).

Fish Tissue. Fish tissue (and aquatic tissue) samples were collected and analyzed to meet the objectives of the BERA. All samples were analyzed by EPA-approved methods and complied with EPA-definitive data requirements. Laboratory requirements of precision, accuracy, and completeness for confirmation samples generated during the investigation are provided in Chapter 12.0 of the QAPP (IT, 1996b).

Toxicity Testing. The mandatory inclusion of controls in the toxicity testing that was conducted provided the QA/QC for this component of the BERA. For the toxicity tests to be considered valid, test organism survival of at least 80 percent is required in the controls. Toxicity is defined based on comparisons to the control samples. Samples are considered toxic if a given test endpoint (survival or weight) is statistically different ($p<0.05$) from the control sample or from the reference site (if available), and at least 20 percent lower than mean test organism response in the control samples. This approach is consistent with statistical evaluation procedures recommended by EPA. Organisms to be used for testing were positively identified by a qualified expert and were of similar age and life stage. Only organisms that behave normally, appear healthy and feed normally in culture were used. The quality and general health of test organisms were verified through positive and negative control tests. Positive control tests, or Standard Reference Toxicant (SRT) tests, provide documentation that test organisms are responding to a SRT as expected and are not more or less tolerant. This is documented through control charts for the organism and SRT. Negative controls or laboratory control sediments

provide a measure of nonchemical related stress to which organisms may be subjected during the course of the testing. Unacceptable mortality in the control indicates that test organisms are being adversely affected by something other than the contaminants being tested. For tests to be considered valid, control organisms must achieve at least 80 percent survival.

4.0 Verification of Field Sampling Design

Field verification is Step 5 of the ERAGS eight-step process. IT provided an ecological risk professional to the project to verify that methods and sampling efforts as described in the work plan (IT, 2000b) were actually feasible at the RWP sites. The field verification visit was conducted June 29 and 30, 2000, and a field verification memorandum documenting the site visit, dated July 18, 2000, is provided in Appendix A. The site conditions and feasibility of the proposed approach that were documented in the memorandum were sent to CELRN, PBS, and OEPA on July 18, 2000. OEPA review comments on the work plan and memorandum were received August 1, 2000. The work plan was subsequently revised and resubmitted to OEPA on August 31, 2000. It should be noted that the potential laboratory spiking of COPECs, as discussed in the memorandum, was not performed due to the complexities of obtaining reliable data through this process.

The field verification memorandum (Appendix A) and the revised work plan (IT, 2000b) fulfilled SMDP No. 4 for Step 5 of the ERAGS eight-step process (EPA, 1997).

5.0 Site Investigation and Data Analysis

This chapter presents information on the collection and analysis of analytical data (Section 5.1) and discussion of the toxicity data (Section 5.2).

5.1 Collection and Discussion of Analytical Data

The section presents information on abiotic media (soil, surface water, and sediment; Section 5.1.1) and biotic media (fish tissue, earthworms, and aquatic worms; Section 5.1.2). Lists of all abiotic and biotic media samples used in the BERA, either collected at the sites, or obtained via laboratory bioaccumulation studies using site media, are presented in Tables 5-1 and 5-2, for WARWP and PRRWP, respectively. Two field duplicate samples were collected, Sample No. AD1011 as a duplicate of Sample No. AD1002, and Sample No. AC0006, as a duplicate of Sample No. AC0001. Also presented in Tables 5-1 and 5-2 are the analytical tests performed on the samples. Analytical methods utilized by the laboratory are summarized in Table 5-3. Chemical analysis of surface water, sediment, soil, and tissue samples was performed by Severn Trent Laboratory (STL), Sparks, Maryland and University Park, Illinois. Bioaccumulation studies and biological toxicity studies were performed by EA Engineering, Science, and Technology, Inc. (EA), Sparks, Maryland.

5.1.1 Abiotic Media

This section presents site investigation sampling activities for abiotic media (soil, surface water, and sediment) conducted by IT from September 12 through 16, 2000. Sample collection logs and survey data are presented in Appendix B. All samples were collected in accordance with the procedures discussed in the approved work plan (IT, 2000b) and in accordance with the procedures used during the previous IT RWP direct-push investigation (IT, 2000a). Throughout the following sections, “hot spot area” is defined as the historical sample location(s) where the concentrations of the COPECs contributing the most to the ecological hazard were the greatest. All chemical analytical data are presented in Appendix C-1, with a data validation summary presented in Appendix C-2. All analytical results were 100 percent reviewed by an independent party separate from the primary analytical laboratory used for the project. The criteria outlined in the *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis* (EPA, 1998) and *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1994) were used. Field sampling locations were surveyed by a licensed State of Ohio surveyor.

5.1.1.1 Soil Sampling for Earthworm COPEC Uptake Estimates

Discrete surface soil samples were collected from identified RWP area hot spots and sent to the selected bioassay laboratory and analytical laboratory. The bioassay lab held the samples until chemical analytical results were available from the analytical laboratory. Once given the go-ahead by IT, the bioassay lab introduced earthworms to the impacted soil. The earthworms were allowed to bioaccumulate COPECs as they burrowed over the 28-day study period, and at the end of the study these invertebrates were sacrificed and tissue COPEC concentrations were determined. These analytical results are utilized, in conjunction with paired surface soil COPEC data, to calculate site-specific invertebrate bioaccumulation factors for use in the BERA. Note: soil COPEC earthworm toxicity data were also obtained from the study.

PRRWP. The PRRWP COPECs in invertebrates were nitroaromatics (SLERA; IT, 2000a). IT collected five (5) surface soil samples for the uptake study (Sample Nos. AC0001 through AC0005). These samples were split, with sample volume sent to the bioassay laboratory and to the analytical laboratory for the analysis of nitroaromatic constituents by EPA Method 8330. Detected constituent concentrations are presented in Table 5-4. The sample locations (Figure 5-1) were all situated at the potential hot spot area, to maximize the potential for usable uptake study results. It should be noted that the nitroaromatics of concern (4-amino-2,6-DNT and, to a much lesser extent, 1,3-DNB) were very infrequently detected historically in surface soil. The nitroaromatic 4-amino-2,6-DNT was only detected in one out of 50 historical surface soil samples, and 1,3-DNB was only detected in six out of 50 historical surface soil samples. Based on analytical results, only Sample No. AC0001 had an uptake study performed (see Section 5.1.2.2 for further details).

WARWP. The WARWP COPECs in invertebrates were nitroaromatics and PAHs (SLERA; IT, 2000a). IT collected five (5) surface soil samples for the uptake study (Sample Nos. AD0001 through AD0005) (Table 5-1). These samples were split, with sample volume sent to the bioassay laboratory and to the analytical laboratory for the analysis of nitroaromatic by EPA Method 8330 and PAH constituents by Method 8310. Detected constituent concentrations are presented in Table 5-5. The sample locations (Figure 5-2) were all situated at the potential hot spot area, to maximize the potential for usable uptake study results. It should be noted that the COPECs (4-amino-2,6-DNT and PAHs) were very infrequently detected historical in surface soils. The nitroaromatic 4-amino-2,6-DNT was only detected historically in one out of 40 surface soil samples, and PAHs were only detected historically in one out of 10 surface soil samples.

5.1.1.2 Surface Water Sampling for COPEC Surface Water Toxicity

Discrete surface water grab samples were collected from the RWP areas for fish (*Pimephales promelas*) and cladoceran (*Ceriodaphnia dubia*) toxicity studies and sent to the selected bioassay laboratory where surface water toxicity bioassays were performed. The surface water toxicity results were utilized in the BERA, in conjunction with paired surface water COPEC concentration data, to determine whether or not surface water is potentially toxic to water-column-dwelling organisms at PRRWP and WARWP.

PRRWP. The PRRWP COPECs for surface water toxicity were aluminum, iron and manganese (SLERA; IT, 2000a). IT collected five (5) surface water samples for the toxicity study (Sample Nos. AC2006 through AC2010) (Table 5-2). These samples were split, with sample volume sent to the bioassay laboratory and to the analytical laboratory for the analysis of inorganics (EPA Methods 6010B and 365.3). Detected constituent concentrations are presented in Table 5-4. The sample locations (Figure 5-3) were situated at both potential hot spot and non-hot spot areas, so as to maximize the potential for usable toxicity study results (i.e., a concentration gradient was planned that would allow a better determination of potential surface water toxicity).

WARWP. The WARWP COPECs for surface water toxicity were aluminum, iron, lead, manganese, and vanadium (SLERA; IT, 2000a). IT collected five (5) surface water samples for the toxicity study (Sample Nos. AD2006 through AD2010) (Table 5-1). These samples were split, with sample volume sent to the bioassay laboratory, and to the analytical laboratory for the analysis of inorganics (EPA Methods 6010B and 365.3). Detected constituent concentrations are presented in Table 5-5. The sample locations (Figure 5-4) were situated at both potential hot spot and non-hot spot areas, so as to maximize the potential for usable toxicity study results (i.e., a concentration gradient was planned that would allow a better determination of potential surface water toxicity).

5.1.1.3 Sediment Sampling for COPEC Uptake Estimates

Discrete sediment samples were collected from identified RWP area hot spots for invertebrate uptake studies, and sent to the selected bioassay laboratory and the analytical laboratory. The bioassay laboratory held the samples until the chemical analytical results were available from the analytical laboratory, and then, when given the go-ahead by IT, introduced sediment invertebrates (using the invertebrate aquatic worm species *Lumbriculus variegatus*) to the impacted sediment. The invertebrates were allowed to bioaccumulate COPECs as they burrowed over the 28-day study period, and at the end of the study these invertebrates were sacrificed and tissue COPEC concentrations were determined. These analytical results are utilized, in

conjunction with paired sediment COPEC data, to calculate site-specific bioaccumulation factors for use in the BERA.

PRRWP. The PRRWP COPECs in aquatic invertebrates were the PAH carbazole and the inorganic potassium (SLERA; IT, 2000a). IT collected five (5) sediment samples for the uptake study (Sample Nos. AC1001 through AC1005). These samples were split, with sample volume sent to the bioassay laboratory and to the analytical laboratory for the analysis of SVOCs and inorganics (EPA Methods 8270C, 6010B, and 365.3). Detected constituent concentrations are presented in Table 5-4. The sample locations (Figure 5-5) were all situated at the potential hot spot area, to maximize the potential for usable uptake study results. It should be noted that the sediment COPECs were only historically detected in one out of two samples in previous studies (IT, 2000a).

WARWP. The WARWP COPECs in aquatic invertebrates were the nitroaromatic 2-amino-4,6-DNT and the inorganics aluminum, calcium, and phosphorus (SLERA; IT, 2000a). IT collected five (5) sediment samples for the uptake study (Sample Nos. AD1001 through AD1005). These samples were split, with sample volume sent to the bioassay laboratory and to the analytical laboratory for the analysis of nitroaromatics, inorganics, and total organic carbon (EPA Methods 8330, 6010B, 365.3, and 9060). Detected constituent concentrations are presented in Table 5-5. The sample locations (Figure 5-6) were all situated at the potential hot spot area, to maximize the potential for usable uptake study results. It should be noted that 2-amino-4,6-DNT was very infrequently detected in sediments in previous studies (IT, 2000a). The nitroaromatic 2-amino-4,6-DNT was only detected in one out of 13 historical sediment samples.

5.1.1.4 Sediment Sampling for COPEC Sediment Toxicity

Discrete sediment samples were collected from the WARWP for invertebrate toxicity studies (using the invertebrate species *Hyalella azteca*) and sent to the selected bioassay laboratory where sediment toxicity bioassays were performed. It should be noted that for the PRRWP area, sediment toxicity was not predicted (IT, 2000a); therefore, no sediment toxicity tests using sediment from PRRWP were performed. The WARWP sediment toxicity results were utilized in the BERA, in conjunction with paired sediment COPEC concentration data, to determine whether or not sediment is potentially toxic to sediment-dwelling organisms at WARWP.

WARWP. The WARWP COPECs for sediment invertebrate toxicity were arsenic, copper, and iron (SLERA; IT, 2000a). IT collected five (5) sediment samples for the toxicity study (Sample Nos. AD1006 through AD1010). These samples were split, with sample volume sent to the bioassay laboratory and to the analytical laboratory for the analysis of inorganics (EPA Methods

6010B and 365.3). Detected constituent concentrations are presented in Table 5-5. The sample locations (Figure 5-6) were situated at both potential hot spot and non-hot spot areas, so as to maximize the potential for usable toxicity study results (i.e., a concentration gradient was planned that would allow a better determination of potential sediment toxicity). The upstream reference sample location was selected to match the substrate type (e.g., sediment grain size) of the impacted downstream areas.

5.1.1.5 Background Sampling

To assess whether inorganic concentrations in surface water and sediment were related to background, six (6) additional background surface water and sediment samples were collected for the BERA to supplement the SLERA. Background surface water and sediment samples were collected at locations hydraulically upgradient from the RWP sites and analyzed for the 18 target metals as listed in Table 5-3. These included 3 surface water samples (Sample Nos. AE2001 through AE2003, Table 5-2), 3 sediment samples (Sample Nos. AE1001 through AE1003, Table 5-2) near PRRWP, and 3 surface water samples (Sample Nos. AE2004 through AE2006, Table 5-1) and 3 sediment samples (Sample Nos. AE1004 through AE1006, Table 5-1) near WARWP (Figures 5-3 through 5-6). For the surface water samples, total (unfiltered) metal samples were collected. Detected constituent concentrations are presented in Tables 5-4 and 5-5.

In addition, to assess whether inorganic and/or PAH concentrations in surface soil are related to background, anthropogenic or non-RWP activities, six (6) background surface soil samples were collected for the BERA to supplement the SLERA (3 samples near PRRWP [Sample Nos. AE0001 through AE0003, Table 5-2] and 3 samples near WARWP [Sample Nos. AE0004 through AE0006, Table 5-1]). It should be noted that only PAHs are considered to be anthropogenic related. Background soil sample locations (Figures 5-1 and 5-2) were finalized during the field verification step (Chapter 4.0; Appendix A), as site-specific factors had to be taken into account. Detected constituent concentrations are presented in Tables 5-4 and 5-5.

Statistical comparisons between constituent concentrations in background samples and site samples were performed using the nonparametric Mann-Whitney test (also called the Wilcoxin Rank Sum test). The Mann-Whitney test is the nonparametric version of the two groups paired t-test and tests the hypothesis that the distributions underlying the two groups are the same. The requirements for validity of the Mann-Whitney test are that the two groups of observations come from continuous distributions and are independent of each other, both within and between groups. Since the Mann-Whitney test does not look at the observations but instead considers their ranks, it is resistant to outliers in either of the groups being compared and does not require assumptions of normality. Table 5-6 presents a summary of the statistical tests comparing the

background and site data, by medium for each area, and determines whether or not a COPEC is background related. Background statistical test details are presented in Appendix D.

5.1.2 Biotic Media

This section presents information on the collection and analysis of biotic media obtained either from the RWPs (fish or aquatic organism tissue) or from abiotic media obtained from the RWPs (earthworm tissue harvested in the lab from site soils and aquatic worm tissue harvested in the lab from site sediments). Site samples were collected by IT from September 12 through 16, 2000.

5.1.2.1 Fish and Aquatic Organism Sampling for COPEC Uptake Estimates Based on Tissue

Available fish and aquatic organism samples were collected from the two RWP sites. Although the goal was to collect both water column feeders (such as sunfish) and bottom feeders (such as catfish), no fin fish bottom feeders were found after repeated electroshocking and seining events, thus no bottom feeder fish tissue samples were collected. Similar aquatic species were composited into individual samples, resulting in three samples from PRRWP and four samples from WARWP. Organism counts, length, and weight were recorded prior to compositing, and data are presented in Table 5-7. The aquatic tissue samples were whole organism (not fillets), to best represent the diet of piscivorous (fish-eating) predators such as the great blue heron. The goal of each aquatic organism composite sample was to represent a similar aquatic organism size and age group. The samples were frozen and sent on ice to the analytical laboratory for metals analysis, as inorganic COPECs were the hazard drivers estimated in fish (IT, 2000a). Concurrent unfiltered water column samples were collected and sent to the analytical laboratory, in order to obtained paired aquatic organism/surface water data from which to estimate uptake factors (i.e., surface water to fish tissue bioaccumulation factors) for subsequent use in the BERA.

PRRWP. A shallow stream located at the bottom of a deep ravine runs adjacent to the PRRWP and is filled with emergent vegetation. Another stream flows along Pentolite Road north of the site, and may receive drainage from the site via an old discharge pipe (IT, 2000a). Metals of concern in potential fish at PRRWP were iron and aluminum (SLERA; IT, 2000a). Aquatic sample collection was successful, as fish (Sample No. AC4001), tadpoles (Sample No. AC4002) and crayfish (Sample No. AC4003) were collected from the surface water along Pentolite Road using aquatic dipnets and electroshocking, and seines (Table 5-2). The aquatic biota sample locations are shown in Figure 5-7. Detected constituent concentrations are presented in Table 5-8.

WARWP. A large open water pond and a smaller pond covered with emergent aquatic vegetation are located at the WARWP. Metals of concern in fish at WARWP were iron, lead, aluminum, and magnesium (SLERA; IT, 2000a). Four composite fish samples (two fathead minnow and two green sunfish) were collected from the large open water pond (Sample Nos. AD4001 through AD4004, Table 5-1). Fish sample locations are shown in Figure 5-8. Fish collection techniques involved boat-mounted electroshocking and retrieval of stunned fish using an aquatic dipnet. Detected constituent concentrations are presented in Table 5-9.

5.1.2.2 Soil Sampling for Earthworm COPEC Uptake Estimates

Discrete surface soil samples were collected from the RWP areas on September 15, 2000 and sent to EA for bioaccumulation testing using the invertebrate species *Eisenia foetida*. All soils used for bioaccumulation testing were used within 60 days of sample collection. EA introduced earthworms to the impacted soil samples for the 28-day study. The earthworms were allowed to bioaccumulate COPECs as they burrowed in the soil over the duration of the study, and at the end of the study these invertebrates were sacrificed and tissue COPEC concentrations were determined by STL. The chronic bioaccumulation tests with *E. foetida* were performed on five WARWP surface soils (Sample Nos. AD0001 through AD0005), and one PRRWP soil sample (Sample No. AC0001) to obtain five WARWP tissue samples (Sample Nos. AD4011 through AD4015, Table 5-1) and one PRRWP tissue sample (Sample No. AC4011, Table 5-2). Detected constituent concentrations are presented in Tables 5-8 and 5-9. Sample locations are shown on Figures 5-1 and 5-2. These analytical results are utilized, in conjunction with paired surface soil COPEC data, to calculate site-specific invertebrate bioaccumulation factors for use in the BERA (Section 6.2.1). It should be noted that four of the PRRWP soil samples (Sample Nos. AC0002 through AC0005) did not have bioaccumulation tests run because the nitroaromatic COPECs were not detected in the soils (Sample Nos. AC0002 through AC0005), and therefore the uptake study would not have produced usable results.

5.1.2.3 Sediment Sampling for Aquatic Worm COPEC Uptake Estimates

Discrete sediment samples were collected from the WARWP area on September 14, 2000 and sent to EA for bioaccumulation testing using the invertebrate species *Lumbriculus variegatus*. All sediments used for bioaccumulation testing were used within 45 days of sample collection. EA introduced freshwater aquatic worms to the impacted sediment for the 28-day study. The invertebrates were allowed to bioaccumulate COPECs as they burrowed in the sediment over the duration of the study, and at the end of the study these invertebrates were sacrificed and tissue COPEC concentrations were determined by STL. The chronic bioaccumulation tests with *L. variegatus* were performed on five WARWP sediments (Sample Nos. AD1001 through AD1005) to obtain five WARWP tissue samples (Sample Nos. AD4016 through AD4020, Table 5-1).

Detected constituent concentrations are presented in Table 5-9 and sample locations are shown on Figure 5-6. These analytical results are utilized, in conjunction with paired sediment COPEC data, to calculate site-specific bioaccumulation factors for use in the BERA (Section 6.2.1). It should be noted that none of the PRRWP sediment samples (Sample Nos. AC4016 through AC4020) had bioaccumulation tests run because the primary COPEC (i.e., the PAH carbazole) was not detected in sediment (Sample Nos. AC1001 through AC1005), and therefore the uptake study would not have produced usable results.

5.2 Discussion of Toxicity Data

This section presents a discussion of site-specific toxicity data for surface water (Section 5.2.1), sediment (Section 5.2.2), and soil (Section 5.2.3). The complete results of the toxicity testing are presented in Appendix E. EA performed the toxicity tests, and the tests used appropriate laboratory-supplied freshwater invertebrate and vertebrate test species. Each media sample run for toxicity included a method-specified number of sample replicates. Replicate data were used to perform appropriate statistical analyses in order to determine whether or not the toxicity recorded, if any, was statistically different from the laboratory control. For surface water samples the water flea tests included 10 replicates and the fathead minnow tests included five replicates; for sediment samples the *Hyalella azteca* tests included eight replicates; and for soil samples the earthworm tests included five replicates (Appendix E, Attachments I through V).

5.2.1 Surface Water

As discussed in Section 5.1.1, discrete surface water grab samples were collected from the RWP areas on September 13 and 14, 2000 and sent to EA for chronic toxicity testing using *Pimephales promelas* (fathead minnow) and *Ceriodaphnia dubia* (water flea). Due to an error by the courier service, the PRRWP surface water samples did not arrive at EA in time to initiate toxicity testing within 36 hours of collection. All surface waters used for toxicity testing, however, were used within 56 hours of sample collection. Given that (1) the surface water hazard drivers identified in the SLERA were limited to metals (Section 2.1) and metals are expected to be persistent in surface water; (2) both WARWP and PRRWP samples showed some toxicity; and (3) the acceptable surface water holding time ranges from 36 to 72 hours (Weber et al., 1989), the initiation of the PRRWP toxicity testing beyond 36 hours from the time of collection is considered insignificant.

Chronic 6-day toxicity tests with *C. dubia* were conducted on five WARWP surface waters (Sample Nos. AD2006 through AD2010) and five PRRWP surface waters (Sample Nos. AC2006 through AC2010). Two of the ten surface water samples, (WARWP Sample Nos. AD2008 and AD2009) had a statistically significant (p=0.05) decrease in young production compared to the

hardness control, however, only Sample No. AD2008 was biologically significant as the reproduction rate was more than 20 percent lower than the control. For the remaining surface waters samples (three surface waters from WARWP and the five surface waters from PRRWP), there was no significant difference in survival or reproduction as compared to the hardness control.

Chronic 7-day toxicity tests with *P. promelas* were performed on five WARWP surface waters (AD2006-AD2010) and five PRRWP surface waters (Sample Nos. AC2006 through AC2010). The five surface waters from WARWP did not show a statistically significant decrease in survival of *P. promelas*. Two of the PRRWP surface waters (PRRWP Sample Nos. AC2006 and AC2008) did show a statistically significant (p=0.05) lower survival than the hardness control for *P. promelas*. However, only the survival in Sample No. AC2006 was biologically significant as the survival rate was more than 20 percent lower than the control.

In summary, two surface water samples showed biologically significant toxicity, including PRRWP Sample No. AC2006 and WARWP Sample No. AD2008. A discussion of which surface water constituents may be responsible for the measured toxicity is presented in Section 6.3.

5.2.2 Sediment

As discussed in Section 5.1.1, discrete sediment samples were collected from the WARWP on September 13 and 14, 2000 and sent to EA for invertebrate toxicity testing using the invertebrate species *Hyalella azteca*. All sediments used for toxicity testing were used within 10 days of sample collection. PRRWP sediment samples were not collected for *H. azteca* toxicity testing because in the SLERA (IT, 2000a) PRRWP sediments were not predicted to be toxic to aquatic organisms.

Chronic 10-day toxicity tests with *H. azteca* were performed on five sediment samples (WARWP Sample Nos. AD1006 through AD1010). Two of the five WARWP sediments (Sample Nos. AD1006 and AD1008) had statistically significant (p=0.05) lower survival than the hardness control; however, neither had a biologically significant reduction in survival, as survival was not reduced by more than 20 percent compared with the control. The remaining three sediment samples had survival that was not significantly different from the control.

In summary, no sediment samples showed biologically significant toxicity. A discussion comparing sediment concentrations and measured survival is presented in Section 6.3 for informational purposes only.

5.2.3 Soil

As discussed in Section 5.1.1, discrete surface soil samples were collected from the RWP areas on September 15, 2000 and sent to EA for bioaccumulation testing using the invertebrate earthworm species *Eisenia foetida*. All soils used for bioaccumulation testing were used within 60 days of sample collection. Although the test was primarily for an assessment of bioaccumulation of COPECs from soil, information on toxicity was obtained as well.

Chronic (28-day) bioaccumulation tests with *E. foetida* were performed on five WARWP soils (Sample Nos. AD0001 through AD0005) and one PRRWP soil sample (Sample No. AC0001). Survival was significantly (p=0.05) lower in WARWP Sample Nos. AD0001, AD0005, and AC001, but was only reduced by more than 20 percent in Sample No. AD0001. The remaining soil samples did not have survival that was statistically significantly different from the control. In summary, one soil sample showed biologically significant toxicity (Sample No. AD0001). A discussion of which soil constituents may be responsible for the toxicity is presented in Section 6.3.

6.0 Risk Characterization

This risk characterization chapter presents a refined selection of COPECs (Section 6.1), a refined food chain model (Section 6.2), a discussion of the toxicity test results and possible correlations with chemical concentrations (Section 6.3), a risk characterization weight of evidence discussion (Section 6.4), a discussion of additional risk information (Section 6.5), and an uncertainties analysis (Section 6.6).

6.1 Refined Selection of COPECs

COPECs identified as hazard drivers in the SLERA (IT, 2000a) were summarized, by media, in Section 2.1. These hazard drivers are reevaluated using the additional data collected as part of this BERA (Section 5.1), specifically considering (1) results of statistical tests comparing concentrations measured in site samples and background samples; and (2) the frequency of detection. Constituents were eliminated as hazard driver COPECs if concentrations were not found to be statistically greater than background concentrations (Table 5-6) or if the frequency of detection (by media) was less than 5 percent and the constituent was not detected in the current site investigation sampling event. COPEC hazard drivers that were retained were carried forward for assessment in the refined food chain model (Section 6-2). It is assumed that focusing on only the hazard driver COPECs is appropriate for the BERA refined food chain model, as other COPECs have not been shown to contribute significantly to the estimated receptor hazards (IT, 2000a). Tables 6-1 through 6-8 present the results of the refined COPEC selection process. Results show that for surface soil and total soil at WARWP, 8 and 10 hazard driver COPECs were retained, respectively (Tables 6-1 and 6-2). For WARWP surface water three COPEC hazard drivers were retained (Table 6-3), whereas for sediment two COPEC hazard drivers were retained (Table 6-4). For PRRWP surface soil and total soil, two COPEC hazard drivers were retained for each medium (Tables 6-5 and 6-6, respectively). For PRRWP surface water and sediment, however, no COPEC hazard drivers were retained, as all concentrations were related to background (Tables 6-7 and 6-8, respectively) as discussed in Section 5.1.1.5 – Background Sampling.

6.2 Refined Food Chain Model

This section presents a summarized approach and detailed results for a refined food chain model for terrestrial and aquatic receptors. A screening level food chain model was presented in the SLERA (IT, 2000a), and this model is refined herein using more realistic exposure assumptions. The exposure characterization (Section 6.2.1) is based on site-specific data collected as part of this BERA. The ecological effects characterization (Section 6.2.2) considers both NOAELs and

lowest observed adverse effect level (LOAEL). Estimated ecological hazards from this refined food chain model are summarized in Section 6.2.3.

6.2.1 Exposure Characterization

General exposure pathways for the RWP sites were summarized in Section 2.2.2. Details on the general exposure characterization approach used in the food chain model are presented and discussed in detail in Section 6.3 of the SLERA (IT, 2000a) and are not repeated herein.

For the refined food chain model (based on the food chain model used in the SLERA), two different approaches are presented in order to provide risk managers with a risk range to aid in decision making. The two approaches include a reasonable maximum exposure (RME) scenario and a central tendency (CT) exposure scenario. The RME scenario estimates the upper-end of the risk range by using 95 percent upper confidence level (UCL) exposure-point concentrations and site-specific biological concentration factors (BCF) calculated in a conservative fashion to overestimate uptake (described below). The CT exposure scenario estimates a more realistic risk value by using arithmetic mean exposure-point concentrations and site-specific BCFs calculated using a more realistic approach (described below).

Exposure point concentrations (i.e., 95 percent UCL and arithmetic mean) for both approaches are presented in Tables 6-1 through 6-8 for the retained COPEC hazard drivers. These exposure-point concentrations are based on data collected and presented in the SLERA (IT, 2000a). Details on how the 95 percent UCL exposure-point concentrations were calculated are presented in Section 6.2.2.2 of the SLERA (IT, 2000a). Sample results collected as part of the BERA (Section 5.1) were not used to recalculated the exposure-point concentrations because the BERA sampling program (IT, 2000b) was not designed for this purpose. As the BERA samples were collected using a biased sampling approach, in order to resample the hazard driver “hot spots” for subsequent use in toxicity or uptake studies, inclusion of these data would overestimate the receptor exposure point concentrations. Therefore, the more representative SLERA data were retained to estimate the exposure point concentrations.

Site-specific BCFs were calculated by dividing COPEC tissue concentrations (i.e., fish, crayfish, tadpole, aquatic worm, and terrestrial earthworm) by the appropriate paired media constituent concentration (i.e., in surface water, sediment, or soil). Some tissue concentrations were reported as blank related (i.e., qualified with a "B" following the 5-times and 10-times convention for common and non-common laboratory contaminants, per *Guidance for Data Usability in Risk Assessment* [EPA, 1992]), that is, the constituent concentration in the tissue was within 5-times or 10-times the constituent concentration in the corresponding blank sample. For

earthworm and aquatic worm tissue, the blank sample was the pretest tissue sample (prior to execution of the bioaccumulation study at the laboratory). For other tissue samples, the blank samples were standard laboratory water blanks. For the RME approach, BCFs were estimated using one-half of the B-qualified constituent concentration in the tissue, thereby potentially overestimating the resultant BCF. For the CT approach, BCFs were estimated using one-half of the associated analytical detection limit concentration for the B-qualified tissue constituent, thereby obtaining a more reasonable BCF value.

For all of the site-specific BCF calculations (summarized in Tables 6-9 through 6-12), one-half of the analytical detection limit was used if the constituent was not detected in the sample. If both sample components of a BCF sample pair were not detected (e.g., if arsenic in worm tissue was not detected and arsenic in the corresponding soil sample was not detected), then no BCF value was estimated. For the estimation of aquatic tissue BCFs from surface water, all of the surface water constituent concentrations for a site were averaged together first, prior to use in the divisor of the BCF calculation. This approach was taken because the fish, tadpoles, and/or crayfish were collected by seining and electroshocking throughout the surface water area at the sites, and not at just one specific location. These aquatic species are mobile and are expected to integrate exposure as they move throughout the water column. For PRRWP, separate BCFs were calculated for fathead minnows, tadpoles, and crayfish because all three species were collected. The CT approach used the mean BCF value, whereas the RME approach used the maximum species BCF value (Tables 6-11 and 6-12, respectively). All individual sample data used in calculating the BCFs are presented in Appendix F.

If a site-specific BCF could not be calculated for a particular constituent due to the fact that the constituent was not detected in both the media and paired tissue sample, and a BCF value was needed for a hazard driver constituent for the refined food chain model, the screening-level BCF value from the SLERA (IT, 2000a) was used.

6.2.2 Ecological Effects Characterization

Ecological effects were estimated in the refined food chain models using reference toxicity values (RTV), following the general approach used in the SLERA, as recommended by Wentsel et al. (1996) (Section 6.4 of IT, 2000a). For the RME approach, NOAEL RTVs were used, whereas for the CT approach, LOAEL RTVs were used (Table 6-13). If LOAELs were not available from the literature, they were generally estimated by multiplying the NOAEL value by a factor of 10, based on guidance presented in Sample et al. (1996). For essential nutrients (calcium, iron, magnesium, phosphorus, and potassium), NOAELs are discussed and derived as in the SLERA (IT, 2000a), with information presented in Appendix G. LOAELs for nutrients

were estimate by multiplying the derived NOAELs by a factor a 5, due to the fact that the nutrient NOAELs that have been derived (Appendix G) may be overly conservative.

In the SLERA (IT, 2000a), intraclass extrapolation factors were used to account for uncertainty in applying RTVs derived for laboratory species to another species representing the selected wildlife receptor. These extrapolation factors are presented in Table 6-14. These factors were retained in the refined food chain model for the RME approach. However, as ERAGS (EPA, 1997) does not require this conservative approach, the RTV intraclass extrapolation factors default to 1 for the CT approach.

As specified in Chapter 2.0, a literature search was performed to obtain a more accurate avian RTV for the nitroaromatic hazard driver COPECs (the amino-DNTs). In the SLERA (IT, 2000a), avian toxicity to amino-DNTs was assessed using acute data (i.e., lethal dose data [LD_{50}]), and this former approach added considerable uncertainty to the assessment. No chronic or subchronic toxicity studies could be found that assessed avian toxicity to amino-DNTs. However, a recent toxicity study (Johnson and McAtee, 2000) on the effects of 2,4,6-TNT to birds was located in the literature, and RTVs from this study were used as appropriate surrogates for avian amino-DNT toxicity.

6.2.3 Estimated Ecological Hazards

Estimated ecological hazards from the refined food chain model are presented in Tables 6-15 through 6-17. Risk characterization spreadsheets with all exposure and toxicity input values are presented in Appendix H. The terrestrial hazards for WARWP are estimated to range from 0.009 to 0.8 for the deer mouse (CT to RME estimates, respectively); from 0.005 to 0.3 for the cottontail rabbit, from 0.03 to 2.7 for the shrew; from 0.01 to 1.0 for the marsh wren; from 0.01 to 1.2 for the raccoon, and from 0.004 to 0.3 for the deer (Table 6-15). For the shrew, hazard drivers are PAHs as a result of predicted ingestion of soil invertebrates.

The aquatic hazards for WARWP are estimated to range from 0.4 to 26 for the great blue heron, and from 0.4 to 21 for the raccoon (CT to RME estimates, respectively) (Table 6-16). For the heron, the hazard driver is iron due to the predicted ingestion of impacted sediment. For the raccoon, the hazard driver is also iron as a result of the predicted ingestion of impacted sediment (Table 6-16).

The terrestrial hazards for PRRWP are estimated to range from 0.06 to 2.7 for the deer mouse (CT to RME estimates, respectively); from 0.07 to 3.2 for the cottontail rabbit; from 0.01 to 0.3 for the shrew; from 0.01 to 0.5 for the marsh wren; from 0.05 to 2.2 for the raccoon; and from

0.002 to 0.03 for the deer (Table 6-17). For the mouse, cottontail, and raccoon, the hazard driver is 1,3-DNB, as a result of predicted ingestion of impacted plants. No aquatic hazards are estimated for PRRWP as all of the surface water and sediment hazard driver COPECs were eliminated as a result of either statistical similarity with background concentrations or a frequency of detection less than 5 percent (Section 6.1).

6.3 Toxicity Testing Findings

This section presents a summary of toxicity test results and potential correlations with surface water, sediment, and soil concentrations. A significant correlation between toxicity and media concentrations suggests a potential relationship between toxicity and the measured chemical concentrations, although not a definitive cause and effect linkage. The finding is not definitive because concentrations of other chemicals or stressors not measured in the media may be responsible for the observed toxicity.

6.3.1 Surface Water Toxicity Correlations

As discussed in Section 5.2.1, some of the surface water samples collected from WARWP and PRRWP were found to exhibit biologically significant toxicity to the laboratory test organisms, compared to the laboratory controls. In order to assess which chemical parameters in surface water may be responsible for the measured toxicity, statistical and graphical evaluations have been performed. Table 6-18 presents results of statistical correlations between fathead minnow (*P. promelas*) survival and surface water constituent concentrations, and between water flea (*C. dubia*) offspring production and surface water constituent concentrations. Statistical correlation results may range from +1.0 to !1.0, with a positive value indicating a positive correlation, and a negative value indicating a negative correlation. Correlation values near zero suggest poor statistical correlation, whereas values near ∀1.0 suggest good statistical correlation, however, whether or not a correlation value is statistically significant at the 0.05-level of significance depends on the number of sample pairs used in the statistical analysis. The number of samples used in a statistical test is used to calculate the degrees of freedom, and the degrees of freedom are used to determine which correlations are statistically significant. For minnow survival, concentrations of calcium show a statistically significant ($P_{0.05}$) correlation of !0.93, meaning that 93 percent of the variability is accounted for between this constituent's surface water concentration and the associated minnow survival. The correlation is negative because as calcium concentrations increase, percent survival decreases. Although no other constituent concentrations show a statistically significant negative correlation with minnow survival, the next highest negative correlation was for barium, with a correlation of !0.47 (Table 6-18). Neither calcium nor barium were found to be surface water hazard drivers in the SLERA,

although aluminum, manganese, vanadium, and iron were potential hazard drivers, as concentrations exceeded water quality criteria for the protection of aquatic life (IT, 2000a). It should be noted that concentrations of aluminum, manganese, and iron in the current samples were generally similar to concentrations used in the SLERA, although vanadium concentrations were blank related.

Graphical plots of minnow survival and associated inorganic surface water concentrations are presented in Figures 6-1 through 6-4. Sample No. AC2006 (collected from PRRWP) demonstrated biologically significant toxicity (i.e., 70 percent survival) compared to the laboratory hardness control with 94 percent survival, however, none of the 16 inorganics appear to have an elevated relative concentration in this sample. Thus, although calcium and perhaps barium surface water concentrations show an overall negative correlation with survival, concentrations of these two constituents in Sample No. AC2006 were not greater than in the other samples. This finding suggests that the cause of the biologically significant toxicity in this sample is unknown based on the available data.

For water flea reproduction, no inorganic constituent concentrations show a statistically significant ($P_{0.05}$) correlation (Table 6-18). The highest negative correlation was for barium, with a correlation of !0.43, although this relationship was not statistically significant. Graphical plots of water flea offspring production and associated inorganic surface water concentrations are presented in Figures 6-5 through 6-8. Sample No. AD2008 (collected from WARWP) demonstrated biologically significant toxicity (i.e., production of 17.3) compared to the laboratory control with a measured offspring production of 23.3, however, none of the 16 inorganics appear to have an elevated relative concentration in this samples. Thus, although barium surface water concentrations appear to show an overall negative correlation with reproduction, the concentration of this constituent in Sample No. AD2008 was not greater than in the other samples. This finding suggests that the cause of the biologically significant toxicity in this sample is unknown based on the available data.

6.3.2 Sediment Toxicity Correlations

As discussed in Section 5.2.2, none of the sediment samples collected from WARWP were found to exhibit biologically significant toxicity to the laboratory test organisms, relative to the laboratory control. However, some statistically significant differences in survival were measured, although not reducing survival by more than 20 percent (considered to be the biological significance threshold). In order to assess which chemical parameters in sediment may be responsible for the measured survival difference, statistical and graphical evaluations have been performed for informational purposes. Table 6-19 presents results of statistical

correlations between amphipod crustacean (*H. azteca*) survival and sediment constituent concentrations. Depending on the number of samples used in the statistical test, the degrees of freedom may be calculated thereby allowing a determination of which correlations are statistically significant. For amphipod survival, concentrations of antimony show a statistically significant ($P_{0.05}$) correlation of !0.94, meaning that 94 percent of the variability is accounted for between this constituent's sediment concentration and the associated amphipod survival. The correlation is negative because as antimony concentrations increase, percent survival decreases. The correlation for antimony is likely spurious, as four of the five antimony concentrations were nondetect, and the correlation test was run using one-half of the analytical detection limit for those samples with nondetect results. No other constituent concentrations show a statistically significant negative correlation with amphipod survival, however, the next two highest negative correlations are for arsenic and cobalt, with correlations of !0.80 and !0.65, respectively (Table 6-19). It should be noted that arsenic's correlation value is almost significant at the $P_{0.05}$ level, as the significance correlation threshold for the sample size is ∀0.81. Both arsenic and cobalt were detected in all of the five sediment samples collected and tested. Arsenic was found to be a sediment hazard driver in the SLERA, along with copper and iron, as concentrations exceeded sediment quality criteria for the protection of aquatic life (IT, 2000a). It should be noted that concentrations of arsenic, cobalt, copper, and iron in the current sediment samples were similar to those used in the SLERA.

Graphical plots of amphipod survival and associated inorganic concentrations are presented in Figures 6-9 through 6-13. No samples demonstrated biologically significant toxicity compared to the laboratory control with a measured survival of 94 percent, and none of the 17 inorganics appear to have elevated relative concentrations in these two samples with reduced survival (e.g., Sample Nos. AD1006 and AD1008), except for perhaps arsenic, calcium, iron, lead and manganese. Note: antimony concentrations are uncertain as one-half of the detection limit was used for four of the five samples that had nondetectable concentrations of this inorganic. Thus, although arsenic and perhaps cobalt sediment concentrations show an overall negative correlation with survival, of these two constituents, only arsenic concentrations in Sample Nos. AD1006 and AD1008 were greater than in the other samples. This finding suggests that the cause of the reduced survival in these samples may be related to arsenic concentrations; however, it is important to note that the reduced survival is not considered biologically significant.

6.3.3 Soil Toxicity Correlations

As discussed in Section 5.2.3, one of the soil samples collected from WARWP was found to exhibit biologically significant toxicity to the laboratory test organisms, relative to the laboratory control (i.e., 70 vs. 99.7 percent survival). In order to assess which chemical parameters in soil may be responsible for the measured toxicity, statistical and graphical evaluations have been performed. Table 6-20 presents results of statistical correlations between earthworm (*E. foetida*) survival and soil constituent concentrations. Depending on the number of samples used in the statistical test, the degrees of freedom may be calculated thereby allowing a determination of which correlations are statistically significant. For earthworm survival, concentrations of nine of the PAHs show a statistically significant ($P_{0.05}$) correlation, ranging from !0.98 to !1.0, meaning that most of the variability is accounted for between these constituent's soil concentrations and the associated earthworm survival. The correlations are negative because as PAH concentrations increase, percent survival decreases. PAHs were found to be soil COPECs in the SLERA as concentrations were above EPA Region 3 Biological Technical Advisory Group screening levels for soil (IT, 2000a). It should be noted that PAH concentrations in the current WARWP soil samples are approximately an order of magnitude lower than those used in the SLERA.

Graphical plots of earthworm survival and associated PAH concentrations are presented in Figures 6-14 through 6-16. It should be noted that only PAH constituents that had statistically significant negative correlations were graphed and the one sample collected from PRRWP (Sample No. AC0001) is not included in this discussion as the soil from this sample was analyzed for a different suite of chemical constituents and the sample did not exhibit biologically significant toxicity to earthworms. Sample No. AD0001 (collected from WARWP) demonstrated biologically significant toxicity (i.e., 70 percent survival) compared to the laboratory control with a measured survival of 99.7 percent. Almost all of the nine PAHs appear to have elevated relative concentrations in this one sample, except for perhaps anthracene (Figures 6-14 through 6-16). These results suggest that elevated PAH concentrations in one surface soil sample are potentially toxic to earthworms at WARWP.

6.4 Weight of Evidence

Results of the refined food chain models, using site-specific BCFs, demonstrated that ecological hazards for the receptors estimated using the more realistic CT approach were all considerably less than 1, EPA's hazard threshold of concern. HIs were found to range from 0.002 up to 0.4 for both the great blue heron and raccoon. Hazards estimated using the more conservative RME food chain model approach were above 1 for several receptors, with the highest HIs (26 for the great blue heron and 21 for the raccoon) due primarily to elevated concentrations of iron in WARWP sediment. Due to the highly conservative approach used in the RME food chain

model, it is very unlikely that these elevated hazards would be expected to result in actual adverse effects in the real world.

Results of the site-specific toxicity testing demonstrated some biologically significant toxicity in a few of the surface water, sediment, and soil samples, summarized as follows:

- 10 percent of the surface water samples showed significant minnow toxicity (Sample No. PRRWP-AC2006)
- 10 percent of the surface water samples showed significant water flea toxicity (Sample No. WARWP-AD2008)
- None of the sediment samples showed significant amphipod crustacean toxicity)
- 17 percent of the soil samples showed significant earthworm toxicity (Sample No. WARWP-AD0001).

Potential causes of the measured surface water toxicity, based on the available data evaluating using correlation statistics and graphical evaluations, could not be reliably determined. Although elevated calcium concentrations were implicated by the correlation results, surface water calcium levels were not noticeably greater in the one sample demonstrating biologically significant toxicity. For sediment, elevated arsenic levels were implicated as a potential cause of reduced survival, using correlation results and a graphical evaluation, however, the reduced survival measured was not biologically significant. The potential cause of the measured soil toxicity was convincingly shown to be related to soil PAH concentrations.

It is important to note that the toxicity measured in the site media samples was generally relatively minor, compared with the laboratory controls. Survival or reproduction was reduced by not more than 25 to 30 percent, as shown below.

Survival or Reproduction Measured in Site Sample(s) [a]	Survival or Reproduction in Associated Laboratory Control Sample	Calculated Reduction in Survival or Reproduction (Site vs. Lab Control) [b]
70 percent (minnow)	94 percent (minnow)	25 percent
17.3 (water flea offspring)	23.3 (water flea offspring)	26 percent
70 percent (earthworm)	99.7 percent (earthworm)	30 percent

[a] Only samples results determined to have biologically significant toxicity are presented.
[b] Calculated by comparing laboratory control result with site sample result.

It is possible that these relatively minor reductions in survival and reproduction may have insignificant adverse effects at the population or community levels of biological organization.

A weight of evidence summary may be based on the two lines of evidence presented in this BERA – namely the refined food chain model and the site surface water, sediment, and soil toxicity studies. The more realistic CT food chain model approach demonstrated no adverse ecological impacts for either of the two RWP sites. Alternatively, the highly conservative RME food chain model approach suggested some potential adverse effects (from iron sediment concentrations at WARWP; from 1,3-DNB soil concentrations at PRRWP; and from PAH soil concentrations at WARWP). Using results from the toxicity studies, arsenic levels in sediment at WARWP were implicated as a potential cause of reduced survival, whereas for WARWP soils, the potential cause of the measured soil toxicity was convincingly shown to be related to soil PAHs concentrations. Constituents contributing to the measured surface water toxicity could not be identified based on the available data.

Based on the previous discussion, the following weight of evidence summary is presented:

- Elevated PAH concentrations in WARWP soils are an ecological concern due to: (1) measured earthworm toxicity; and (2) predicted RME food-chain impacts to the shrew via biological uptake by prey items such as earthworms.

- Elevated iron concentrations in WARWP sediments are also an ecological concern due to the observation that: (1) concentrations were determined to be potentially deleterious to herons and raccoons using the RME food chain model; and (2) the iron concentration used in the RME food chain model (24,300 mg/kg) is similar to an iron sediment concentration of 24,200 mg/kg that is associated with reduced survival of sediment amphipods (in WARWP Sample No. AD1008). It should be noted that the amphipod reduced survival that was measured may be due to other sediment factors, as overall iron concentrations were not significantly correlated with sediment toxicity (Table 6-19).

- In light of current site activities (burning for habitat management), CT HI outcomes, biological toxicity text results, and uncertainty analysis discussions, remedial activity based on the results of the BERA is not recommended at this time.

6.5 Additional Risk Information

This section presents a discussion on the extent, magnitude, and potential ecological significance of BERA findings, following guidance in Section 7.7.3 of ERAGS (EPA, 1997).

Based on the data presented in the BERA, the elevated concentrations of PAHs in soil at WARWP are a potential ecological concern. The elevated PAH concentrations are limited to Sample No. AD0001 (Figure 5-2), which is also located near the historic PAH hot spot soil

sample collected at DP-13 (IT, 2000a). This location is situated in a grassy area commonly used for vehicular access to the WARWP area, and by site visitors and drillers. As mentioned in Section 6.4, it is possible that the 30 percent reduction in earthworm survival may have an insignificant adverse effect at the population or community levels of biological organization at the WARWP site. Although there are predicted RME food-chain impacts to the shrew from biological uptake of PAHs by prey items such as earthworms, the RME HI is only 2.5, and the CT HI is even lower at 0.03.

Based on the data presented in the BERA, the elevated concentrations of iron in sediment at WARWP are a potential ecological concern. The elevated iron concentrations are limited to Sample No. AD1008 (Figure 5-6) and the historic iron hot spot sediment sample collected at WARP-SD04 located downstream on Pipe Creek adjacent to the eastern RWP (IT, 2000a). It should be noted that this historic sample is very close to Sample No. AD1010 (Figure 5-6) that reported a relatively low sediment iron concentration of 8,790 mg/kg. The 12 percent reduction in amphipod survival (that may be due to the sediment iron level) is expected to have an insignificant adverse effect at the population or community levels of biological organization at the WARWP site, as the reduction in survival is not considered biologically significant (i.e., it is not greater than 20 percent). Although there are predicted RME food-chain impacts due to sediment iron concentrations (i.e., an HI of 26 for the great blue heron and an HI of 21 for the raccoon), the more realistic CT food chain hazards are estimated to be approximately 0.4.

6.6 Uncertainty Analysis

The results of the BERA are influenced to some degree by variability and uncertainty. In theory, investigators reduce variability by increasing sample size of the media or species sampled. Alternatively, uncertainty within the risk analysis can be reduced by using species-specific and site-specific data (i.e., to better quantify contamination of media, vegetation, and prey through direct field measurements, toxicity testing of site-specific media, and field studies using site-specific receptor species). Several of these approaches have been used in the BERA, including the collection of additional samples to supplement the SLERA, the development of site-specific BCFs, and the performance of toxicity testing of site media.

A number of factors, however, still contribute to the overall variability and uncertainty inherent in the BERA. Variability is due primarily to measurement error; laboratory media analyses and receptor study design are the major sources of this kind of error. Uncertainty, on the other hand, is associated primarily with deficiency or irrelevancy of effects, exposure, or habitat data to actual ecological conditions at the site. Species physiology, feeding patterns, and nesting behavior are poorly predictable; therefore, all toxicity information derived from toxicity testing,

field studies, or observation will have uncertainties associated with them. Laboratory studies conducted to obtain site-specific, measured information often suffer from poor relevance to the actual exposure and uptake conditions on site (i.e., bioavailability, exposure, assimilation, etc., are generally greater under laboratory conditions as compared to field conditions). Calculating an estimated value based on a large number of assumptions is often the only alternative to the accurate (but costly) method of direct field or laboratory observation, measurement, or testing.

The BERA uses a soil exposure depth of 0 to 6 feet to account for burrowing mammals such as the shrew. While it is true that a shrew species may not burrow as deep as 6 feet, this depth interval was used in the BERA for consistency with other PBOW ERAs that have been performed (i.e., TNT Areas A, B, and C). In addition, the shrew was selected as a "representative" burrowing insectivorous mammal and there may be other burrowing mammals at the site that do burrow to depths approaching six feet. Another reason for use of the 0 to 6 foot depth interval was due, in part, to the limitations of the sampling data. Many of the surface samples represent an interval of 0 to 2 feet, and many of the next depths represent 4 to 6 feet. It was believed that use of only 0 to 2 foot soil data would underestimate burrowing mammal exposure to subsurface COPECs. Based on the previous discussion, there is the potential for overestimation of risk due to using COPEC concentrations from as deep as 6 feet for shrew HI calculations.

The uncertainty analysis is presented in Table 6-21 and this table lists some of the major assumptions made for the BERA; the direction of bias caused by each assumption (i.e., if the uncertainty results in an overestimate or underestimate of risk); the likely magnitude of impact (quantitative [percent difference], or qualitative [high, medium, low, or unknown]); and, if possible, a description of recommendations for minimizing the identified uncertainty.

7.0 Conclusions

The purpose of the BERA was to produce a supplement to the SLERA (IT, 2000a), to provide additional site-specific information to risk managers to allow them to decide if revised estimated ecological hazards to potentially exposed receptors are acceptable. The investigation evaluated current and future risk from environmental media including soil, sediment, and surface water. BERA findings are discussed using a weight of evidence approach (Section 6.4) and weight of evidence conclusions are summarized in the following bullets.

- Elevated PAH concentrations in WARWP soils are an ecological concern due to: (1) measured earthworm toxicity; and (2) predicted RME food-chain impacts to the shrew via biological uptake by prey items such as earthworms.

- Elevated iron concentrations in WARWP sediments are also an ecological concern due to the observation that: (1) concentrations were determined to be potentially deleterious to herons and raccoons using the RME food chain model; and (2) the iron concentrations may be associated with reduced sediment amphipod survival.

- Environmental media at PRRWP do not appear to pose significant unacceptable risks to ecological receptors.

It is important to note that the extent of elevated PAH concentrations in WARWP soil, and the extent of elevated iron concentrations in WARWP sediments appear to be very localized. In addition, the toxicity associated with some RWP site media may not have a significant adverse effect at the population or community levels of biological organization, due to the fact that reductions in survival or reproduction were not more than 25 to 30 percent, compared with the laboratory controls. Finally, the results of the refined food chain model, using the more realistic CT approach, demonstrated no adverse effects.

In light of current site activities (burning for habitat management), CT HI outcomes, biological toxicity text results, and uncertainty analysis discussions, remedial activity based on the results of the BERA is not recommended at this time.

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TABLES

Table 3-1

Measurement and Assessment Endpoints
Plum Brook Ordnance Works, Sandusky, Ohio

Assessment Goal	Assessment Endpoint	Null Hypothesis (H_o)	Selected Receptor and Exposure Routes	Measurement Endpoint
Protection of terrestrial ecosystem structure and function.	Protection of long-term survival and reproductive capabilities for soil invertebrate populations.	The presence of site contaminants within surficial soils will have no adverse effect on survival and reproductive capabilities of terrestrial invertebrates.	Terrestrial invertebrates ingestion of soil and direct exposure to soil	Survival and growth of earthworms in site-specific soil bioassays
	Protection of long-term survival and reproductive capabilities for herbivorous mammal populations.	The presence of site contaminants within surface and subsurface soils, surface water, and vegetation will have no adverse effect on survival and reproductive capabilities of herbivorous mammals.	Eastern cottontail (*Sylvilagus floridanus*) white-tailed deer (*Odocoileus virginianus*) ingestion of plants, water, and incidental soil	Comparison of total daily dose to species-specific toxicity endpoint values (TEV) using refined food chain model.
	Protection of long-term survival and reproductive capabilities for omnivorous mammal populations.	The presence of site contaminants within surface soils, surface water, terrestrial invertebrates and vegetation will have no adverse effect on survival and reproductive capabilities of omnivorous mammals.	Raccoon (*Procyon lotor*) ingestion of terrestrial plants, and invertebrates, small mammals, water and incidental soil	Comparison of total daily dose to species-specific toxicity endpoint values (TEV) using refined food chain model.
	Protection of long-term survival and reproductive capabilities for omnivorous mammal populations.	The presence of site contaminants within surficial soils, surface water, terrestrial invertebrates, and vegetation will have no adverse effect on survival and reproductive capabilities of omnivorous mammals.	Deer mouse (*Peromyscus maniculatus*) ingestion of terrestrial invertebrates, plants, water, and incidental soil	Comparison of total daily dose to species-specific TEVs using refined food chain model.

Table 3-1

Measurement and Assessment Endpoints
Plum Brook Ordnance Works, Sandusky, Ohio

Assessment Goal	Assessment Endpoint	Null Hypothesis (H_o)	Selected Receptor and Exposure Routes	Measurement Endpoint
Protection of terrestrial ecosystem structure and function.	Protection of long-term survival and reproductive capabilities for small insectivorous mammal populations.	The presence of site contaminants within surficial soils, surface water, and terrestrial invertebrates will have no adverse effect on survival and reproductive capabilities of insectivorous mammals.	short-tailed shrew (*Blarnia brevicauda*) ingestion of terrestrial invertebrates, water, and incidental soil	Comparison of total daily dose to species-specific TEVs using refined food chain model.
	Protection of long-term survival and reproductive capabilities for insectivorous bird populations.	The presence of site contaminants within surficial soils, surface water, and terrestrial invertebrates will have no adverse effect on survival and reproductive capabilities of insectivorous birds.	marsh wren (*Cistorthorus palustris*) ingestion of terrestrial invertebrates, water, and incidental soil	Comparison of total daily dose to species-specific TEVs using refined food chain model.

Table 3-1

Measurement and Assessment Endpoints
Plum Brook Ordnance Works, Sandusky, Ohio

Assessment Goal	Assessment Endpoint	Null Hypothesis (H_o)	Selected Receptor and Exposure Routes	Measurement Endpoint
Protection of aquatic ecosystem structure and function.	Protection of long-term survival and reproductive capabilities for benthic invertebrate populations.	The presence of site contaminants within sediments and surface water will have no adverse effect on survival and reproductive capabilities of benthic invertebrates.	Benthic invertebrates ingestion of sediment and direct exposure to surface water	Survival and growth of *Hyalella azteca* in site-specific sediment bioassays.
	Protection of long-term survival and reproductive capabilities for aquatic vertebrate (fin fish) populations.	The presence of site contaminants within surface water, benthic invertebrates, and plants will have no adverse effect on survival and reproductive capabilities of aquatic vertebrates.	aquatic vertebrates ingestion of benthic invertebrates, plants, and direct exposure to water	Survival and growth of fathead minnows and survival and reproduction of cladocerans in site-specific surface water bioassays.
	Protection of long-term survival and reproductive capabilities for semi-aquatic omnivorous mammal populations (also considered in the terrestrial assessment).	The presence of site contaminants within surface water, sediments, aquatic invertebrates, and fish have no adverse effect on survival and reproductive capabilities of aquatic mammals.	raccoon (*Procyon lotor*) ingestion of aquatic invertebrates, fish, water and incidental sediment	Comparison of total daily dose to species-specific TEVs using refined food chain model.
	Protection of long-term survival and reproductive capabilities for piscivorous bird populations.	The presence of site contaminants within aquatic vertebrates and benthic invertebrates will have no adverse effect on survival and reproductive capabilities of piscivorous birds.	great blue heron (*Ardea herodias*) ingestion of aquatic vertebrates, benthic invertebrates, water, and incidental sediment	Comparison of total daily dose to species-specific TEVs using refined food chain model.

Table 5-1

West Area Ecological Samples
Red Water Ponds, PBOW, Sandusky, Ohio

Soil/Water Samples	Tissue Samples	Analytical Suite	Comments
Earthworm COPEC Uptake Estimates			
Soil	Earthworm Tissue	Analytical	Comments
AD0001	AD4011	Nitroaromatics, PAHs	Uptake study run
AD0002	AD4012	Nitroaromatics, PAHs	
AD0003	AD4013	Nitroaromatics, PAHs	
AD0004	AD4014	Nitroaromatics, PAHs	
AD0005	AD4015	Nitroaromatics, PAHs	
Fish COPEC Uptake Estimates			
Surface Water	Fish Tissue	Analytical	
AD2001 (not collected)	AD4001	Metals, Lipids in fish	Results from AD2006-AD2010 used for metal surface water concentrations. Only enough fish biomass collected for four samples.
AD2002 (not collected)	AD4002	Metals, Lipids in fish	
AD2003 (not collected)	AD4003	Metals, Lipids in fish	
AD2004 (not collected)	AD4004	Metals, Lipids in fish	
AD2005 (not collected)	*AD4005 (not collected)*	NA	
	AD4006 (not collected)	NA	
	AD4007 (not collected)	NA	
	AD4008 (not collected)	NA	
	AD4009 (not collected)	NA	
	AD4010 (not collected)	NA	
Surface Water Toxicity			
Surface Water		Analytical	
AD2006		Metals	Toxicity study completed
AD2007		Metals	
AD2008		Metals	
AD2009		Metals	
AD2010		Metals	
Aquatic Invertebrate COPEC Uptake Estimates			
Sediment	Aquatic Worm Tissue	Analytical	
AD1001	AD4016	Metals, Nitroaromatics, TOC in Sediment	Uptake study run
AD1002	AD4017	Metals, Nitroaromatics, TOC in Sediment	
AD1003	AD4018	Metals, Nitroaromatics, TOC in Sediment	
AD1004	AD4019	Metals, Nitroaromatics, TOC in Sediment	
AD1005	AD4020	Metals, Nitroaromatics, TOC in Sediment	
Sediment Toxicity			
Sediment		Analytical	
AD1006		Metals	Toxicity study completed
AD1007		Metals	
AD1008		Metals	
AD1009		Metals	
AD1010		Metals	
Background			
Soil		Analytical	
AE0004		Metals, PAHs	Collected
AE0005		Metals, PAHs	
AE0006		Metals, PAHs	
Surface Water		Analytical	
AE2004		Metals	Collected
AE2005		Metals	
AE2006		Metals	
Sediment		Analytical	
AE1004		Metals	Collected
AE1005		Metals	
AE1006		Metals	

Note: Shaded text indicates samples not collected, or study not run, as proposed in the Work Plan. See comments for explanation.
COPEC - Constituent of potential ecological concern.
NA - Not Applicable
PAH - Polynuclear aromatic hydrocarbon.
TOC - Total organic carbon.

Table 5-2

Pentolite Road Ecological Samples
Red Water Ponds, PBOW, Sandusky, Ohio

Soil/Water Samples	Tissue Samples	Analytical Suite	Comments
Earthworm COPEC Uptake Estimates			
Soil	Earthworm Tissue Samples	Analytical	Comments
AC0001	AC4011	Nitroaromatics	COPECs not detected in some soil samples, thus uptake study not run.
AC0002	*AC4012 (uptake study not run)*	Nitroaromatics	
AC0003	*AC4013 (uptake study not run)*	Nitroaromatics	
AC0004	*AC4014 (uptake study not run)*	Nitroaromatics	
AC0005	*AC4015 (uptake study not run)*	Nitroaromatics	
Fish COPEC Uptake Estimates			
Surface Water	Fish Tissue Samples	Analytical	
AC2001 (not collected)	AC4001 (fatheads)	Metals, Lipids in tissu	Results from AC 2006-AC2010 used for metal surface water concentrations. Only enough biomass for three samples.
AC2002 (not collected)	AC4002 (tadpoles)	Metals, Lipids in tissu	
AC2003 (not collected)	AC4003 (crayfish)	Metals, Lipids in tissu	
AC2004	*AC4004 (not collected)*	Metals	
AC2005 (not collected)	*AC4005 (not collected)*	NA	
	AC4006 (not collected)	NA	
	AC4007 (not collected)	NA	
	AC4008 (not collected)	NA	
	AC4009 (not collected)	NA	
	AC4010 (not collected)	NA	
Surface Water Toxicity			
Surface Water		Analytical	
AC2006		Metals	Toxicity study completed
AC2007		Metals	
AC2008		Metals	
AC2009		Metals	
AC2010		Metals	
Aquatic Invertebrate COPEC Uptake Estimates			
Sediment	Acquatic Worm Tissue	Analytical	
AC1001	*AC4016 (uptake study not run)*	Metals, SVOCs	COPECs not detected in sediment samples, thus uptake study not run.
AC1002	*AC4017 (uptake study not run)*	Metals, SVOCs	
AC1003	*AC4018 (uptake study not run)*	Metals, SVOCs	
AC1004	*AC4019 (uptake study not run)*	Metals, SVOCs	
AC1005	*AC4020 (uptake study not run)*	Metals, SVOCs	
Background			
Soil		Analytical	
AE0001		Metals, PAHs	Samples collected
AE0002		Metals, PAHs	
AE0003		Metals, PAHs	
Surface Water		Analytical	
AE2001		Metals	Samples collected
AE2002		Metals	
AE2003		Metals	
Sediment		Analytical	
AE1001		Metals	Samples collected
AE1002		Metals	
AE1003		Metals	

Note: Shaded text indicates samples not collected, or study not run, as proposed in the Work Plan. See comments for explanation.
COPEC - Constituent of potential ecological concern.
NA - Not Applicable.
PAH - Polynuclear aromatic hydrocarbon.
SVOC - Semivolatile organic compound.

Table 5-3

Summary of Analytical Methods for Soil, Sediment, and Tissue Samples
Red Water Ponds, PBOW, Sandusky, Ohio

Parameter Name	Soil, Sediment and Tissue Method Number	Surface Water Method Number
Nitroaromatics	8330	NA
Total Inorganics[a]	6010B/365.3	6010B/365.3
Total Organic Carbon	9060	NA
Lipids in Tissue	STL-M-LIPIDS-REV3	NA
Semivolatile Organic Compounds	8270C	NA
Polynuclear Aromatic Hydrocarbons	8310	NA
Toxicity	USEPA (2000)	Weber (1989)
Bioaccumulation in Soil	Linder (1992)	NA
Bioaccumulation in Sediment	USEPA (2000)	NA

[a] Total inorganics include 18 key constituents of concern for the Red Water Pond Areas as follows:

Aluminum	Lead
Antimony	Magnesium
Arsenic	Manganese
Barium	Nickel
Calcium	Phosphorus
Chromium	Potassium
Cobalt	Sodium
Copper	Vanadium
Iron	Zinc

Table 5-4

Summary of Detected Constituents
Pentolite Road Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SEDIMENT

		GROUP_NAME	PRRP			PRRP			PRRP			PRRP			PRRP		
		LOCATION_CODE	PRWP-SD001			PRWP-SD002			PRWP-SD003			PRWP-SD004			PRWP-SD005		
		SAMPLE_NO	AC1001			AC1002			AC1003			AC1004			AC1005		
		SAMPLE_DATE	15-Sep-00			15-Sep-00			15-Sep-00			15-Sep-00			15-Sep-00		
		START_DEPTH	0			0			0			0			0		
		END_DEPTH	0			0.5			0.5			0.5			0.5		
		SAMPLE_PURPOSE	REG			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																	
% Solids	Percent	N															
Phosphorous	mg/kg	N	138												87.4		
Total organic carbon	mg/kg	N	24800			25900			9040			5190			10400		
METALS																	
Aluminum	mg/kg	N	6520			5570			8420			5840			6880		
Arsenic	mg/kg	N	5.7			5.6			5			6.3			7.7		
Barium	mg/kg	N	100			63.3			62.5			55.1			49		
Calcium	mg/kg	N	93400			44500			48700			39400			27500		
Chromium	mg/kg	N	12.6			10.1			13.8			10.3			12.2		
Cobalt	mg/kg	N	6.7			6.2			8.8			7			6.7		
Copper	mg/kg	N	17.2			14.8			19.6			13.9			13.7		
Iron	mg/kg	N	15500			13700			19800			15800			18100		
Lead	mg/kg	N	9.8		J	9.4		J	9.5		J	7.2		J	9		J
Magnesium	mg/kg	N	11200			9140			15900			12400			6920		
Manganese	mg/kg	N	491			310			461			361			1050		
Nickel	mg/kg	N	16.2		J	15.1		J	22.9		J	17.1		J	16.6		J
Potassium	mg/kg	N	1530		B	1170		B	2480		J	1650		J	1520		B
Sodium	mg/kg	N	158			113			174			138			118		
Vanadium	mg/kg	N	19.3		B	16.5		B	23.5		B	19.9		B	22.3		B
Zinc	mg/kg	N	130			135			47.8			36.2			50.5		
SEMIVOLATILES																	
Benzo(a)anthracene	µg/kg	N	67	J	J												
Benzo(a)pyrene	µg/kg	N	82	J	J												
Benzo(b)fluoranthene	µg/kg	N	100	J	J												
Benzo(k)fluoranthene	µg/kg	N	68	J	J												
Chrysene	µg/kg	N	100	J	J												
Fluoranthene	µg/kg	N	140	J	J												
Phenanthrene	µg/kg	N	96	J	J												
Pyrene	µg/kg	N	190	J	J												

Table 5-4

Summary of Detected Constituents
Pentolite Road Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SEDIMENT

		GROUP_NAME	BCG			BCG			BCG		
		LOCATION_CODE	BCG-SD001			BCG-SD002			BCG-SD003		
		SAMPLE_NO	AE1001			AE1002			AE1003		
		SAMPLE_DATE	15-Sep-00			15-Sep-00			15-Sep-00		
		START_DEPTH	0			0			0		
		END_DEPTH	1			1			1		
		SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY											
% Solids	Percent	N	40.9			14.8			39.5		
Phosphorous	mg/kg	N				530					
Total organic carbon	mg/kg	N									
METALS											
Aluminum	mg/kg	N	6190		J	11400		J	10400		J
Arsenic	mg/kg	N	7.4		J	3.4		J	6.1		J
Barium	mg/kg	N	51.5		J	86.2		J	58.3		J
Calcium	mg/kg	N	34500		J	79100		J	47900		J
Chromium	mg/kg	N	13.7		J	17.1		J	15.5		J
Cobalt	mg/kg	N	6.6		J	8.1		J	9.5		J
Copper	mg/kg	N	16.9			21			20.3		
Iron	mg/kg	N	14100		J	20900		J	19500		J
Lead	mg/kg	N	13.1		J	18.9		J	15		J
Magnesium	mg/kg	N	10300		J	7940		J	8480		J
Manganese	mg/kg	N	275		J	1330		J	575		J
Nickel	mg/kg	N	16.2		J	22.5		J	23		J
Potassium	mg/kg	N	1210		J	3240		J	2110		J
Sodium	mg/kg	N	776			1060			955		
Vanadium	mg/kg	N	18.9		J	26.2		J	26.4		J
Zinc	mg/kg	N	96		J	118		J	66		J
SEMIVOLATILES											
Benzo(a)anthracene	µg/kg	N									
Benzo(a)pyrene	µg/kg	N									
Benzo(b)fluoranthene	µg/kg	N									
Benzo(k)fluoranthene	µg/kg	N									
Chrysene	µg/kg	N									
Fluoranthene	µg/kg	N									
Phenanthrene	µg/kg	N									
Pyrene	µg/kg	N									

Table 5-4

Summary of Detected Constituents
Pentolite Road Red Water Pond - Abiotic Samples
PBOW, Sandusky, Ohio

SURFACE SOIL

		GROUP_NAME	PRRP			PRRP			BCG			BCG			BCG		
		LOCATION_CODE	PRWP-SO001			PRWP-SO001			BCG-SO001			BCG-SO002			BCG-SO003		
		SAMPLE_NO	AC0001			AC0006			AE0001			AE0002			AE0003		
		SAMPLE_DATE	15-Sep-00			15-Sep-00			12-Sep-00			12-Sep-00			12-Sep-00		
		START_DEPTH	0			0			0			0			0		
		END_DEPTH	1			1			1			1			1		
		SAMPLE_PURPOSE	REG			FD			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																	
% Solids	Percent	N							72.4			75			66.8		
Phosphorous	mg/kg	N										10.7			141		
METALS																	
Aluminum	mg/kg	N							10600		J	10400		J	7900		J
Arsenic	mg/kg	N							9.3		J	4.5		J	5.1		J
Barium	mg/kg	N							104		J	48.8		J	110		J
Calcium	mg/kg	N							5740		J	4550		J	5930		J
Chromium	mg/kg	N							14.8		J	14.2		J	12.1		J
Cobalt	mg/kg	N							7.1		J	4.3		J	4.8		J
Copper	mg/kg	N							14.2			12.4			10.9		
Iron	mg/kg	N							26200		J	14700		J	17900		J
Lead	mg/kg	N							12.8		J	11.6		J	12.8		J
Magnesium	mg/kg	N							2320		J	2180		J	1540		J
Manganese	mg/kg	N							465		J	152		J	605		J
Nickel	mg/kg	N							17.4		J	14.8		J	13.1		J
Potassium	mg/kg	N							1010		J	1250		J	683		J
Sodium	mg/kg	N							774			732			686		
Vanadium	mg/kg	N							28.9		J	21.7		J	22.1		J
Zinc	mg/kg	N							46.8		J	38.2		J	32.1		J
NITROAROMATICS																	
2,4-Dinitrotoluene	µg/kg	N	1200			680											
SEMIVOLATILES																	
Anthracene	mg/kg	N										9E-04	J	J	0.001	J	J
Benzo(a)anthracene	mg/kg	N							0.0071			0.006			0.01		
Benzo(a)pyrene	mg/kg	N							0.01			0.009			0.016		
Benzo(b)fluoranthene	mg/kg	N							0.01			0.008			0.0078		
Benzo(k)fluoranthene	mg/kg	N							0.004			0.004			0.0062		
Chrysene	mg/kg	N							0.01			0.009			0.012		
Fluoranthene	mg/kg	N							0.023			0.021			0.032		
Indeno(1,2,3-cd)pyrene	mg/kg	N							0.0084			0.006			0.028		
Phenanthrene	mg/kg	N							0.0098			0.01			0.017		
Pyrene	mg/kg	N							0.017			0.016			0.025		

Table 5-4

Summary of Detected Constituents
Pentolite Road Red Water Pond - Abiotic Samples
PBOW, Sandusky, Ohio

SURFACE WATER

		GROUP_NAME	PRRP			PRRP			PRRP			PRRP			PRRP			PRRP		
		LOCATION_CODE	PRWP-SW004			PRWP-SW006			PRWP-SW007			PRWP-SW008			PRWP-SW009			PRWP-SW010		
		SAMPLE_NO	AC2004			AC2006			AC2007			AC2008			AC2009			AC2010		
		SAMPLE_DATE	14-Sep-00			14-Sep-00			14-Sep-00			14-Sep-00			14-Sep-00			14-Sep-00		
		SAMPLE_PURPOSE	REG			REG			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																				
Phosphorous	mg/L	N				0.05			0.066			0.12			0.051			0.086		
METALS																				
Aluminum	µg/L	N	712						137			237						494		
Barium	µg/L	N	88.6			74.1			82.5			86.9			83.1			89.7		
Calcium	µg/L	N	109000			107000			118000			117000			118000			113000		
Chromium	µg/L	N	1.2			1.1			0.8			0.9			1.9			0.9		
Cobalt	µg/L	N	1.8																	
Copper	µg/L	N	2.4			1.8			1.8			1.8						7.4		
Iron	µg/L	N	1220			388			364			608			314			1010		
Magnesium	µg/L	N	26000			24400			27100			27100			27300			26400		
Manganese	µg/L	N	149			104			106			148			101			147		
Nickel	µg/L	N	1.7																	
Potassium	µg/L	N	2330			1870			2100			2190			2110			2090		
Sodium	µg/L	N	9510			8950			9910			9790			9920			9620		
Vanadium	µg/L	N	7.2		B	3.6		B	4.1		B	5		B	4.4		B	4.3		B
Zinc	µg/L	N	54.3		J	14		J	13		J	15.2		J	12.1		J	14		J

Table 5-4

Summary of Detected Constituents
Pentolite Road Red Water Pond - Abiotic Samples
PBOW, Sandusky, Ohio

SURFACE WATER

		GROUP_NAME	BCG			BCG			BCG		
		LOCATION_CODE	BCG-SW001			BCG-SW002			BCG-SW003		
		SAMPLE_NO	AE2001			AE2002			AE2003		
		SAMPLE_DATE	15-Sep-00			15-Sep-00			15-Sep-00		
		SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY											
Phosphorous	mg/L	N	0.11			0.084					
METALS											
Aluminum	µg/L	N	270			435					
Barium	µg/L	N	77.2			37.4			32.7		
Calcium	µg/L	N	105000			109000			113000		
Chromium	µg/L	N	0.9		B	1.1		B	1.1		B
Cobalt	µg/L	N									
Copper	µg/L	N	2.3			2.2			1.7		
Iron	µg/L	N	717			1070			618		
Magnesium	µg/L	N	24800			22700			23100		
Manganese	µg/L	N	109			357			332		
Nickel	µg/L	N				1.6					
Potassium	µg/L	N	2050			3050			2990		
Sodium	µg/L	N	9660			24600			21200		
Vanadium	µg/L	N	4.5		B	4.7		B	5.2		B
Zinc	µg/L	N	45.9			11			4.4		B

Table 5-4

Summary of Detected Constituents
Pentolite Road Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

NOTES

Laboratory Qualifiers
J - Result was less than the reporting limit but greater than the instrument detection limit (value is estimated).
B - Analyte was detected in an associated method blank.

Validation Qualifiers
J - Estimated value.
B - Analyte was detected in an associated method blank.

mg/kg - Milligrams per kilogram.
mg/L - Milligrams per liter.
µg/kg - Micrograms per kilogram.
µg/L - Micrograms per liter.
Qual - Laboratory qualifier.
ValQual - Validation qualifier.
REG - Field sample.

Filtered
N - No (applicable to surface water only).

For all analytical results, see Appendix C.

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SEDIMENT

		GROUP_NAME	WARP			WARP			WARP			WARP			WARP			WARP		
		LOCATION_CODE	WRWP-SD001			WRWP-SD001			WRWP-SD002			WRWP-SD003			WRWP-SD004			WRWP-SD005		
		SAMPLE_NO	AD1001			AD1011			AD1002			AD1003			AD1004			AD1005		
		SAMPLE_DATE	14-Sep-00			14-Sep-00			14-Sep-00			14-Sep-00			14-Sep-00			14-Sep-00		
		START_DEPTH	0			0			0			0			0			0		
		END_DEPTH	1			1			1			1			1			1		
		SAMPLE_PURPOSE	REG			FD			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																				
% Solids	Percent	N																		
Phosphorous	mg/kg	N	17.5									29.9						35.2		
Total organic carbon	mg/kg	N	17300						17300			17100			36600			38000		
METALS																				
Aluminum	mg/kg	N	9150			7800			8690			17600			10600			12300		
Antimony	mg/kg	N																		
Arsenic	mg/kg	N	5.1			3.4			3.6			7.7			4.3			4.9		
Barium	mg/kg	N	83.9			46.1			46			126			94.4			102		
Calcium	mg/kg	N	3220			3650			2710			2890			2880			3570		
Chromium	mg/kg	N	12.9			10.6			11.7			22.3			13.9			16.5		
Cobalt	mg/kg	N	8.9			5.5			6.4			11.3			13.1			15.2		
Copper	mg/kg	N	12.5			9.4			9.2			18.3			15.5			17.6		
Iron	mg/kg	N	18000			13200			14100			29300			17600			20900		
Lead	mg/kg	N	25		J	17			14.1		J	23.4		J	14.7		J	19.8		J
Magnesium	mg/kg	N	2630			2390			2390			3880			2900			3460		
Manganese	mg/kg	N	301			157			142			371			321			347		
Nickel	mg/kg	N	16.7		J	11			12.3		J	29		J	23.6		J	23.6		J
Potassium	mg/kg	N	1070		B	855			937		B	2420		J	1490		B	1880		J
Sodium	mg/kg	N	549			755			268			488			420			426		
Vanadium	mg/kg	N	20.2		B	16.6		B	18		B	36.5		B	20.5		B	24.8		B
Zinc	mg/kg	N	56.8			42.7		J	47.2			94.8			77.6			77.2		

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SEDIMENT

		GROUP_NAME	WARP			WARP			WARP			WARP			WARP			BCG		
		LOCATION_CODE	WRWP-SD006			WRWP-SD007			WRWP-SD008			WRWP-SD009			WRWP-SD010			BCG-SD004		
		SAMPLE_NO	AD1006			AD1007			AD1008			AD1009			AD1010			AE1004		
		SAMPLE_DATE	13-Sep-00			14-Sep-00			14-Sep-00			13-Sep-00			13-Sep-00			15-Sep-00		
		START_DEPTH	0			0			0			0			0			0		
		END_DEPTH	1			1			1			1			1			0.5		
		SAMPLE_PURPOSE	REG			REG			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																				
% Solids	Percent	N																63.1		
Phosphorous	mg/kg	N				236			221			208								
Total organic carbon	mg/kg	N																		
METALS																				
Aluminum	mg/kg	N	6930			9270			16400			2170			3630			4920		J
Antimony	mg/kg	N	0.83		J															
Arsenic	mg/kg	N	4.9			3.5			5.5			2.9			3.1			3.9		J
Barium	mg/kg	N	62.5			92.2			154			19.2			26.9			40		J
Calcium	mg/kg	N	11000			3400			6470			8810			7990			10900		J
Chromium	mg/kg	N	12			12.7			22			3.7		B	5.8			7.4		J
Cobalt	mg/kg	N	10.5			7.7			15			4.9			6.4			8.2		J
Copper	mg/kg	N	13.2			19.7			23.4			5.6			9.8			12.1		
Iron	mg/kg	N	13800			16300			24200			7490			8790			11400		J
Lead	mg/kg	N	27.3		J	18		J	68.5		J	5		J	7.5		J	9.1		J
Magnesium	mg/kg	N	2780			2780			5170			1750			1900			2200		J
Manganese	mg/kg	N	283			230			637			178			183			390		J
Nickel	mg/kg	N	14.3		J	20.8		J	36.5		J	10.6		J	14.8		J	20.2		J
Potassium	mg/kg	N	838		B	1040		B	3230		J	596		B	804		B	916		J
Sodium	mg/kg	N	553			860			1890			63.5			93.7			513		
Vanadium	mg/kg	N	15.7		B	18.7		B	30.1		B	6.4		B	9.4		B	11.2		J
Zinc	mg/kg	N	45.7			60.2			117			24.7			36.7			45.6		J

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SEDIMENT

	GROUP_NAME		BCG			BCG		
	LOCATION_CODE		BCG-SD005			BCG-SD006		
	SAMPLE_NO		AE1005			AE1006		
	SAMPLE_DATE		15-Sep-00			15-Sep-00		
	START_DEPTH		0			0		
	END_DEPTH		0.5			0.5		
	SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY								
% Solids	Percent	N	60.8			71		
Phosphorous	mg/kg	N	12.3					
Total organic carbon	mg/kg	N						
METALS								
Aluminum	mg/kg	N	7680		J	6260		J
Antimony	mg/kg	N						
Arsenic	mg/kg	N	5.2		J	3.5		J
Barium	mg/kg	N	48		J	40		J
Calcium	mg/kg	N	9750		J	8190		J
Chromium	mg/kg	N	10.5		J	8.7		J
Cobalt	mg/kg	N	9.3		J	7.6		J
Copper	mg/kg	N	13.6			11.6		
Iron	mg/kg	N	14700		J	11700		J
Lead	mg/kg	N	12.2		J	9.9		J
Magnesium	mg/kg	N	3070		J	2340		J
Manganese	mg/kg	N	321		J	279		J
Nickel	mg/kg	N	21.7		J	17.6		J
Potassium	mg/kg	N	1440		J	1140		J
Sodium	mg/kg	N	744			605		
Vanadium	mg/kg	N	17		J	14.2		J
Zinc	mg/kg	N	56.3		J	44.3		J

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SURFACE SOIL

		GROUP_NAME	WARP			WARP			WARP			WARP		
		LOCATION_CODE	WRWP-SO001			WRWP-SO002			WRWP-SO003			WRWP-SO004		
		SAMPLE_NO	AD0001			AD0002			AD0003			AD0004		
		SAMPLE_DATE	15-Sep-00			15-Sep-00			15-Sep-00			15-Sep-00		
		START_DEPTH	0			0			0			0		
		END_DEPTH	1			1			1			1		
		SAMPLE_PURPOSE	REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY														
% Solids	Percent	N												
Phosphorous	mg/kg	N												
METALS														
Aluminum	mg/kg	N												
Arsenic	mg/kg	N												
Barium	mg/kg	N												
Calcium	mg/kg	N												
Chromium	mg/kg	N												
Cobalt	mg/kg	N												
Copper	mg/kg	N												
Iron	mg/kg	N												
Lead	mg/kg	N												
Magnesium	mg/kg	N												
Manganese	mg/kg	N												
Nickel	mg/kg	N												
Potassium	mg/kg	N												
Sodium	mg/kg	N												
Vanadium	mg/kg	N												
Zinc	mg/kg	N												
SEMIVOLATILES														
Anthracene	µg/kg	N	3.6											
Benzo(a)anthracene	µg/kg	N	25			49	J	J	5.9			3.6	J	J
Benzo(a)pyrene	µg/kg	N	39			7.4			9.9			5.5		
Benzo(b)fluoranthene	µg/kg	N	33			6			9.5			4.8		
Benzo(ghi)perylene	µg/kg	N	16											
Benzo(k)fluoranthene	µg/kg	N	19	D		3.3			3.9			2.6		
Chrysene	µg/kg	N	26			6.7			8.2			4.7	J	J
Dibenz(a,h)anthracene	µg/kg	N	22						9.5	J	J			
Fluoranthene	µg/kg	N	76			17			21			13		
Fluorene	µg/kg	N				6	J	J	7.4	J	J	6.9	J	J
Indeno(1,2,3-cd)pyrene	µg/kg	N	29			6.8			8.3			4.6	J	J
Phenanthrene	µg/kg	N	32			33			40			40		
Pyrene	µg/kg	N	55			120			15			9	J	J

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

SURFACE SOIL

		GROUP_NAME	WARP			BCG			BCG			BCG		
		LOCATION_CODE	WRWP-SO005			BCG-SO004			BCG-SO005			BCG-SO006		
		SAMPLE_NO	AD0005			AE0004			AE0005			AE0006		
		SAMPLE_DATE	15-Sep-00			12-Sep-00			12-Sep-00			12-Sep-00		
		START_DEPTH	0			0			0			0		
		END_DEPTH	1.5			1			1			1		
		SAMPLE_PURPOSE	REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY														
% Solids	Percent	N				80.8			79.7			80.8		
Phosphorous	mg/kg	N				9.1			29.5					
METALS														
Aluminum	mg/kg	N				8280		J	6970		J	6330		J
Arsenic	mg/kg	N				2.3		J	2.6		J	2		J
Barium	mg/kg	N				39.2		J	34.4		J	44.3		J
Calcium	mg/kg	N				1350		J	2300		J	2830		J
Chromium	mg/kg	N				8.4		J	8.1		J	6.3		J
Cobalt	mg/kg	N				2.5		J	2.5		J	2.3		J
Copper	mg/kg	N				4.7		B	5.5		B	8.4		B
Iron	mg/kg	N				10600		J	9890		J	8230		J
Lead	mg/kg	N				7		J	10.4		J	8.3		J
Magnesium	mg/kg	N				949		J	904		J	832		J
Manganese	mg/kg	N				242		J	216		J	277		J
Nickel	mg/kg	N				7.5		J	6.8		J	5.8		J
Potassium	mg/kg	N				430		B	384		J	381		B
Sodium	mg/kg	N				548			469			436		
Vanadium	mg/kg	N				18.3		J	17.5		J	12.5		J
Zinc	mg/kg	N				97.9		J	34.4		J	33.4		J
SEMIVOLATILES														
Anthracene	µg/kg	N	1	J	J									
Benzo(a)anthracene	µg/kg	N	6.6						0.0049	J	J	0.0048	J	J
Benzo(a)pyrene	µg/kg	N	12			0.0038	J	J	0.0078			0.0078		
Benzo(b)fluoranthene	µg/kg	N	9.9			0.0036			0.0078			0.0074		
Benzo(ghi)perylene	µg/kg	N												
Benzo(k)fluoranthene	µg/kg	N	2.9			0.0018	J	J	0.0035			0.0038		
Chrysene	µg/kg	N	9.2			0.0032	J	J	0.0062			0.0063		
Dibenz(a,h)anthracene	µg/kg	N												
Fluoranthene	µg/kg	N	26			0.0085			0.016			0.017		
Fluorene	µg/kg	N												
Indeno(1,2,3-cd)pyrene	µg/kg	N	8.6			0.0022	J	J	0.0074			0.0048	J	J
Phenanthrene	µg/kg	N	32			0.056			0.068			0.13	D	
Pyrene	µg/kg	N	20			0.0058	J	J	0.012			0.012		

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
PBOW, Sandusky, Ohio

SURFACE WATER

		GROUP_NAME	WARP			WARP			WARP			WARP			WARP		
		LOCATION_CODE	WRWP-SW006			WRWP-SW007			WRWP-SW008			WRWP-SW009			WRWP-SW010		
		SAMPLE_NO	AD2006			AD2007			AD2008			AD2009			AD2010		
		SAMPLE_DATE	13-Sep-00			13-Sep-00			13-Sep-00			13-Sep-00			13-Sep-00		
		SAMPLE_PURPOSE	REG			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																	
Phosphorous	mg/L	N	0.26			0.37			0.26						0.21		
METALS																	
Aluminum	µg/L	N	286			888			313			13500			2610		
Arsenic	µg/L	N	9.6			7.2			7.1			10.7					
Barium	µg/L	N	18.3			22			20.4			131			57.1		
Calcium	µg/L	N	15400			18800			16000			21800			69600		
Chromium	µg/L	N				2.5		B	1.2		B	19.8			3.3		B
Cobalt	µg/L	N				1.6						18.7			2.1		
Copper	µg/L	N	3			2.9			1.4			20.5			7.2		
Iron	µg/L	N	331			1060			284			26000			2980		
Lead	µg/L	N										16.8			2.8		
Magnesium	µg/L	N	29700			43600			34000			9040			15500		
Manganese	µg/L	N	91.3			265			130			2960			104		
Nickel	µg/L	N	2.1			3.2			2.1			32.7			8.9		
Potassium	µg/L	N	878		B	1810			726		B	12800			5060		
Sodium	µg/L	N	56000			63200			58400			27100			20100		
Vanadium	µg/L	N	7.5		B	9.7		B	7.9		B	32.7		B	7.6		B
Zinc	µg/L	N	14			11.3			31.9			145			19.9		

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
PBOW, Sandusky, Ohio

SURFACE WATER

		GROUP_NAME	BCG			BCG			BCG		
		LOCATION_CODE	BCG-SW004			BCG-SW005			BCG-SW006		
		SAMPLE_NO	AE2004			AE2005			AE2006		
		SAMPLE_DATE	15-Sep-00			15-Sep-00			15-Sep-00		
		SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY											
Phosphorous	mg/L	N	0.074			0.073			0.085		
METALS											
Aluminum	µg/L	N	478			361			182		
Arsenic	µg/L	N									
Barium	µg/L	N	49.9			50.8			52		
Calcium	µg/L	N	85000			87700			90400		
Chromium	µg/L	N	1.6		B	0.8		B	1		B
Cobalt	µg/L	N				1.1					
Copper	µg/L	N	3.2			2.6			6.7		
Iron	µg/L	N	457			362			201		
Lead	µg/L	N									
Magnesium	µg/L	N	18200			18800			19300		
Manganese	µg/L	N	19.9			19.3			20.4		
Nickel	µg/L	N	4.4			4.3			4.4		
Potassium	µg/L	N	4890			5030			5070		
Sodium	µg/L	N	28000			28200			29000		
Vanadium	µg/L	N	4.7		B	4.9		B	3.9		B
Zinc	µg/L	N	8			6.1			6.1		

Table 5-5

Summary of Detected Constituents
West Area Red Water Pond - Abiotic Samples
PBOW, Sandusky, Ohio

NOTES

Laboratory Qualifers
D - Sample required dilution.
J - Result was less than the reporting limit but greater than the instrument detection limit (value estimated).

Validation Qualifiers
J - Estimated value.
B - Analyte was detected in associated method blank.

µg/kg - Micrograms per kilogram.
µg/L - Micrograms per liter.
mg/kg - Milligrams per kilogram.
mg/L - Milligrams per liter.
REG - Field sample.
FD - Field duplicate.
Qual - Laboratory qualifier.
ValQual - Validation qualifier.

Filtered
N - No (for surface water only).

For all analytical results, see Appendix C.

Table 5-6

Summary of Statistical Tests Comparing Background and Site Data
Plum Brook Ordnance Works, Sandusky, Ohio

Location	Media	COPEC[a]	P-Value[b]	Significant?[c]	Mean Background Rank[d]	Mean Onsite Rank[d]	COPEC Background Related?[e]
West Area RWP	Sediment	Aluminum	0.46	No	4.40	5.75	Yes
		Iron	0.014	Yes	3.00	7.50	No
		Arsenic	0.70	No	12.5	11.2	Yes
		Calcium	0.33	No	4.20	6.00	Yes
		Copper	0.038	Yes	16.8	9.94	Yes
		Phosphorus	0.65	No	2.33	3.00	Yes
	Surface Water	Aluminum	0.54	No	4.50	5.63	Yes
		Iron	0.05	Yes	3.40	7.00	No
		Lead	0.005	Yes	3.40	9.78	No
		Magnesium	0.086	No	3.60	6.75	Yes
		Manganese	0.028	Yes	4.20	9.33	No
		Vanadium	0.055	No	3.60	6.75	Yes
	Soil	Anthracene	0.006	Yes	2.00	12.5	No
		Benzo(a)anthracene	0.006	Yes	2.00	12.5	No
		Benzo(a)pyrene	0.006	Yes	2.00	12.5	No
		Benzo(b)fluoranthene	0.006	Yes	2.00	12.5	No
		Benzo(ghi)perylene	0.006	Yes	2.00	12.5	No
		Benzo(k)fluoranthene	0.006	Yes	2.00	12.5	No
		Chrysene	0.006	Yes	2.00	12.5	No
		Indeno(123-cd)pyrene	0.006	Yes	2.00	12.5	No
		Phenanthrene	0.006	Yes	2.00	12.5	No
Pentolite Road RWP	Sediment	Magnesium	0.062	No	4.20	8.14	Yes
		Potassium	0.17	No	8.20	5.29	Yes
		Carbazole	0.14	No	2.50	5.71	Yes
	Surface Water	Aluminum	0.77	No	6.60	7.25	Yes
		Iron	0.46	No	8.00	6.38	Yes
		Lead	0.72	No	7.40	6.75	Yes
		Manganese	0.66	No	7.60	6.63	Yes
	Soil	Antimony	<0.0001	Yes	92.2	49.6	Yes

See footnotes on page 2.

Table 5-6
Summary of Statistical Tests Comparing Background and Site Data
Plum Brook Ordnance Works, Sandusky, Ohio

[a] Only risk drivers presented, i.e., the COPECs that contributed the majority of the estimated risk in the SLERA.
[b] Calculated using the Mann-Whitney nonparametric statistical test, and tied p-values used.
[c] A p-value of 0.05 or lower is considered statistically significant for a one-tailed test.
[d] Values ranked from lowest to highest, with rank number 1 = lowest rank.
[e] If on-site COPEC mean concentration rank was significantly greater than background mean concentration rank, then the COPEC not considered to be background related. If on-site COPEC mean concentration rank not significantly greater than background mean concentration rank, then the COPEC considered to be background related.

Note: Statistical test details presented in the Appendix D.

Table 5-7

Aquatic Organism Data – Field Counts, Lengths, and Weights
Red Water Ponds, PBOW, Sandusky, Ohio

Location/Sample ID	Species	Count	Total Weight (g)	Average Weight (g)	Lengths (cm)
West Area/AD4001	Fathead minnow	150	240	1.6	3.5 (average)
West Area/AD4002	Green sunfish	29	90	3.1	5.4, 6.0, 4.0, 4.5, 3.8, 6.0, 4.8, 4.4, 6.0, 4.8, 6.2, 5.4, 4.5, 4.5, 5.5, 3.8, 5.0, 6.0, 5.6, 3.4, 6.2, 4.0, 6.0, 3.4, 5.0, 4.4, 3.8, 3.8, 4.0 average = 4.8
West Area/AD4003	Green sunfish	9	115	13	8.0, 7.5, 8.0, 8.2, 8.3, 8.0, 7.5, 7.6, 8.8 average = 8.0
West Area/AD4004	Fathead minnow	170	250	1.5	3.5 (average)
Pentolite Rd/AC4001	Fathead minnow	165	140	0.85	2 - 4, some 7
Pentolite Rd/AC4002	Tadpoles	42	75	1.8	4 and 7 (2 size classes)
Pentolite Rd/AC4003	Crayfish	59	130	2.2	5.0 (average)

g - Grams.
cm - Centimeters.

Table 5-8

Summary of Detected Constituents
Pentolite Road Red Water Pond - Biotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

		GROUP_NAME	PRRP			PRRP			PRRP		
		LOCATION_CODE	PRWP-BI001			PRWP-BI002			PRWP-BI003		
		SAMPLE_NO	AC4001			AC4002			AC4003		
		SAMPLE_DATE	14-Sep-00			14-Sep-00			14-Sep-00		
		SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY											
Percent Lipids	Percent	N	1.4			1.3			0.69		
Phosphorous	mg/kg	N	124		J	162		J	173		J
METALS											
Aluminum	mg/kg	N	148	*	J	541	*	J	183	*	J
Antimony	mg/kg	N	0.16	B	B	0.13	B	B	0.08	B	B
Arsenic	mg/kg	N				1.5	B	J			
Barium	mg/kg	N	5.9	B	J	24			21.3		
Calcium	mg/kg	N	8310			9670			23200		
Chromium	mg/kg	N	0.72	B	J	1.2			0.56	B	J
Cobalt	mg/kg	N				1	B	B			
Copper	mg/kg	N	0.43	B	J	1.7			16.6		
Iron	mg/kg	N	442	N*	J	2900	N*	J	696	N*	J
Lead	mg/kg	N	0.36	B	B	1.4		B	0.55	B	B
Magnesium	mg/kg	N	541			1360			642		
Manganese	mg/kg	N	16.3			68.8			89.7		
Nickel	mg/kg	N	0.58	B	J	2.2			0.66	B	J
Potassium	mg/kg	N	2440			1840			2120		
Sodium	mg/kg	N	727	B	J	1140			1620		
Vanadium	mg/kg	N	0.58	B	J	1.2	B	J	0.38	B	J
Zinc	mg/kg	N	27.3			26			19.3	B	J

mg/kg - Milligrams per kilogram.
Qual - Laboratory qualifier.
ValQual - Validation qualifier.

Laboratory Qualifiers
B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).
N - Spiked sample recovery not within control limits.
* - Duplicate analysis not within control limits.

Validation Qualifiers
J -Estimated value.
B - Analyte was detected in associated method blank.

Filtered
N - No (for surface water samples only).

For all analytical data, see Appendix C.

Table 5-9

Summary of Detected Constituents
West Area Red Water Pond - Biotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

		GROUP_NAME	WARP			WARP			WARP			WARP			WARP			WARP			WARP		
		LOCATION_CODE	WRWP-BI001			WRWP-BI002			WRWP-BI003			WRWP-BI004			WRWP-BI011			WRWP-BI012			WRWP-BI013		
		SAMPLE_NO	AD4001			AD4002			AD4003			AD4004			AD4011			AD4012			AD4013		
		SAMPLE_DATE	13-Sep-00			13-Sep-00			13-Sep-00			13-Sep-00			28-Nov-00			28-Nov-00			28-Nov-00		
		SAMPLE_PURPOSE	REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																							
Percent Lipids	Percent	N	1.4			3.9			2.5			1.5											
Phosphorous	mg/kg	N	129		J	37.8		J	54.6		J	152		J									
METALS																							
Aluminum	mg/kg	N	106	*	J	25	*	J	11.8	B*	J	61.9	*	J									
Antimony	mg/kg	N	0.09	B	B	0.09	B	B	0.1	B	B	0.14	B	B									
Arsenic	mg/kg	N																					
Barium	mg/kg	N	10.1	B	J	1.2	B	J				5.7	B	J									
Cadmium	mg/kg	N																					
Calcium	mg/kg	N	9160			12200			5900			6980											
Chromium	mg/kg	N	0.21	B	J	0.12	B	J				0.11	B	J									
Cobalt	mg/kg	N																					
Copper	mg/kg	N	2									0.44	B	J									
Iron	mg/kg	N	234	*	J	37.6	BN*	J	20.8	B*	J	144	N*	J									
Lead	mg/kg	N	0.52	B	B				0.29	B	B	0.39	B	B									
Magnesium	mg/kg	N	456			411			277			377											
Manganese	mg/kg	N	14.7			6			4	B	J	11											
Nickel	mg/kg	N																					
Potassium	mg/kg	N	2460			2800			2600			2380											
Sodium	mg/kg	N	749	B	J	1030			1020			681	B	J									
Vanadium	mg/kg	N	0.44	B	J																		
Zinc	mg/kg	N	46.9			13.1	B	J	21.3	B	J	36.3											
SEMIVOLATILES																							
Acenaphthene	mg/kg	N																0.38		B	0.84		B
Acenaphthylene	mg/kg	N													0.74		B	0.24		B	0.37		B
Fluorene	mg/kg	N													0.018	J	B	0.019		B	0.047		B
Indeno(1,2,3-cd)pyrene	mg/kg	N													0.008	J	B						
Phenanthrene	mg/kg	N													0.099		B	0.032		B	0.017		B

Table 5-9

Summary of Detected Constituents
West Area Red Water Pond - Biotic Samples
Red Water Ponds, PBOW, Sandusky, Ohio

		GROUP_NAME	WARP			WARP			WARP			WARP			WARP			WARP			WARP		
		LOCATION_CODE	WRWP-BI014			WRWP-BI015			WRWP-BI016			WRWP-BI017			WRWP-BI018			WRWP-BI019			WRWP-BI020		
		SAMPLE_NO	AD4014			AD4015			AD4016			AD4017			AD4018			AD4019			AD4020		
		SAMPLE_DATE	28-Nov-00			28-Nov-00			1-Dec-00			1-Dec-00			1-Dec-00			1-Dec-00			1-Dec-00		
		SAMPLE_PURPOSE	REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Filtered	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
GEN CHEMISTRY																							
Percent Lipids	Percent	N																					
Phosphorous	mg/kg	N							0.037		B	0.056		B	0.047		B	0.098		B	0.146		B
METALS																							
Aluminum	mg/kg	N							70.1			25.5			17.6	B	J	47.8			17.1	B	J
Antimony	mg/kg	N																					
Arsenic	mg/kg	N							2	B	B	1.5	B	B	2	B	B	2.9	B	B	2.1	B	B
Barium	mg/kg	N							58.9		B	65.8		B	69.1		B	72.8		B	50		B
Cadmium	mg/kg	N							0.05	B	B	0.04	B	B	0.06	B	B	0.05	B	B			
Calcium	mg/kg	N							236		B	170	B	B	182	B	B	205		B	215		B
Chromium	mg/kg	N							0.33	B	B	0.27	B	B	0.28	B	B	0.26	B	B	0.13	B	B
Cobalt	mg/kg	N							0.28	B	B	0.21	B	B	0.18	B	B	0.31	B	B	0.38	B	B
Copper	mg/kg	N							3	*	B	4.5	*	B	2.9	*	B	3.2	*	B	3.7	*	B
Iron	mg/kg	N							824		B	445		B	534		B	694		B	346		B
Lead	mg/kg	N							0.88	B	J	0.31	B	J	0.56	B	J	0.43	B	J	0.25	B	J
Magnesium	mg/kg	N							214		B	168	B	B	171	B	B	189	B	B	149	B	B
Manganese	mg/kg	N							5.4		B	2.4	B	B	3.3	B	B	4	B	B	2.3	B	B
Nickel	mg/kg	N							0.37	B	J	0.45	B	J	0.27	B	J	0.27	B	J	0.29	B	J
Potassium	mg/kg	N							1170		B	1300		B	1230		B	1350		B	821		B
Sodium	mg/kg	N							624	B	B	689	B	B	658	B	B	753	B	B	353	B	B
Vanadium	mg/kg	N							0.33	B	B	0.04	B	B	0.17	B	B	0.15	B	B			
Zinc	mg/kg	N							28.5		B	33.9		B	31		B	35		B	24.5	B	B
SEMIVOLATILES																							
Acenaphthene	mg/kg	N	0.38		B	0.36		B															
Acenaphthylene	mg/kg	N	0.29		B	0.74		B															
Fluorene	mg/kg	N	0.037		B	0.032		B															
Indeno(1,2,3-cd)pyrene	mg/kg	N				0.004	J	B															
Phenanthrene	mg/kg	N	0.016		B	0.048		B															

mg/kg - Milligrams per kilogram.
Qual - Laboratory qualifier.
ValQual - Validation qualifier.

Laboratory Qualifiers
B - Analyte detected in laboratory or field blank at concentration greater than the reporting limit (and greater than zero).
N - Spiked sample recovery not within control limits.
* - Duplicate analysis not within control limits.

Validation Qualifiers
Estimated value.
B - Analyte was detecged in associated method blank.

Filtered
N - No (for surface water samples only).

For all analytical data, see Appendix C.

Table 6-1

Refined Selection of Constituents of Potential Ecological Concern at West Area - Surface Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS											
1,3-DINITROBENZENE	1/40 (2.5)	N	0.13	0.3	0.25	U	< 0.25	-	B	N	-
4-AMINO-2,6-DITROTOLUENE	1/40 (2.5)	N	0.13	0.3	0.25	U	< 0.25	-	B	N	-
ANTHRACENE	1/10 (10)	Y	0.20	0.23	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
BENZO(A)ANTHRACENE	1/10 (10)	Y	0.21	0.40	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
BENZO(B)FLUORANTHENE	1/10 (10)	Y	0.20	0.3	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
BENZO(GHI)PERYLENE	1/10 (10)	Y	0.19	0.22	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
BENZO(K)FLUORANTHENE	1/10 (10)	Y	0.21	0.35	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
CHRYSENE	1/10 (10)	Y	0.21	0.42	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
INDENO(1,2,3-CD)PYRENE	1/10 (10)	Y	0.20	0.23	0.37 - 0.4	U	< 0.4	N	-	Y	0.2
PHENANTHRENE	1/10 (10)	Y	0.21	0.36	0.37 - 0.4	U	< 0.4	N	-	Y	0.2

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample. Only risk drivers presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = Distribution not determined if sample size is less than 5.
[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5% and not detected in recent 2000 sampling event.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-2

Refined Selection of Constituents of Potential Ecological Concern at West Area - Total Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration, mg/kg [g]
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS											
1,3-DINITROBENZENE	5/74 (6.8)	N	0.20	0.3 - 2.4	0.25	U	< 0.25	-	-	Y	0.125
4-AMINO-2,6-DITROTOLUENE	6/74 (8.1)	N	0.15	0.3 - 0.7	0.25	U	< 0.25	-	-	Y	0.125
ANTHRACENE	2/18 (11)	Y	0.19	0.12 - 0.23	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
BENZO(A)ANTHRACENE	2/18 (11)	Y	0.21	0.17 - 0.4	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
BENZO(B)FLUORANTHENE	2/18 (11)	Y	0.20	0.14 - 0.3	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
BENZO(GHI)PERYLENE	2/18 (11)	Y	0.19	0.076 - 0.22	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
BENZO(K)FLUORANTHENE	2/18 (11)	Y	0.20	0.11 - 0.35	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
CHRYSENE	2/18 (11)	Y	0.21	0.17 - 0.42	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
INDENO(1,2,3-CD)PYRENE	2/18 (11)	Y	0.19	0.076 - 0.23	0.37 - 0.41	U	< 0.4	N	-	Y	0.2
PHENANTHRENE	2/18 (11)	Y	0.21	0.25 - 0.36	0.37 - 0.41	U	< 0.4	N	-	Y	0.2

[a] Total soil is defined as the interval from 0 to 6 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample. Only risk drivers presented.

[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = Distribution not determined if sample size is less than 5.

[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.

[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).

[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5% and not detected in recent 2000 sampling event.

[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.

[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-3

Refined Selection of Constituents of Potential Ecological Concern at West Area - Surface Water[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean, mg/L	Range of values, mg/L Detected	Range of values, mg/L Nondetected	Statistical Distribution [b]	95% UCL mg/L [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/L [g]
INORGANICS											
ALUMINUM	3/4 (75)	Y	6.6	0.3 - 13.8	0.20	L	1.4E+12	Y	A	N	-
IRON	4/4 (100)	Y	10.4	0.646 - 21.1	NA	N	23.6	N	-	Y	21.1
LEAD	3/9 (33)	Y	0.021	0.025 - 0.077	0.003 - 0.025	L	0.168	N	-	Y	0.077
MAGNESIUM	4/4 (100)	Y	37	25.8 - 50.7	NA	N	52.8	Y	A	N	-
MANGANESE	9/9 (100)	Y	0.63	0.126 - 1.60	NA	L	1.95	N	-	Y	1.6
VANADIUM	1/4 (25)	N	0.032	0.0522	0.05	U	0.0522	Y	A	N	-

[a] Surface water results from totals. Only risk drivers presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-4

Refined Selection of Constituents of Potential Ecological Concern at West Area - Sediment[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS											
ALUMINUM	4/4 (100)	Y	5,993	3,230 - 9,600	NA	L	16,929	Y	A	N	-
ARSENIC	9/17 (53)	Y	4.6	4.0 - 11.3	3.8 - 4.8	L	6.5	Y	A	N	-
CALCIUM	4/4 (100)	Y	27,428	6,710 - 74,700	NA	L	1,716,875	Y	A	N	-
COPPER	7/17 (41)	Y	5.2	3.2 - 24.5	2.4 - 3.2	U	24.5	Y	A	N	-
IRON	4/4 (100)	Y	18,700	16,000 - 24,300	NA	L	24,565	N	-	Y	24,300
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROARMOMATICS											
2-AMINO-4,6-DINITROTOLUENE	1/13 (8)	N	0.14	0.3	0.25	U	0.3	-	-	Y	0.3
MISCELLANEOUS											
PHOSPHORUS	1/1 (100)	Y	3.1	3.1	NA	NA	NA	Y	A	N	-

[a] Only risk drivers presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-5

Refined Selection of Constituents of Potential Ecological Concern at Pentolite Road Area - Surface Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean (mg/kg)	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
SEMIVOLATILE ORGANIC COMPOUNDS											
1,3-DINITROBENZENE	6/50 (12)	N	0.20	0.3 - 1.6	0.25	U	< 0.25	-	-	Y	0.125
1,3,5-TRINITROBENZENE	5/50 (10)	N	0.20	0.4 - 1.7	0.25	U	< 0.25	-	-	Y	0.125
4-AMINO-2,6-DINITROTOLUENE	1/50 (2.0)	N	0.18	2.7	0.25	U	< 0.25	-	B	N	-

[a] Surface soil is defined as the interval from 0 to 3 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample. Only risk drivers presented.

[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution. NA = distribution not determined if sample size is less than 5.

[c] 95% Upper confidence limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.

[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).

[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):

A = within background concentration.

B = detection frequency less than 5% and not detected in recent 2000 sampling event.

[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.

[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-6

Refined Selection of Constituents of Potential Ecological Concern At Pentolite Road Area - Total Soil[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean (mg/kg)	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS											
ANTIMONY	11/90 (12)	N	3.5	3.6 - 9.3	5.2 - 7.7	U	< 6.8	Y	A	N	-
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS											
1,3-DINITROBENZENE	15/90 (17)	N	0.48	0.3 - 9.3	0.25	U	< 0.25	-	-	Y	0.125
1,3,5-TRINITROBENZENE	17/90 (19)	N	1.8	0.4 - 58	0.25	U	< 0.25	-	-	Y	0.125
4-AMINO-2,6-DINITROTOLUENE	4/90 (4.4)	N	0.28	0.3 - 9.5	0.25 - 2.5	U	< 0.25	-	B	N	-
NITROBENZENE	1/104 (0.96)	N	0.20	1.1	0.25 - 4.2	U	< 0.26	-	B	N	-

[a] Total soil is defined as the interval from 0 to 6 feet below the ground surface. Soil samples were classified on the basis of the end depth of the sample. Only risk drivers presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution.
NA = distribution not determined if sample size is less than 5.
[c] 95% Upper Confidence Limit calculated for the indicated distribution. NA = sample size is less than 5 and distribution is not calculated.
[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).
[e] Rationale for exclusion of chemical as a contaminant of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5% and not detected in recent 2000 sampling event.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-7

Refined Selection of Constituents of Potential Ecological Concern at Pentolite Road Area - Surface Water[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean, mg/L	Range of values, mg/L		Statistical Distribution [b]	95% UCL mg/L [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/L [g]
				Detected	Nondetected						
INORGANICS											
ALUMINUM	2/2 (100)	Y	1.8	0.53 - 3.04	NA	NA	NA	Y	A	N	-
IRON	2/2 (100)	Y	3.4	0.972 - 5.79	NA	NA	NA	Y	A	N	-
LEAD	1/2 (50)	N	0.0051	0.0087	0.003	NA	NA	Y	A	N	-
MANGANESE	2/2 (100)	Y	0.33	0.261 - 0.404	NA	NA	NA	Y	A	N	-

[a] Surface water results from totals. Only risk drivers presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-8

Refined Selection of Constituents of Potential Ecological Concern at Pentolite Road Area - Sediment[a]
Red Water Ponds, PBOW, Sandusky, Ohio

Chemical	Frequency of Detection	Detected in 2000 Samples	Arithmetic Mean, mg/kg	Range of values, mg/kg Detected	Range of values, mg/kg Nondetected	Statistical Distribution [b]	95% UCL mg/kg [c]	Background Related?[d]	Exclusion Rationale [e]	COPEC? [f]	Source-Term Concentration mg/kg [g]
INORGANICS											
MAGNESIUM	2/2 (100)	Y	16,400	13,500 - 19,300	NA	NA	NA	Y	A	N	-
POTASSIUM	1/2 (50)	Y	678	1,040	631	NA	NA	Y	A	N	-
SEMIVOLATILE ORGANIC COMPOUNDS AND NITROAROMATICS											
CARBAZOLE	1/2 (50)	N	0.23	0.18	0.57	NA	NA	Y	A	N	-

[a] Only risk drivers presented.
[b] Statistical Distribution: N = Normal distribution; L = Lognormal distribution; U = Undetermined distribution; NA = Not applicable.
[c] 95% Upper confidence limit calculated for the indicated distribution.
[d] Results from Mann-Whitney nonparametric statistical test (see Table 5-6).
[e] Rationale for exclusion of chemical as a constituent of potential ecological concern (COPEC):
A = within background concentration.
B = detection frequency less than 5%.
[f] N = Chemical is not chosen as a COPEC; Y = Chemical is chosen as COPEC.
[g] For Reasonable Maximum Exposure (RME) scenario, concentration used in risk assessment equal to 95% UCL or maximum value, if maximum value is less than UCL or if no UCL is calculated.
For Central Tendency (CT) scenario, arithmetic mean value used.

Table 6-9

Summary of Site-Specific BCFs for Inorganics in Aquatic Worms and Fish
West Area Red Water Pond
Red Water Ponds, PBOW, Sandusky, Ohio

Inorganic Constituent	Aquatic Worm BCFs		Fish BCFs	
	CT	RME	CT	RME
Aluminum	0.0035	0.0035	15	15
Antimony	- [a]	-	13	18
Arsenic	0.03	0.22	40	40
Barium	0.00031	0.39	87	87
Cadmium	-	-	NA [b]	NA
Calcium	0.001	0.033	302	302
Chromium	0.004	0.009	29	29
Cobalt	0.002	0.013	40	40
Copper	0.02	0.13	102	102
Iron	0.000051	0.015	18	18
Lead	0.025	0.025	23	43
Magnesium	0.0002	0.030	14	14
Manganese	0.000057	0.006	13	13
Nickel	0.018	0.018	15	15
Potassium	0.18	64.6	648	648
Sodium	0.30	0.77	19	19
Vanadium	0.10	0.50	205	205
Zinc	0.0034	0.23	662	662

[a] Dashes indicate constituent was not detected in both tissue and associated media sample(s).
[b] NA = not analyzed.

Notes:

- Central Tendency (CT) and Reasonable Maximum Exposure (RME) approaches used to calculate the biological accumulation factors (BCFs) are discussed in the text.
- BCF calculation details are presented in Appendix F.

Table 6-10

Summary of Site-Specific BCFs for PAHs and Nitroaromatics in Earthworms
Red Water Ponds
Red Water Ponds, PBOW, Sandusky, Ohio

Constituent	Earthworm BCFs			
	West Area		Pentolite Road	
	CT	RME	CT	RME
PAHs				
Naphthalene	- [a]	-	NA [b]	NA
Acenaphthylene	1.7	9.3	NA	NA
Acenaphthene	1.7	4.9	NA	NA
Fluorene	1.5	2.5	NA	NA
Phenanthrene	0.1	0.6	NA	NA
Anthracene	1.1	1.1	NA	NA
Fluoranthene	0.21	0.21	NA	NA
Pyrene	0.45	0.45	NA	NA
Benzo(a)anthracene	0.58	0.58	NA	NA
Chrysene	0.55	0.55	NA	NA
Benzo(b)fluoranthene	0.21	0.21	NA	NA
Benzo(k)fluoranthene	0.47	0.47	NA	NA
Benzo(a)pyrene	0.46	0.46	NA	NA
Dibenzo(a,h)anthracene	1.42	1.42	NA	NA
Benzo(ghi)perylene	0.50	0.50	NA	NA
Indeno(123-cd)pyrene	0.56	0.51	NA	NA
Nitroaromatics				
2,4-Dinitrotoluene	-	-	0.1	0.1

[a] Dash indicates constituent was not detected in both tissue and associated media sample.
[b] NA = not available, as PAHs were not risk drivers in soil at Pentolite Road RWP, thus PAH analyses were not performed for on soil and tissue samples.

Notes:

- Central Tendency (CT) and Reasonable Maximum Exposure (RME) approaches used to calculate the biological accumulation factors (BCFs) are discussed in the text.
- BCF calculation details are presented in Appendix F.
- Constituent is not presented if it was not detected in both the tissue sample and the associated media sample.

Table 6-11

Summary of Site-Specific BCFs for Inorganics in Aquatic Organisms
Multiple Species Results, Central Tendency Approach
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Constituent	Calculated Fish Bioconcentration Factor (BCF)			CT BCF (Mean)
	Fathead Minnow	Tadpole	Crayfish	
Aluminum	787	2,876	973	1,545
Antimony	12.5	12.7	12.7	12.7
Arsenic	120	682	120	308
Barium	70.86	288	256	205
Calcium	72.5	84.4	202	120
Chromium	643	1,071	500	738
Cobalt	345	345	345	345
Copper	160	632	6,171	2,321
Iron	786	5,402	1,297	2,495
Lead	84.6	84.6	84.6	84.6
Magnesium	20.4	51.4	24.3	32.0
Manganese	134	568	740	481
Nickel	725	2,750	825	1,433
Phosphorous	1,662	2,172	2,319	2,051
Potassium	1,178	888	1,023	1,030
Sodium	75.4	118	168	121
Vanadium	552	1,143	362	686
Zinc	1,999	1,903	1,413	1,772

Notes

(1) For details on Reasonable Maximum Exposure (RME) and Central Tendency (CT) approaches, see text.

(2) Details in Appendix F.

Table 6-12

Summary of Site-Specific BCFs for Inorganics in Aquatic Organisms- Multiple Species Results
Reasonable Maximum Exposure Approach
Pentolite Road
Red Water Ponds, PBOW, Sandusky, Ohio

Constituent	Calculated Fish Bioconcentration Factor Fathead	Calculated Fish Bioconcentration Factor Tadpole	Calculated Fish Bioconcentration Factor Crayfish	RME BCF (Maximum)
Aluminum	787	2,876	973	2,876
Antimony	29.1	23.6	14.5	29.1
Arsenic	120	682	120	682
Barium	70.9	288	256	288
Calcium	72.5	84.4	202	202
Chromium	643	1,071	500	1,071
Cobalt	345	909	345	909
Copper	160	632	6,171	6,171
Iron	786	5,402	1,297	5,402
Lead	138	538	212	538
Magnesium	20.4	51.4	24.3	51.4
Manganese	134	568	740	740
Nickel	725	2,750	825	2,750
Phosphorous	1,662	2,172	2,319	2,319
Potassium	1,178	888	1,023	1,178
Sodium	75.4	118	168	168
Vanadium	552	1,143	362	1,143
Zinc	1,999	1,903	1,413	1,999

Notes

(1) For details on Reasonable Maximum Exposure (RME) and Central Tendency (CT) approaches, see text.

(2) Details in Appendix F.

Table 6-13

Reference Toxicity Values Used to Derive Wildlife Toxicity Benchmarks for Chemicals of Potential Ecological Concern Red Water Ponds, PBOW, Sandusky, Ohio

COPEC	Mammalian Data						Avian Data					
	Toxicity Value	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Test Species	Reference	Body Wt. (kg)	Toxicity Value	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Test Species	Reference	Body Wt. (kg)
Organics												
1,3,5-Trinitrobenzene	--	13.31	2.68	rat	IRIS on-line (2001)	0.35	42 (LD_{50})	4.2	0.42	red-winged black bird	1,3-DNB as surrogate	0.077
1,3-Dinitrobenzene (1,3-DNB)	--	1.13	0.113	rat	Talmage et. al (1999)	0.35	42 (LD_{50})	4.2	0.42	red-winged black bird	Talmage et. al. (1999)	0.077
2-Amino-4,6-dinitrotoluene	1394 (LD_{50})	139	13.9	rat	TOMES database	0.35	178 and 7	17.8	0.7	Bobwhite quail	2,4,6-TNT as surrogate	0.19
4-Amino-2,6-dinitrotoluene	959 (LD_{50})	95.9	9.59	rat	TOMES database	0.35	178 and 7	17.8	0.7	Bobwhite quail	2,4,6-TNT as surrogate	0.19
Anthracene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Carbazole	200 (LD_{50})	20	2.0	mouse	TOMES database	0.03	NA	NA	NA	NA	NA	NA
Chrysene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Nitrobenzene	4.6	2.3	0.23	mouse	IRIS on-line (2001)	0.03	42 (LD_{50})	4.2	0.42	red-winged black bird	1,3-DNB as surrogate	0.077
Phenanthrene	--	10	1.0	mouse	B(a)P as surrogate	0.03	NA	NA	NA	NA	NA	NA
Inorganics												
Aluminum	--	19.3	1.93	mouse	Sample, et al. (1996)	0.03	--	1,100	110	ringed dove	Sample, et al. (1996)	0.155
Arsenic	--		0.126	mouse	Sample, et al. (1996)	0.03	--		5.14	mallard duck	Sample, et al. (1996)	1.0
Antimony	--	1.25	0.125	mouse	Sample, et al. (1996)	0.03	--	NA	NA	NA	NA	NA
Arsenic	--	1.26	0.126	mouse	Sample, et al. (1996)	0.03	--	7.38	2.46	cowbird	Sample, et al. (1996)	0.049
Calcium	--	5265	1053	rabbit	(See Appendix)	3.8	--	14165	2833	Japanese quail	(See Appendix)	0.072
Copper	--	15.14	11.7	mink	Sample, et al. (1996)	1.0	--	61.7	47	chicks	Sample, et al. (1996)	0.534

Table 6-13

Reference Toxicity Values Used to Derive
Wildlife Toxicity Benchmarks for Chemicals of Potential Ecological Concern
Red Water Ponds, PBOW, Sandusky, Ohio

COPEC	Mammalian Data						Avian Data					
	Toxicity Value	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Test Species	Reference	Body Wt. (kg)	Toxicity Value	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Test Species	Reference	Body Wt. (kg)
Iron	--	130	26	rabbit	(See Appendix)	3.80	--	250	50	poultry	(See Appendix)	1.6
Lead	--	80	8.0	rat	Sample, et al. (1996)	0.35	--	38.5	3.85	Am. Kestrel	Sample, et al. (1996)	0.13
Magnesium	--	790	158	rabbit	(See Appendix)	3.8	--	750	150	poultry	(See Appendix)	1.6
Manganese	--	284	88	rat	Sample, et al. (1996)	0.35	--	9770	977	Japanese quail	Sample, et al. (1996)	0.072
Phosphorus	--	2630	526	rabbit	(See Appendix)	3.8	--	2000	400	poultry	(See Appendix)	1.6
Potassium	--	7895	1,579	rabbit	(See Appendix)	3.8	--	5000	1,000	poultry	(See Appendix)	1.6
Vanadium	--	2.1	0.2	rat	Sample, et al. (1996)	0.26	--	114	11.4	mallard duck	Sample, et al. (1996)	1.17

Notes:

NA indicates that the information is not available.
NOAELs for selected nutrients are based on mineral dietary requirements (Appendix G).

The following surrogate values were used:
Benzo(a)pyrene for anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and phenanthrene.
2,4,6-TNT for 2-Amino-4,6-dinitrotoluene and 4-Amino-2,6-dinitrotoluene.

LD50 values are from RTECS (1998) as summarized in the TOMES CPC™ System Data Base (1/1/99).
LD50 values were converted to chronic NOAELs by dividing by a factor of 100 and subchronic LOAELs were converted to chronic NOAELs by dividing by a factor of 20, as recommended by Wentsel, et. al. (1996), Tri-Service Procedural Guidelines for Ecological Risk Assessments.
For Nutrients, NOAELs were set at maximum tolerated dose levels (see Appendix G) and multiplied by an uncertainty factor of 5 (rather than 10 used for non-nutrients) to estimate a LOAEL from a NOAEL because additional uncertainty is associated with nutrient toxicity.
For studies that did not report a LOAEL, it was estimated from the NOAEL by multiplication by an uncertainty factor of 10 (except for nutrients, as discussed above).

Red-wing blackbird body weight assumed to be equal to American robin.
2,4,6-TNT RTV values from Johnson and McAtee, 2000.

Only risk drivers are presented.

Table 6-14

Uncertainty Factors [a] for Ecological RTV [b] Extrapolations [c]
Red Water Ponds, PBOW, Sandusky, Ohio

Laboratory Animals (Toxicity Data Base)		Selected Site Receptor Species	
Rat	G: Rattus F: Muridae O: Rodentia	Deer mouse	G: Peromyscus F: Cricetidae O: Rodentia
Mouse	G: Mus F: Muridae O: Rodentia	Eastern cottontail	G: Sylvilagus F: Leporidae O: Lagomorpha
Mink	G: Mustela F: Mustelidae O: Carnivora	Raccoon	G: Procyon F: Procyonidae O: Carnivora
Rabbit: (N. Zealand White)	G: Oryctolagus F: Leporidae O:Lagomorpha	Short-tailed shrew	G: Blarina F: Soricidae O: Insectivora
Ringed dove	G: Streptopelia F: Columbidae O: Columbiformes	White-tailed deer	G: Odocoileus F: Cervidae O: Artiodactyla
Cowbird	G: Molothrus F: Emberizidae O: Passeriformes	Great blue heron	G: Ardea F: Ardeidae O: Ciconiiformes
Chick, Poultry	G: Gallus F: Phasianidae O: Galliformes	Marsh wren	G: Cistothorus F: Troglodytidae O: Passeriformes
Black duck, Mallard	G: Anas F: Anatidae O: Anseriformes		
Japanese quail	G: Coturnix F: Phasianidae O: Galliformes		
American kestrel	G: Falco F: Falconidae O: Falconiformes		

[a] From *Tri-Service Procedural Guidelines for Ecological Risk Assessment* (Wentsel et al. 1996)
[b] RTV = Reference Toxicity Value
[c] Interclass extrapolations not performed; only within bird class or within mammal class.

Extrapolation between two different species = uncertainty factor of 2
Extrapolation between two different genera (G) = uncertainty factor of 4
Extrapolation between two different families (F) or orders (O) = uncertainty factor of 8
Thus, for all extrapolations used in the BERA RME food chain model (except for the New Zealand White extrapolated to the cottontail), an uncertainty factor of 8 was used. For the latter, an uncertainty factor of 4 was used.

Table 6-15

Terrestrial Receptors Hazard Index (HI) Summary for West Area[a]
Central Tendency and Reasonable Maximum Exposure
Red Water Ponds, PBOW, Sandusky, Ohio

Media	Terrestrial Receptor					
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer
Soil [b] HI	0.006 - 0.5	0.002 - 0.15	0.03 - 2.5	- [c]	0.006 - 0.5	0.0006 - 0.03
Risk Drivers	—	—	100% - PAHs (invertebrate intake)	—	—	—
Surface Water HI	0.003 - 0.3	0.003 - 0.15	0.002 - 0.2	0.01 - 1.0	0.008 - 0.6	0.003 - 0.3
Risk Drivers	—	—	—	—	—	—
Total Receptor HI	0.009 - 0.8	0.005 - 0.3	0.03 - 2.7	0.01 - 1.0	0.01 - 1.2	0.004 - 0.3

[a] Details presented in eco risk assessment spreadsheets in Appendix H. Only risk drivers considered
[b] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated COPEC via deep feeder roots.
[c] No hazard estimated. COPEC(s) screened out due to background or low frequency of detection, or COPEC(s) toxicity values not available.

Notes :

(1) CT and RME approach assumptions include differences in exposure point concentrations; toxicity values; interclass toxicity uncertainty factor; and method of calculation of site-specific soil-to-invertebrate biological accumulation factor (see text for details).

(2) Red-tailed hawk not presented as SLERA hazards were acceptable.

(3) Risk drivers percentage is based on intake pathway indicated.

Table 6-16

Aquatic Receptor Hazard Index (HI) Summary for West Area [a]
Central Tendency and Reasonable Maximum Exposure
Red Water Ponds, PBOW, Sandusky, Ohio

Media	Aquatic Receptor	
	Great Blue Heron	Raccoon
Sediment HI	0.4 - 26	0.37 - 20
Risk Drivers	100% Iron (Sediment intake, for RME)	100% Iron (Sediment intake, for RME)
Surface Water HI	0.002 - 0.2	0.004 - 0.3
Risk Drivers	—	—
Total Receptor HI	0.4 - 26	0.4 - 21

[a]Details presented in ecological risk assessment spreadsheets (Appendix H), only risk drivers considered.

Note:

(1) Central tendency (CT) and reasonable maximum exposure (RME) approach assumptions include differences in exposure point concentrations; toxicity values; interclass toxicity uncertainty factors; and method of calculation of site-specific surface water-to-fish and sediment-to-invertebrate biological accumulation factors (see text for details).

(2) Risk driver percentage is based on intake pathway indicated.

Table 6-17

Terrestrial Receptors Hazard Index (HI) Summary for Pentolite Road Area[a]
Central Tendency and Reasonable Maximum Exposure
Red Water Ponds, PBOW, Sandusky, Ohio

Media	Terrestrial Receptor					
	Deer Mouse	Cottontail	Shrew	Marsh Wren	Raccoon	Deer
Soil [b] HI	0.06 - 2.7	0.07 - 3.2	0.01 - 0.3	0.01 - 0.5	0.05 - 2.2	0.002 - 0.03
Risk Drivers:	94% 1,3-DNB (plant intake for RME)	94% 1,3-DNB (plant intake for RME)	—	—	94% 1,3-DNB(plant intake for RME)	—
Surface Water HI	—[c]	—	—	—	—	—
Risk Drivers:	—	—	—	—	—	—
Total Receptor HI	0.06 - 2.7	0.07 - 3.2	0.01 - 0.3	0.01 - 0.5	0.05 - 2.2	0.002 - 0.03

[a] Details presented in ecological risk assessment spreadsheets in Appendix H. Only risk drivers considered.
[b] All receptors exposed to surface soil, except burrowing shrew exposed to surface and subsurface soil via ingestion of soil and ingestion of terrestrial invertebrates, and deer exposed to surface and subsurface soil via ingestion of plants (e.g., tree leaves) that have translocated COPEC via deep feeder roots.
[C] No hazard estimate due to COPEC(s) screened out due to background or low frequency of detection, or COPEC(s) toxicity values not available.

Notes :

(1) CT and RME approach assumptions include differences in exposure point concentrations; toxicity values; interclass toxicity uncertainty factor; and method of calculation of site-specific soil- to-invertebrate biological accumulation factor (see text for details).

(2) Red-tailed hawk note presented as SLERA hazards were acceptable.

(3) Risk driver percentage based on intake pathway indicated.

Table 6-18

Surface Water Toxicity and Surface Water Concentration Correlation Results
Red Water Ponds, PBOW, Sandusky, Ohio

Test Species = Fathead Minnow
Toxicity Endpoint = Survival

Constituent	Statistical Correlation Between Minnow Survival and Surface Water Concentration	Correlation Result Suggests the Following:
Aluminum	+ 0.36	Inorganic concentration not related to toxicity
Arsenic	+ 0.86	Inorganic concentration not related to toxicity
Barium	! 0.47	Inorganic concentration not related to toxicity
Calcium	**! 0.93**	Inorganic concentration may be related to toxicity
Chromium	+ 0.27	Inorganic concentration not related to toxicity
Cobalt	+ 0.35	Inorganic concentration not related to toxicity
Copper	+ 0.32	Inorganic concentration not related to toxicity
Iron	+ 0.33	Inorganic concentration not related to toxicity
Lead	+ 0.33	Inorganic concentration not related to toxicity
Magnesium	+ 0.20	Inorganic concentration not related to toxicity
Manganese	+ 0.34	Inorganic concentration not related to toxicity
Nickel	+ 0.39	Inorganic concentration not related to toxicity
Phosphorus	+ 0.68	Inorganic concentration not related to toxicity
Potassium	+ 0.16	Inorganic concentration not related to toxicity
Sodium	+ 0.88	Inorganic concentration not related to toxicity
Zinc	+ 0.37	Inorganic concentration not related to toxicity

Test Species = Water Flea
Toxicity Endpoint = Reproductive Success

Constituent	Statistical Correlation Between Water Flea Offspring Production and Surface Water Concentration	Correlation Result Suggests the Following:
Aluminum	! 0.14	Inorganic concentration not related to toxicity
Arsenic	+ 0.17	Inorganic concentration not related to toxicity
Barium	! 0.43	Inorganic concentration not related to toxicity
Calcium	! 0.29	Inorganic concentration not related to toxicity
Chromium	! 0.24	Inorganic concentration not related to toxicity
Cobalt	! 0.16	Inorganic concentration not related to toxicity
Copper	! 0.10	Inorganic concentration not related to toxicity
Iron	! 0.18	Inorganic concentration not related to toxicity
Lead	! 0.20	Inorganic concentration not related to toxicity
Magnesium	+ 0.45	Inorganic concentration not related to toxicity
Manganese	! 0.18	Inorganic concentration not related to toxicity
Nickel	! 0.13	Inorganic concentration not related to toxicity
Phosphorus	+ 0.64	Inorganic concentration not related to toxicity
Potassium	! 0.14	Inorganic concentration not related to toxicity
Sodium	+ 0.43	Inorganic concentration not related to toxicity
Zinc	! 0.29	Inorganic concentration not related to toxicity

Notes:
- Toxicity test details in Appendix E and surface water data in Section 5.0 and Appendix C.
- If constituent concentration was non detect, one-half of the detection limit was used in the statistical analysis.
- Correlation results may range from + 1.0 to ! 1.0, with "+" value indicating positive correlation and "!" value indicating negative correlation. Values near zero suggest poor statistical correlation, whereas values near ∀ 1.0 suggest good statistical correlation. Constituent-specific significant ($P_{0.05}$) toxicity is indicated in **bold** if elevated negative correlation is found, as toxicity is inversely related to survival and reproductive success. For significant negative correlation, correlation must be ∃0.60, given sample size of 10 and degrees of freedom = 9.

Table 6-19

Sediment Toxicity and Sediment Concentration Correlation Results
Red Water Ponds, PBOW, Sandusky, Ohio

Test Species = Amphipod Crustacean **Toxicity Endpoint = Survival**		
Constituent	**Statistical Correlation Between Amphipod Survival and Sediment Concentration**	**Correlation Result Suggests the Following:**
Aluminum	! 0.46	Inorganic concentration not related to toxicity
Antimony	**! 0.94**	Inorganic concentration may be related to toxicity
Arsenic	! 0.80	Inorganic concentration not related to toxicity
Barium	! 0.45	Inorganic concentration not related to toxicity
Calcium	! 0.33	Inorganic concentration not related to toxicity
Chromium	! 0.58	Inorganic concentration not related to toxicity
Cobalt	! 0.65	Inorganic concentration not related to toxicity
Copper	! 0.43	Inorganic concentration not related to toxicity
Iron	! 0.50	Inorganic concentration not related to toxicity
Lead	! 0.51	Inorganic concentration not related to toxicity
Magnesium	! 0.46	Inorganic concentration not related to toxicity
Manganese	! 0.41	Inorganic concentration not related to toxicity
Nickel	! 0.24	Inorganic concentration not related to toxicity
Phosphorus	+ 0.21	Inorganic concentration not related to toxicity
Potassium	! 0.22	Inorganic concentration not related to toxicity
Sodium	! 0.43	Inorganic concentration not related to toxicity
Zinc	! 0.35	Inorganic concentration not related to toxicity

Notes:

- Toxicity test details in Appendix E and sediment data in Section 5.0 and Appendix C.
- If constituent concentration was non detect, one-half of the detection limit was used in the statistical analysis.
- Correlation results may range from + 1.0 to ! 1.0, with "+" value indicating positive correlation and "!" value indicating negative correlation. Values near zero suggest poor statistical correlation, whereas values near ∀ 1.0 suggest good statistical correlation. Constituent-specific significant ($P_{0.05}$) toxicity is indicated in bold if elevated negative correlation is found, as toxicity is inversely related to survival. For significant negative correlation, correlation must be ∃0.81 given sample size of 5 and degrees of freedom = 4.

Table 6-20

Soil Toxicity and Soil Concentration Correlation Results
Red Water Ponds, PBOW, Sandusky, Ohio

Test Species = Earthworm **Toxicity Endpoint = Survival**		
Constituent	**Statistical Correlation Between Earthworm Survival and Soil Concentration**	**Correlation Result Suggests the Following:**
Anthracene	**! 1.0**	Organic concentration may be related to toxicity
Benzo(a)anthracene	! 0.23	Organic concentration not related to toxicity
Benzo(a)pyrene	**! 0.99**	Organic concentration may be related to toxicity
Benzo(b)fluoranthene	**! 0.99**	Organic concentration may be related to toxicity
Benzo(ghi)perylene	**! 1.0**	Organic concentration may be related to toxicity
Benzo(k)fluoranthene	**! 1.0**	Organic concentration may be related to toxicity
Chrysene	**! 0.99**	Organic concentration may be related to toxicity
Dibenzo(ah)anthracene	**! 0.99**	Organic concentration may be related to toxicity
Fluoranthene	**! 0.98**	Organic concentration may be related to toxicity
Fluorene	+ 0.53	Organic concentration not related to toxicity
Indeno(123-cd)pyrene	**! 0.99**	Organic concentration may be related to toxicity
Phenanthrene	+ 0.44	Organic concentration not related to toxicity
Pyrene	! 0.16	Organic concentration not related to toxicity

Notes:

- Toxicity test details in Appendix E and soil data in Section 5.0 and Appendix C.
- If constituent concentration was non detect, one-half of the detection limit was used in the statistical analysis.
- Correlation results may range from + 1.0 to ! 1.0, with "+" value indicating positive correlation and "!" value indicating negative correlation. Values near zero suggest poor statistical correlation, whereas values near ∀ 1.0 suggest good statistical correlation. Constituent-specific significant ($P_{0.05}$) toxicity is indicated in **bold** if elevated negative correlation is found, as toxicity is inversely related to survival. For significant negative correlation, correlation must be ∃0.81, given sample size of 5 and degrees of freedom = 4.

Table 6-21

Uncertainty Analysis
Red Water Ponds, PBOW, Sandusky, Ohio

Component	Bias	Magnitude	Ways to Minimize Uncertainty
Refined Food Chain Model			
Use of 95% UCL as source-term concentration in RME approach	Overestimates Risk	Medium	Use central tendency
Assumption that soil depth interval of 0-3 ft is representative of surface soil	Overestimates Risk	Low to Medium	Resample to obtain additional samples 0-0.5 ft. for surface soil characterization
Use of site-specific BCFs calculated using blank-related tissue concentrations	Overestimates Risk	Medium to High	Use site-specific BCFs calculated using associated analytical detection limit for tissue concentrations
Assumption that MDC for COPEC in surface water or sediment is representative	Overestimates Risk	Medium	Evaluate additional surface water and sediment samples for those COPECs with < 5 data points
Use of representative receptor species for site ecological community	Underestimates Risk	Low	Select additional receptor species
Use of average intake values and average body weights	Underestimates Risk	Low	Measure site-specific intake values and species= body weights
Use of conservative foraging factors (i.e., 100%) for all species, except deer	Overestimates Risk	Medium	Use site-specific foraging factors, i.e., less than 100%
Discounting of dermal and inhalation exposure routes	Underestimates Risk	Low	Include dermal and inhalation routes of exposure
Use of safety factors to convert LOAEL and LD_{50} toxicity data to NOAELs	Overestimates Risk	Medium	Obtain COPEC-specific NOAEL data
For the RME approach, use of uncertainty factor of 8 to extrapolate RTVs between most species within the same class	Overestimates Risk	Medium	1) Assume RTVs similar for all species in the same genus, family, or order (default UF = 1)
Assumption that body weight scaling factor = 0 for all bird species = NOAEL toxicity data	Overestimates or Underestimates Risk	Low	Obtain species-specific NOAEL toxicity data
Use of surrogate constituents to estimate toxicity for those COPECs without available toxicity data	Overestimates Risk	Low to Medium	Obtain COPEC-specific toxicity data

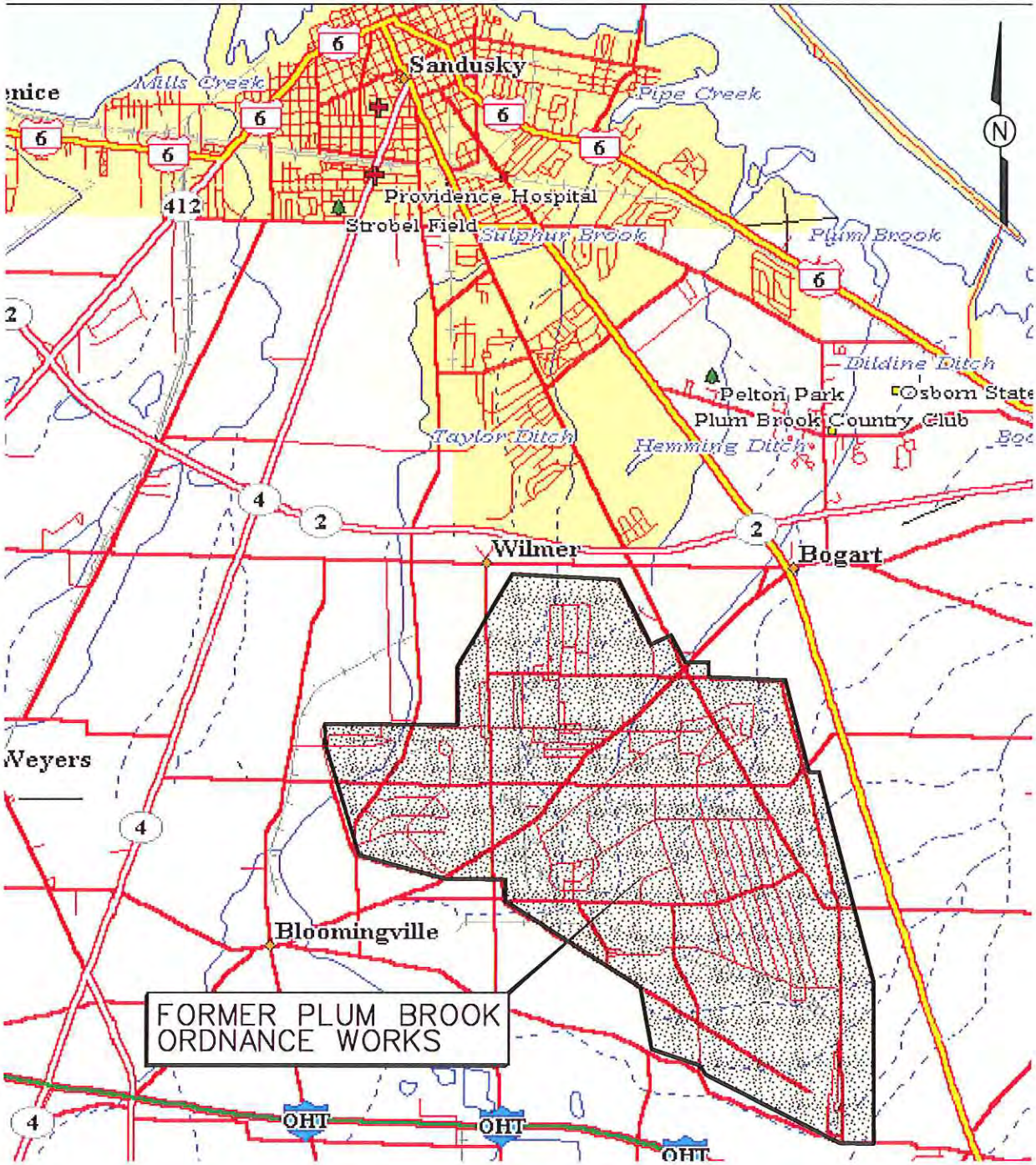
Table 6-21

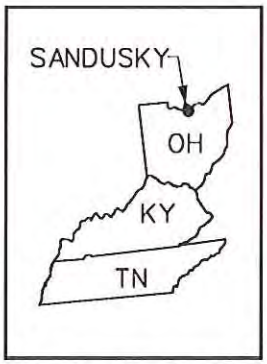
Uncertainty Analysis
Red Water Ponds, PBOW, Sandusky, Ohio

Component	Bias	Magnitude	Ways to Minimize Uncertainty
Toxicity Tests			
Toxicity tests were run on a limited number of samples, thereby limiting the statistical power of COPEC concentration vs. toxicity result correlations	Overestimates or Underestimates Risk	Medium	Perform additional toxicity testing
Chemical contributing to measured toxicity could not be determined (e.g., in surface water)	Overestimates or Underestimates Risk	Medium	Perform additional toxicity testing and analyze media for all chemicals

BCF - Bioconcentration factor.
COPEC - Constituent of potential ecological concern.
ft. - Foot/feet.
LD_{50} - Median lethal dose.
LOAEL - Lowest observed adverse effects level.
MDC - Maximum detectable concentration.
NOAEL - No observed adverse effects level.
RME - Reasonable maximum exposure.
RTV - Reference toxicity value.
UCL - Upper confidence limit.
UF - Uncertainty factor.

FIGURES





NOT TO SCALE

FIGURE 1-1
VICINITY MAP

FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 12/16/97	DATE LAST REV.: 10/30/01	DRAFT. CHCK. BY:	INITIATOR: D. KESSLER	DWG. NO.: \773701ES.001
DRAWN BY: D. BILLINGSLEY	DRAWN BY: bvanderg	ENGR. CHCK. BY: D. KESSLER	PROJ. MGR.: M.SPANGBERG	PROJ. NO.: 773701

01:08:56 10/30/01

bvanderg c:\cadd\design\773701es.001

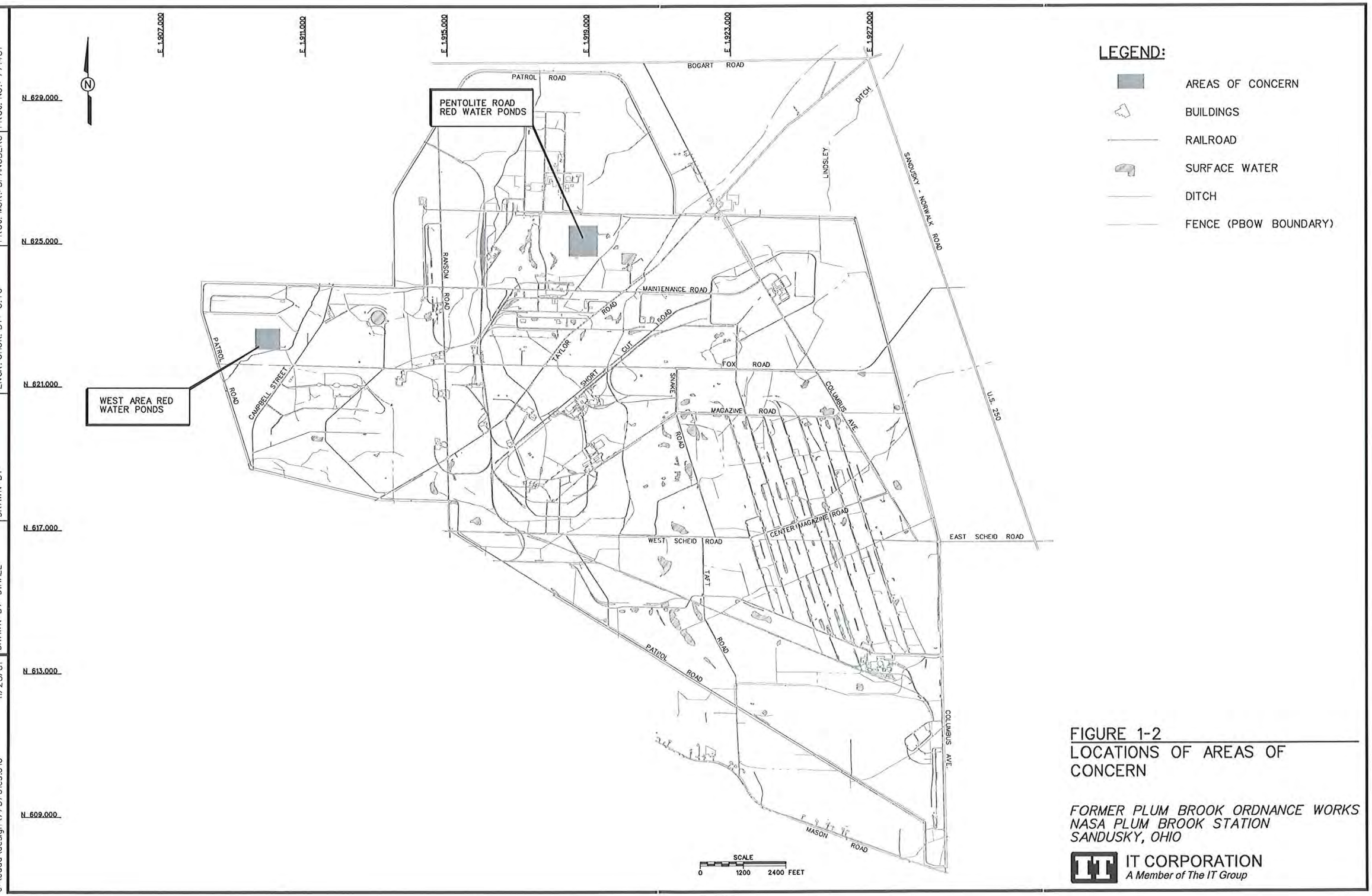


FIGURE 1-2
LOCATIONS OF AREAS OF CONCERN

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

DWG. NO.:..\77370tes.010	INITIATOR: G.YU	DRAFT. CHCK. BY: D.HALL	DATE LAST REV.:
PROJ. NO.: 771481	PROJ. MGR.: SPANGBERG	ENGR. CHCK. BY: G.YU	DRAWN BY:
STARTING DATE: 9/3/98			
DRAWN BY: D.HALL			

02:27:59 11/28/01

bvanderg c:\cadd\design\77370tes.010

Figure 2-1

Simplified Terrestrial Food Web Conceptual Site Model (CSM)
Plum Brook Ordnance Works, Ohio

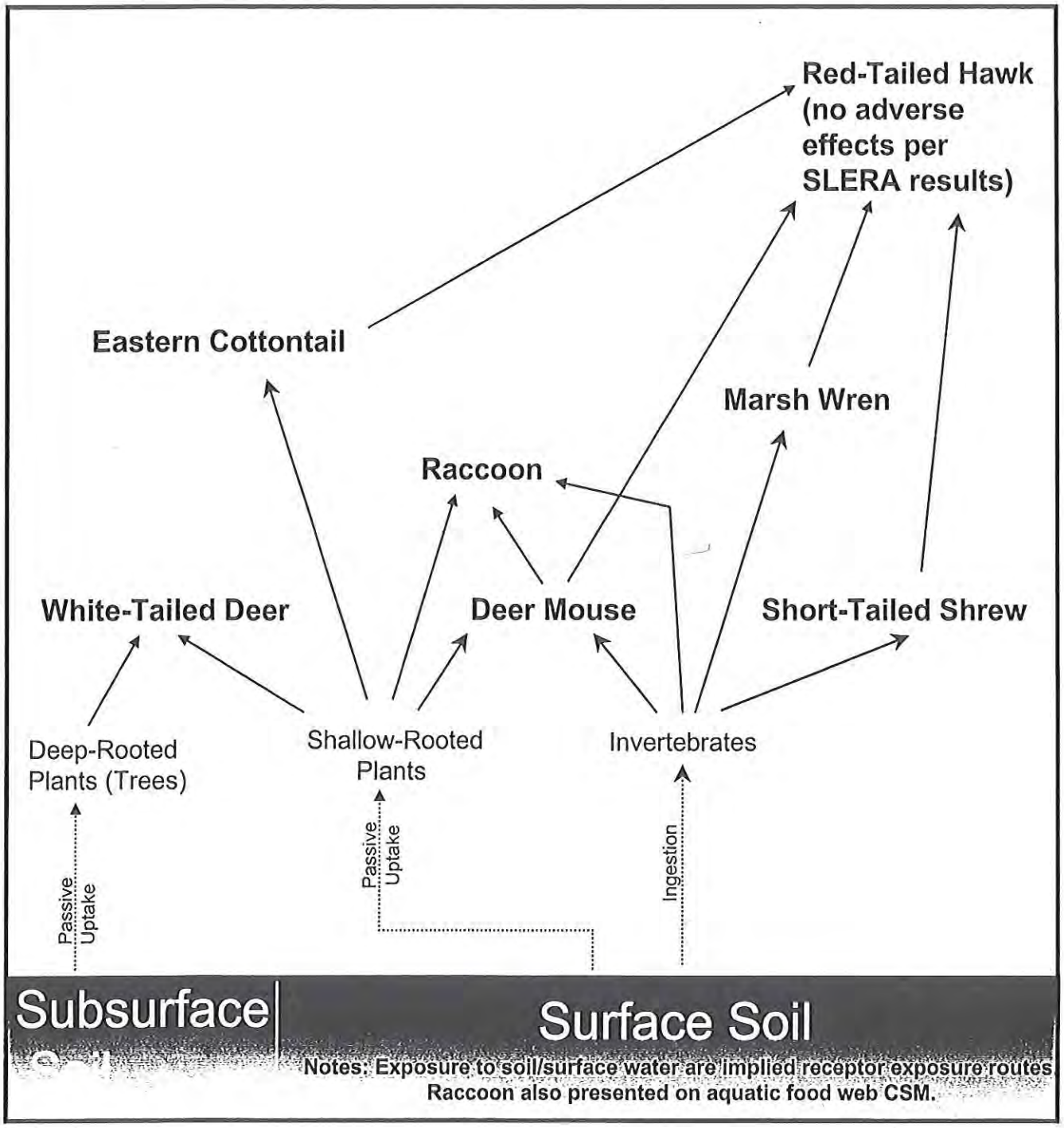
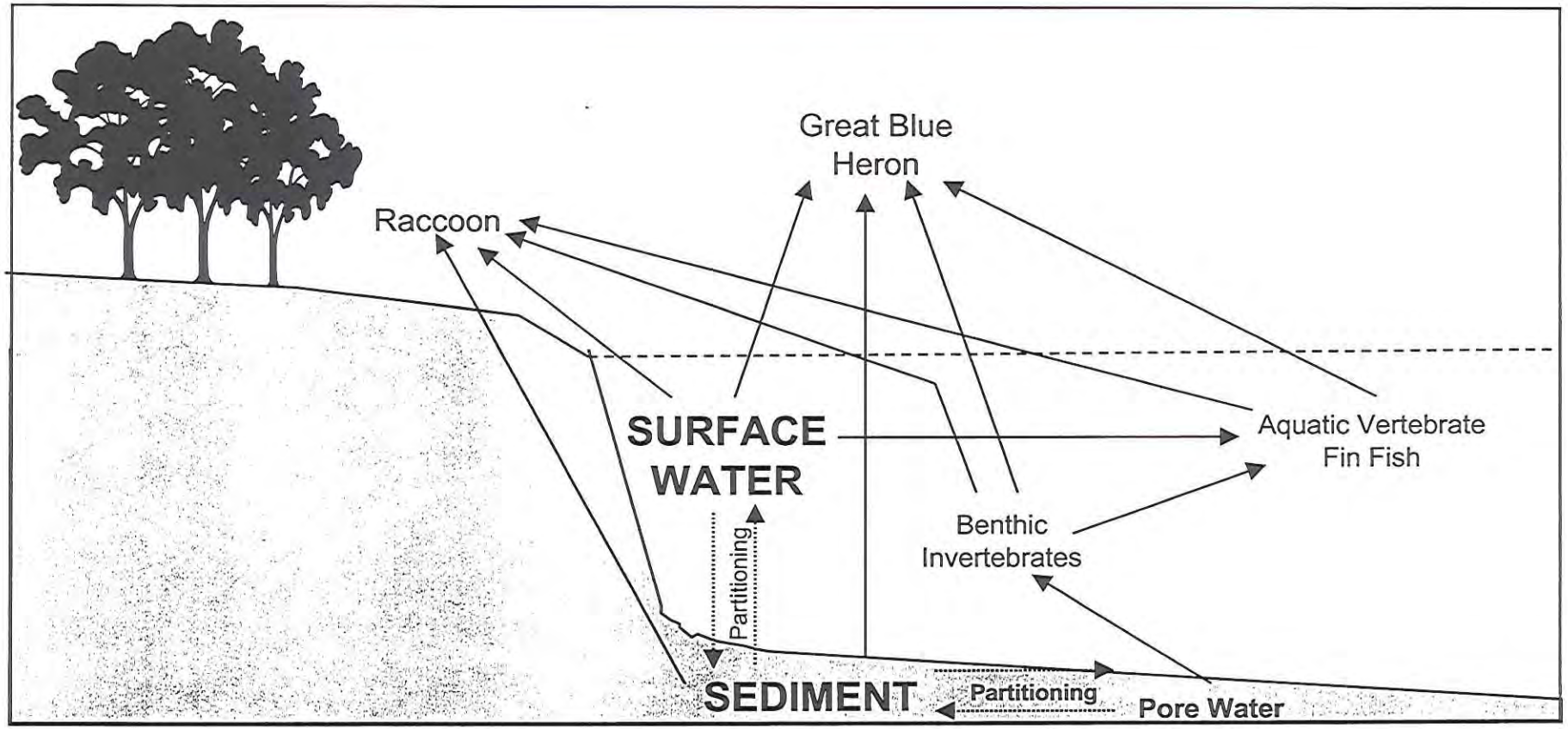


Figure 2-2

Simplified Aquatic Food Web Conceptual Site Model (CSM)
Plum Brook Ordnance Works, Ohio



Note: Raccoon also presented on terrestrial food web CSM.

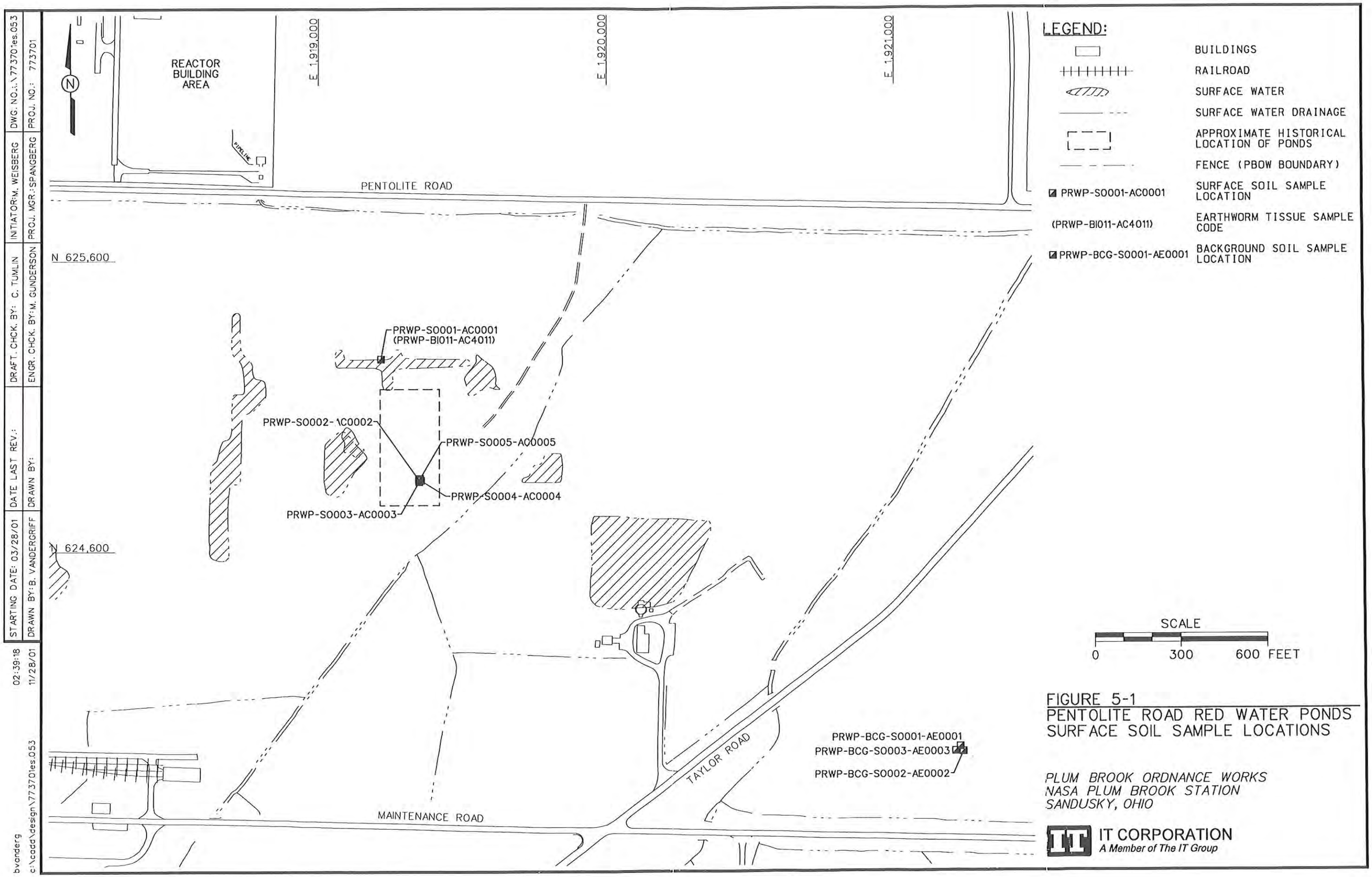
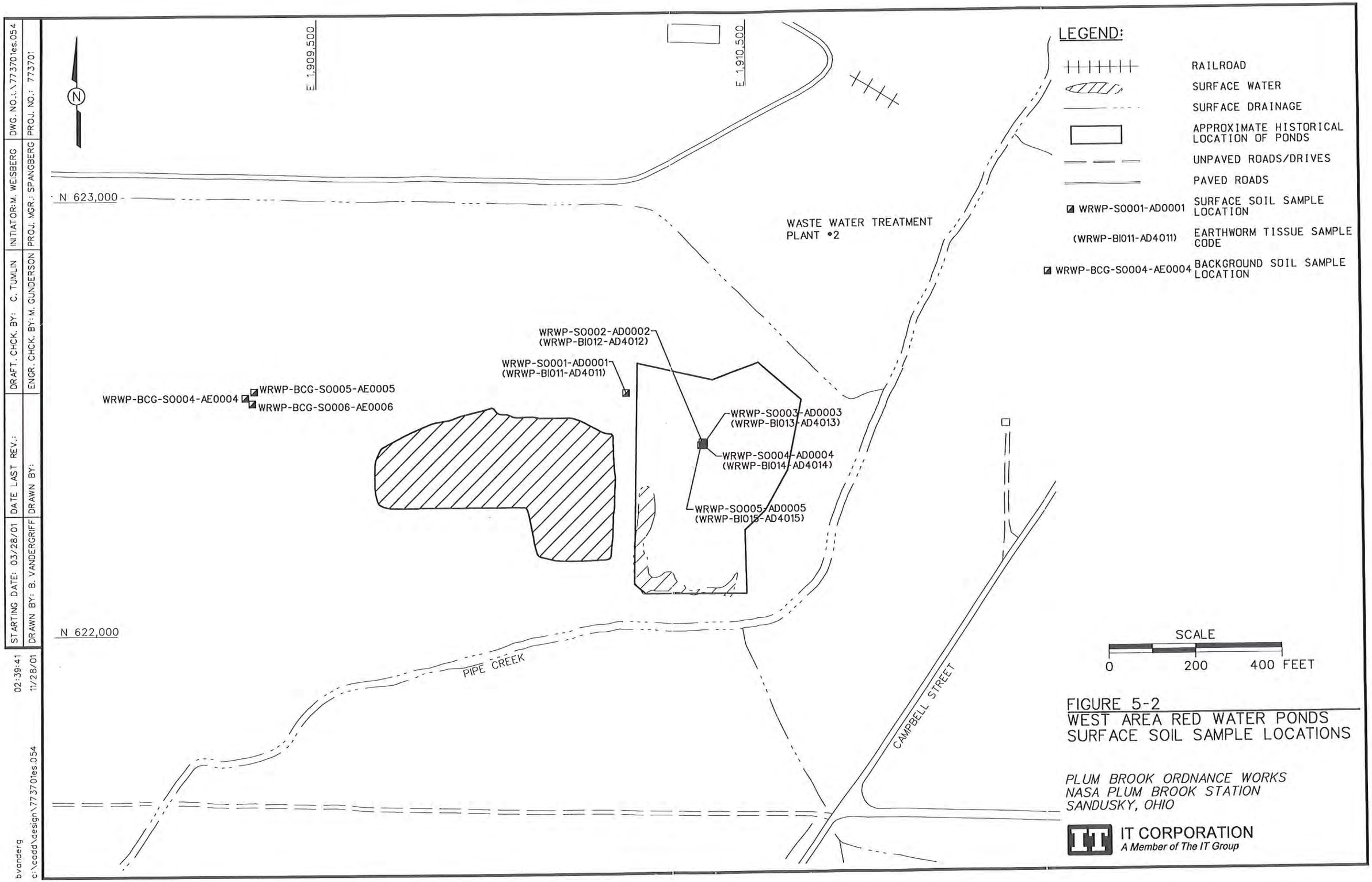


FIGURE 5-1
PENTOLITE ROAD RED WATER PONDS
SURFACE SOIL SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

DWG. NO.: \773701es.053
PROJ. NO.: 773701
INITIATOR: M. WEISBERG
PROJ. MGR.: SPANGBERG
DRAFT. CHCK. BY: C. TUMLIN
ENGR. CHCK. BY: M. GUNDERSON
DATE LAST REV.:
DRAWN BY:
STARTING DATE: 03/28/01
DRAWN BY: B. VANDERGRIFF
02:39:18
11/28/01
bvanderg
c:\cadd\design\773701es.053


LEGEND:
RAILROAD
SURFACE WATER
SURFACE DRAINAGE
APPROXIMATE HISTORICAL LOCATION OF PONDS
UNPAVED ROADS/DRIVES
PAVED ROADS
WRWP-S0001-AD0001 SURFACE SOIL SAMPLE LOCATION
(WRWP-BI011-AD4011) EARTHWORM TISSUE SAMPLE CODE
WRWP-BCG-S0004-AE0004 BACKGROUND SOIL SAMPLE LOCATION
N
E 1,909,500
E 1,910,500
N 623,000
N 622,000
WASTE WATER TREATMENT PLANT #2
WRWP-S0002-AD0002
(WRWP-BI012-AD4012)
WRWP-S0001-AD0001
(WRWP-BI011-AD4011)
WRWP-BCG-S0004-AE0004
WRWP-BCG-S0005-AE0005
WRWP-BCG-S0006-AE0006
WRWP-S0003-AD0003
(WRWP-BI013-AD4013)
WRWP-S0004-AD0004
(WRWP-BI014-AD4014)
WRWP-S0005-AD0005
(WRWP-BI015-AD4015)
PIPE CREEK
CAMPBELL STREET
SCALE
0
200
400 FEET
FIGURE 5-2
WEST AREA RED WATER PONDS
SURFACE SOIL SAMPLE LOCATIONS
PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO
IT CORPORATION
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DATE LAST REV.:
DRAWN BY: B. VANDERGRIFF
DRAWN BY:
DRAFT. CHCK. BY: C. TUMLIN
ENGR. CHCK. BY: M. GUNDERSON
INITIATOR: M. WEISBERG
PROJ. MGR.: SPANGBERG
DWG. NO.: \773701es.054
PROJ. NO.: 773701
02:39:41
11/28/01
bvanderg
c:\cadd\design\773701es.054

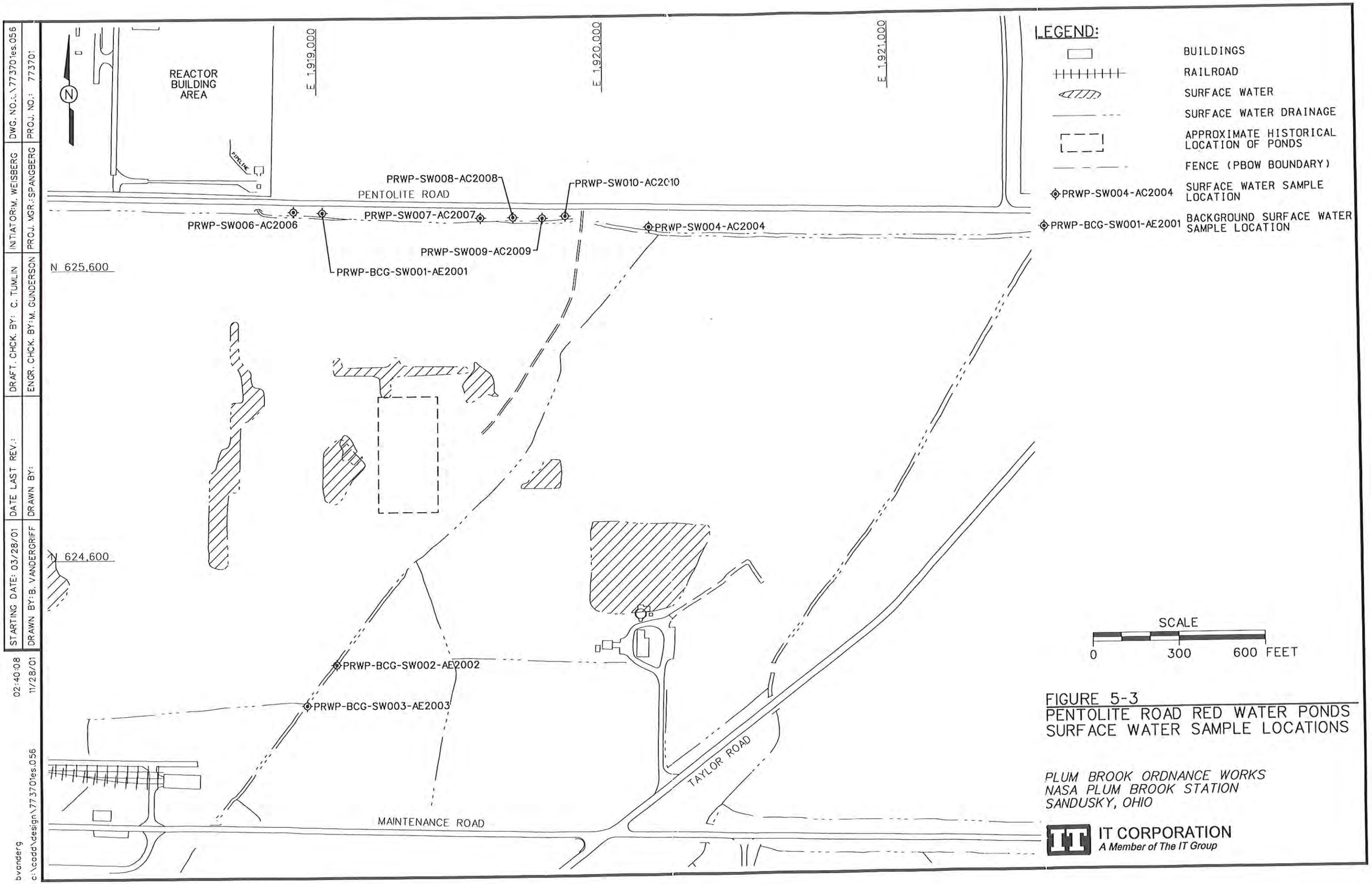


FIGURE 5-3
PENTOLITE ROAD RED WATER PONDS
SURFACE WATER SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

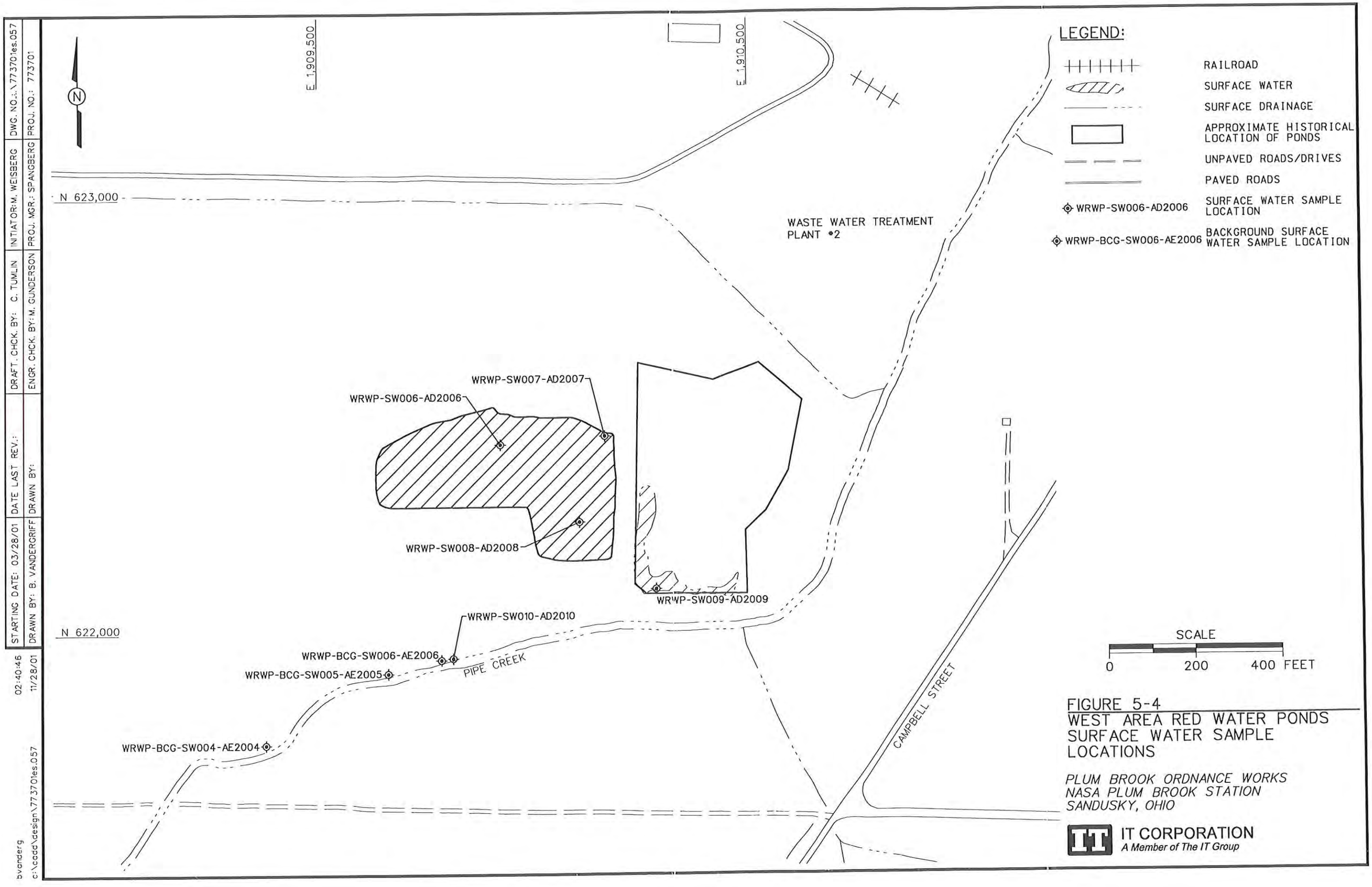
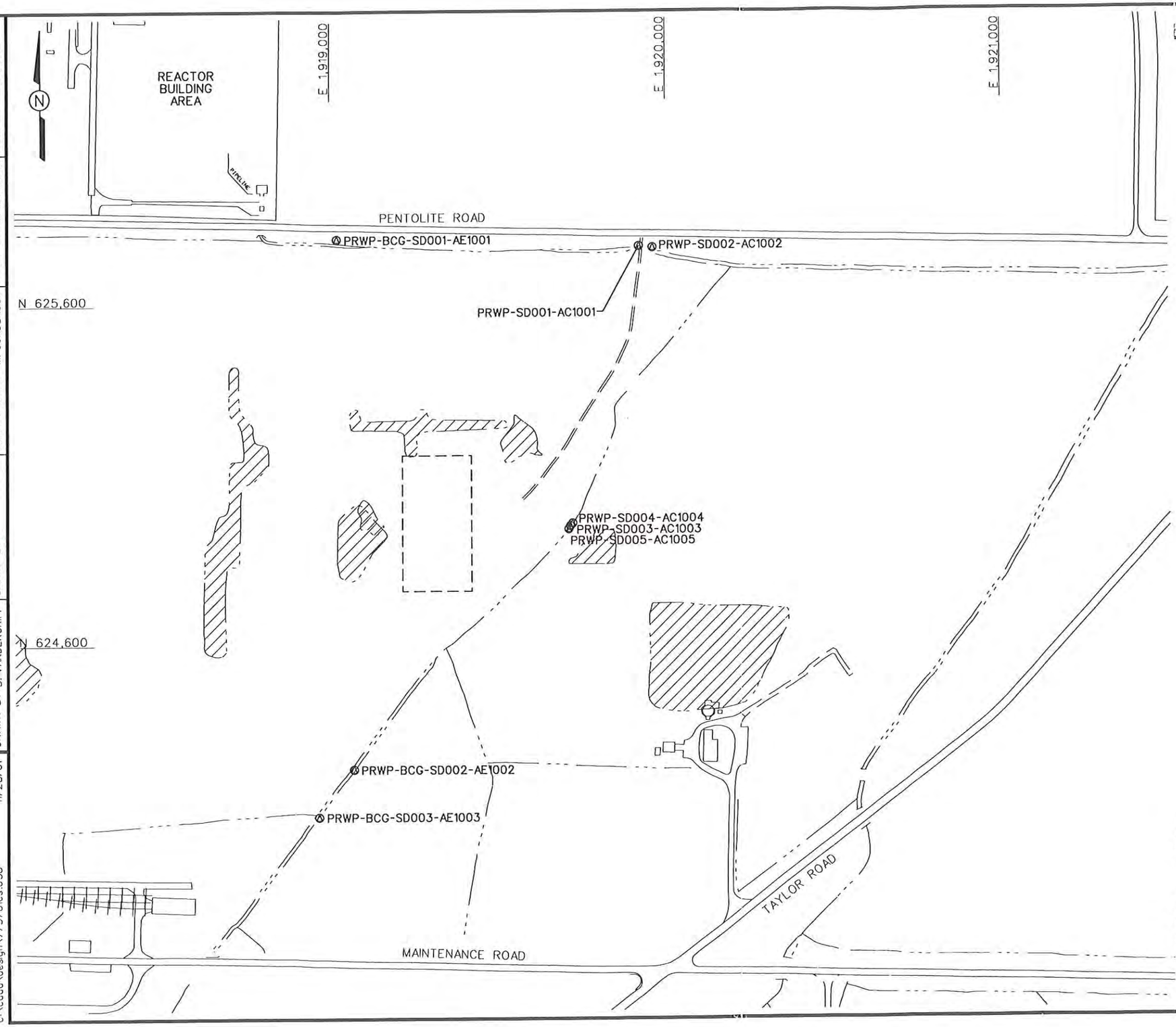


FIGURE 5-4
WEST AREA RED WATER PONDS SURFACE WATER SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO



LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE WATER DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- FENCE (PBOW BOUNDARY)
- PRWP-SD001-AC1001 — SEDIMENT SAMPLE LOCATION
- PRWP-BCG-SD001-AE1001 — BACKGROUND SEDIMENT SAMPLE LOCATION

SCALE

0 300 600 FEET

FIGURE 5-5
PENTOLITE ROAD RED WATER PONDS
SEDIMENT SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
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DWG. NO.:\773701es.058 | PROJ. NO.: 773701
INITIATOR: M. WEISBERG | PROJ. MGR.: SPANGBERG
DRAFT. CHCK. BY: C. TUMLIN | ENGR. CHCK. BY: M. GUNDERSON
DATE LAST REV.: | DRAWN BY:
STARTING DATE: 03/28/01 | DRAWN BY: B. VANDERGRIFF
02:41:12 11/28/01
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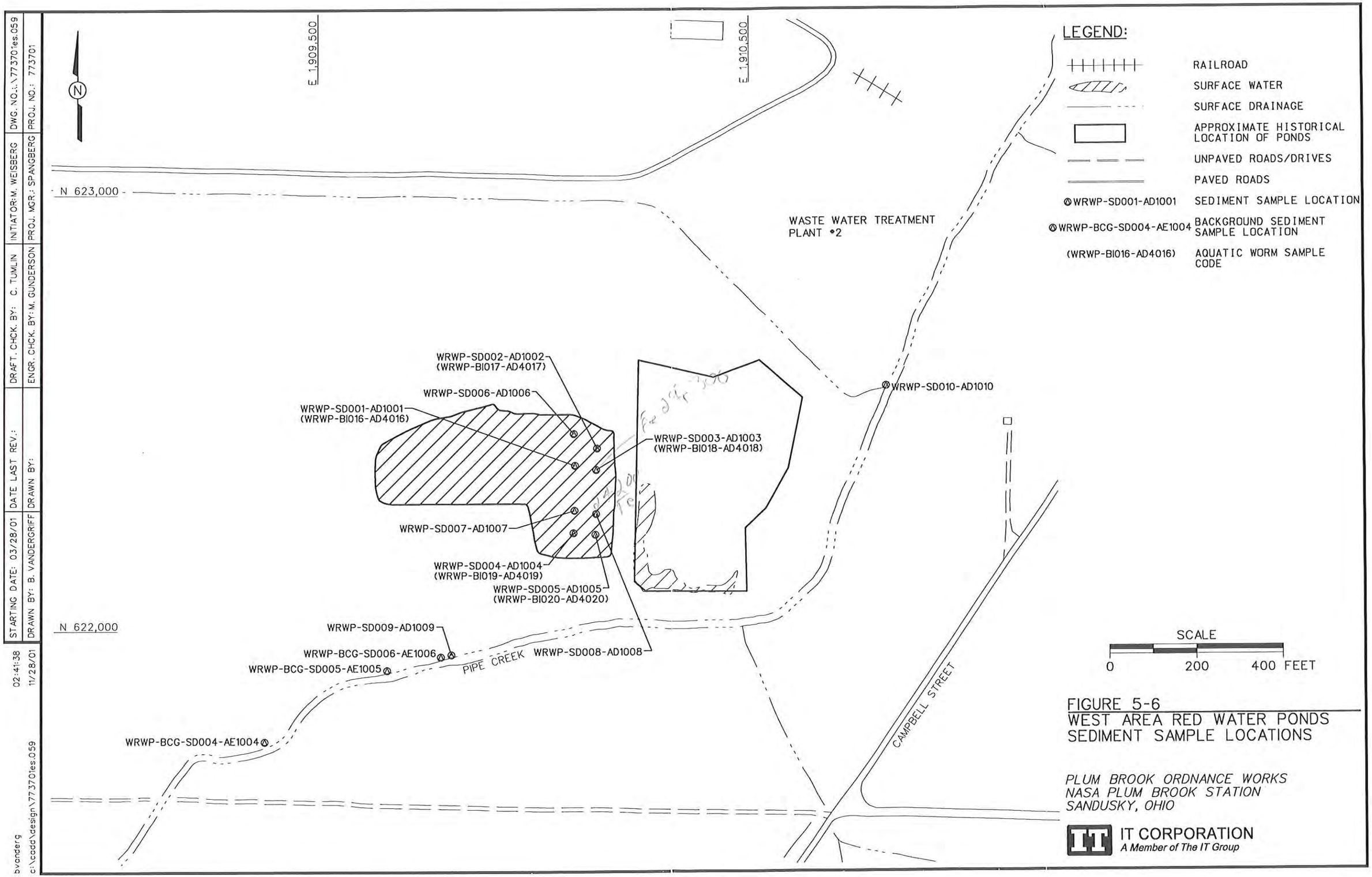
LEGEND:
RAILROAD
SURFACE WATER
SURFACE DRAINAGE
APPROXIMATE HISTORICAL LOCATION OF PONDS
UNPAVED ROADS/DRIVES
PAVED ROADS
WRWP-SD001-AD1001 SEDIMENT SAMPLE LOCATION
WRWP-BCG-SD004-AE1004 BACKGROUND SEDIMENT SAMPLE LOCATION
(WRWP-BI016-AD4016) AQUATIC WORM SAMPLE CODE
N
E 1,909,500
E 1,910,500
N 623,000
N 622,000
WASTE WATER TREATMENT PLANT #2
WRWP-SD002-AD1002
(WRWP-BI017-AD4017)
WRWP-SD006-AD1006
WRWP-SD001-AD1001
(WRWP-BI016-AD4016)
WRWP-SD003-AD1003
(WRWP-BI018-AD4018)
WRWP-SD010-AD1010
WRWP-SD007-AD1007
WRWP-SD004-AD1004
(WRWP-BI019-AD4019)
WRWP-SD005-AD1005
(WRWP-BI020-AD4020)
WRWP-SD009-AD1009
WRWP-BCG-SD006-AE1006
WRWP-BCG-SD005-AE1005
PIPE CREEK
WRWP-SD008-AD1008
WRWP-BCG-SD004-AE1004
CAMPBELL STREET
SCALE
0
200
400 FEET
FIGURE 5-6
WEST AREA RED WATER PONDS
SEDIMENT SAMPLE LOCATIONS
PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO
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ENGR. CHCK. BY: M. GUNDERSON
INITIATOR: M. WEISBERG
PROJ. MGR.: SPANGBERG
DWG. NO.: \773701es.059
PROJ. NO.: 773701
STARTING DATE: 03/28/01
DRAWN BY: B. VANDERGRIFF
DATE LAST REV.:
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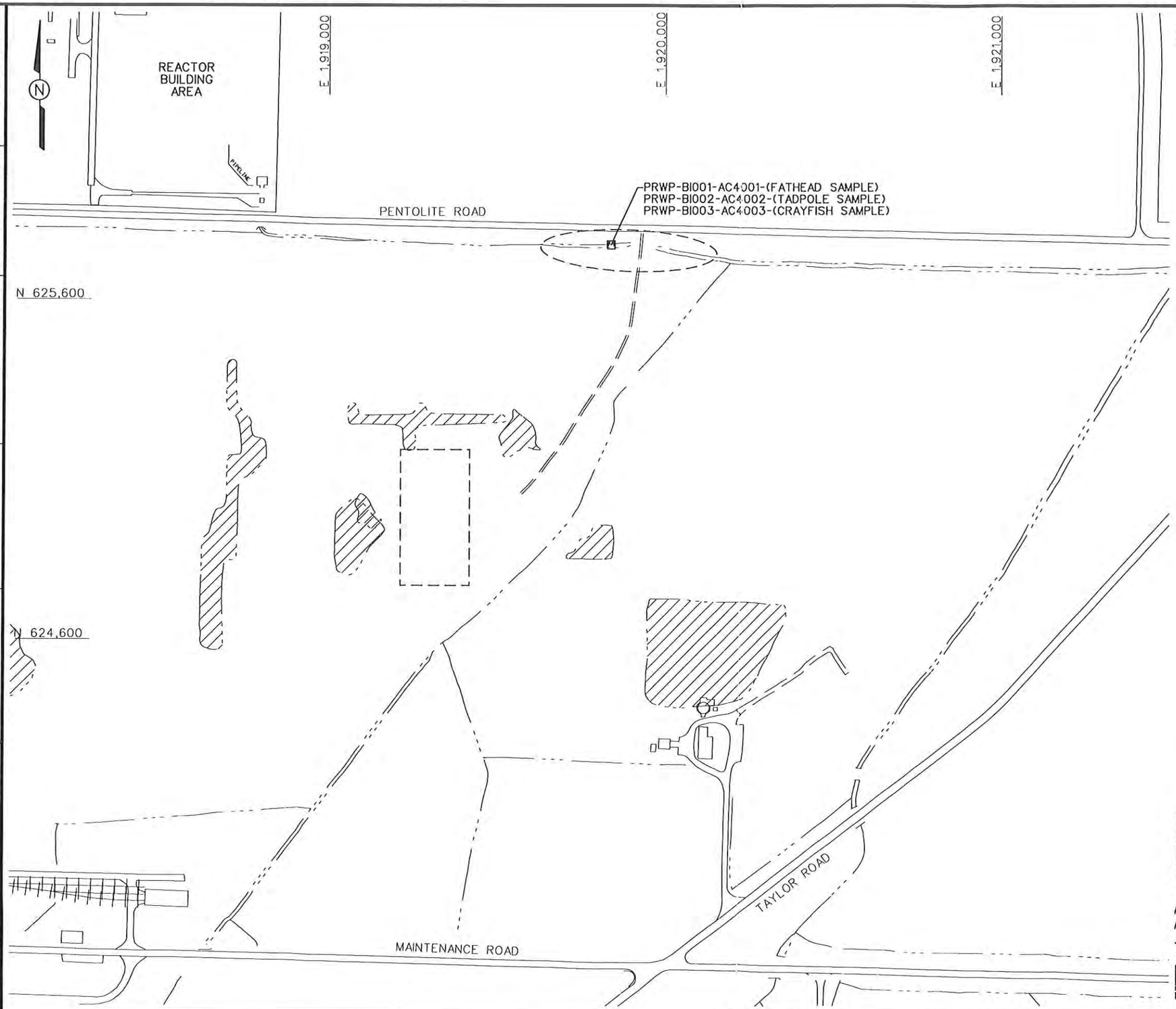

LEGEND:

- BUILDINGS
- RAILROAD
- SURFACE WATER
- SURFACE WATER DRAINAGE
- APPROXIMATE HISTORICAL LOCATION OF PONDS
- FENCE (PBOW BOUNDARY)
- PRWP-BI001-AC4001 — FISH, CRAYFISH, AND TADPOLE SAMPLE LOCATION
- SAMPLE LOCATION ZONE

NOTES

SAMPLES PRWP-BI001-AC4001 THROUGH PRWP-BI003-AC4003 WERE COLLECTED FROM THE INDICATED ZONE.

SCALE

0 300 600 FEET

FIGURE 5-7
PENTOLITE ROAD RED WATER PONDS FISH, CRAYFISH, AND TADPOLE SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

IT CORPORATION
A Member of The IT Group

STARTING DATE: 03/28/01	DATE LAST REV.:	DRAFT. CHCK. BY: C. TUMLIN	INITIATOR: M. WEISBERG
DRAWN BY: B. VANDERGRIFF	DRAWN BY:	ENGR. CHCK. BY: M. GUNDERSON	PROJ. MGR.: SPANGBERG
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			PROJ. NO.: 773701

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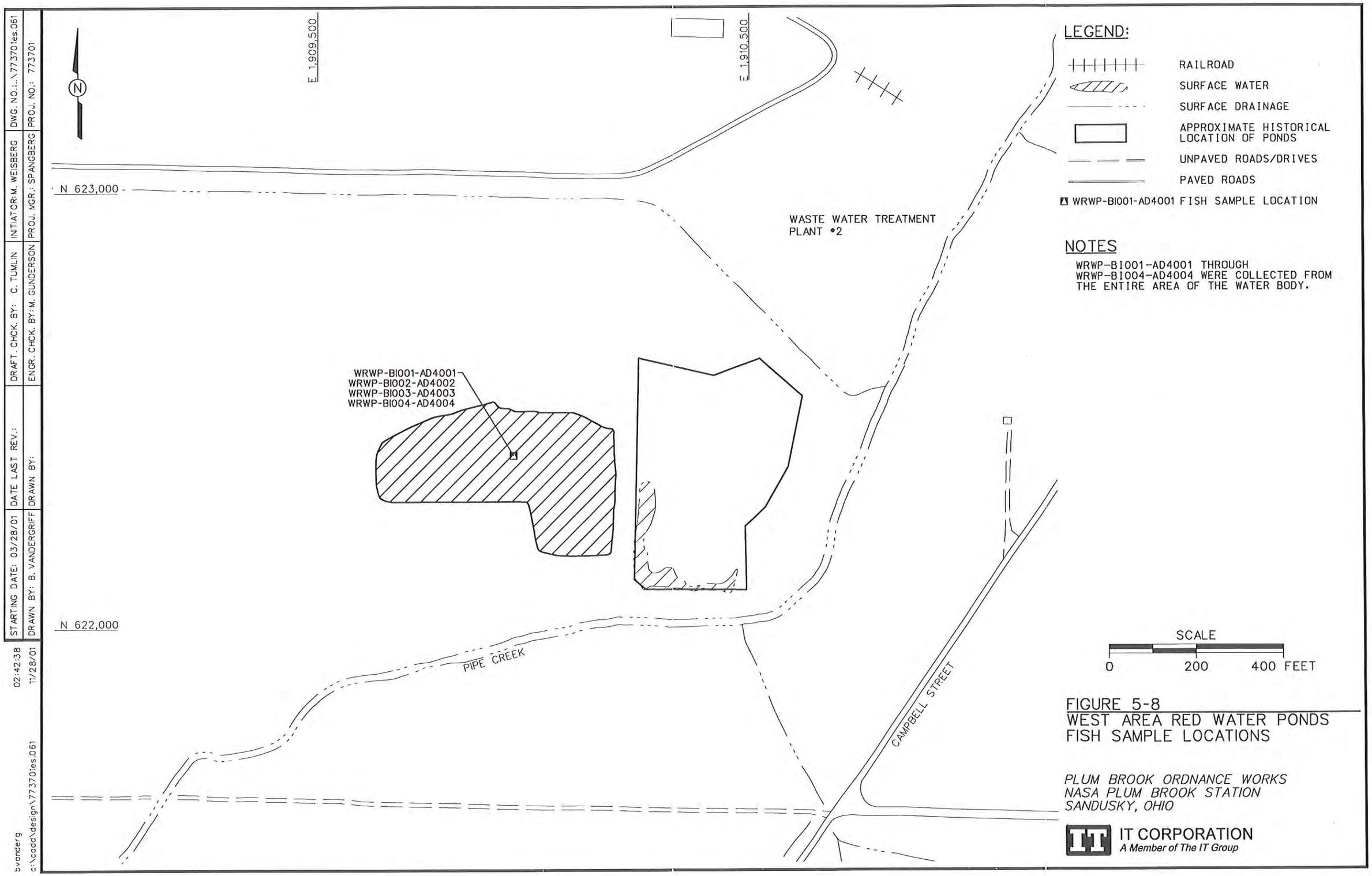
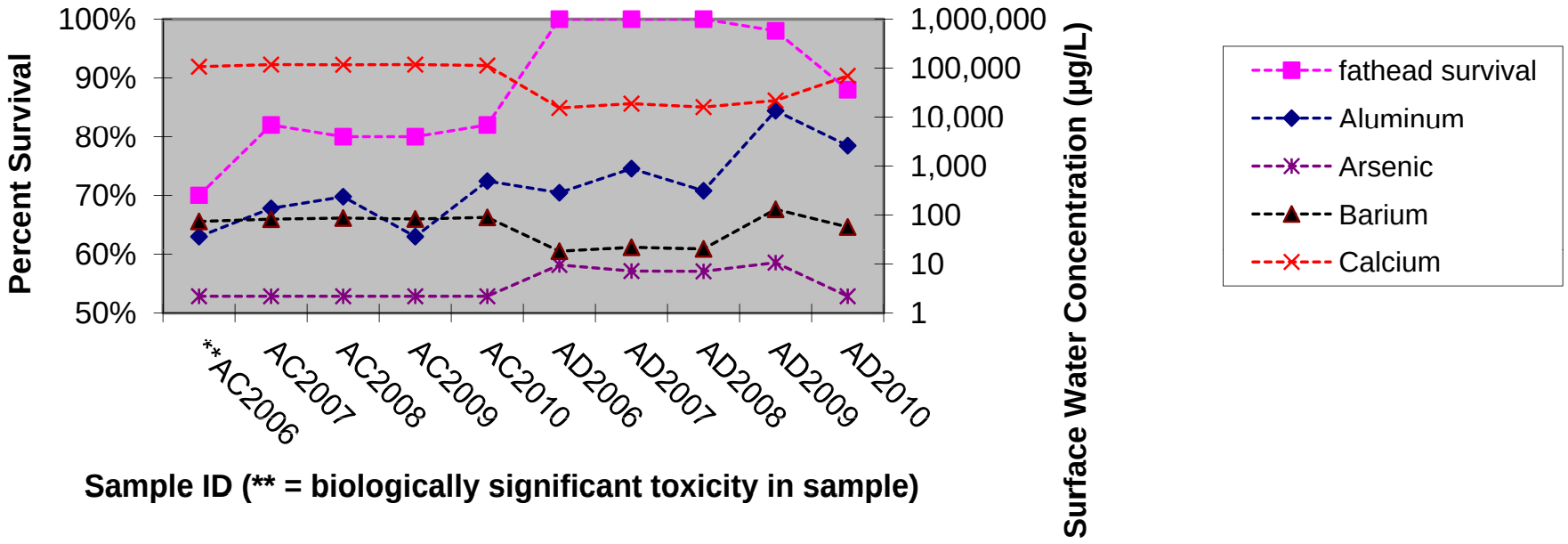


FIGURE 5-8
WEST AREA RED WATER PONDS
FISH SAMPLE LOCATIONS

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Figure 6-1

Minnow Survival and Al, As, Ba, Ca Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio



Sample ID (= biologically significant toxicity in sample)**

Figure 6-2

Minnow Survival and Cr, Co, Cu, Fe Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

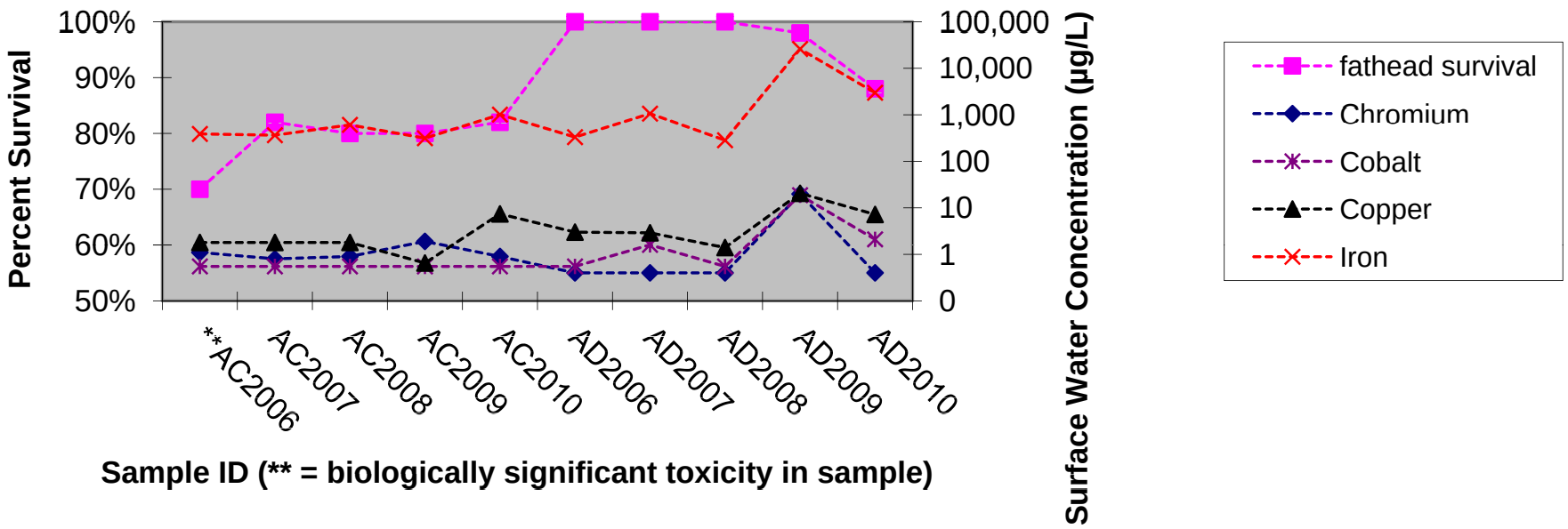


Table 6-3

Minnow Survival and Pb, Mg, Mn, Ni Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

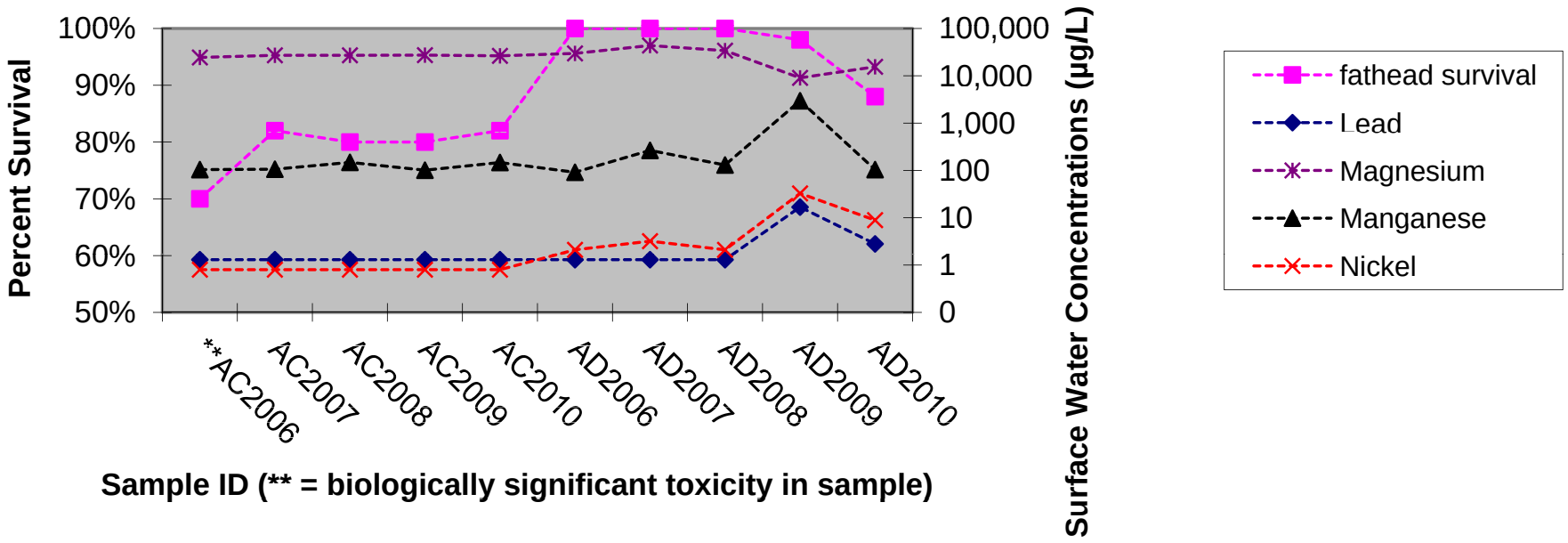


Figure 6-4

Minnow Survival and P, K, Na, Zn Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

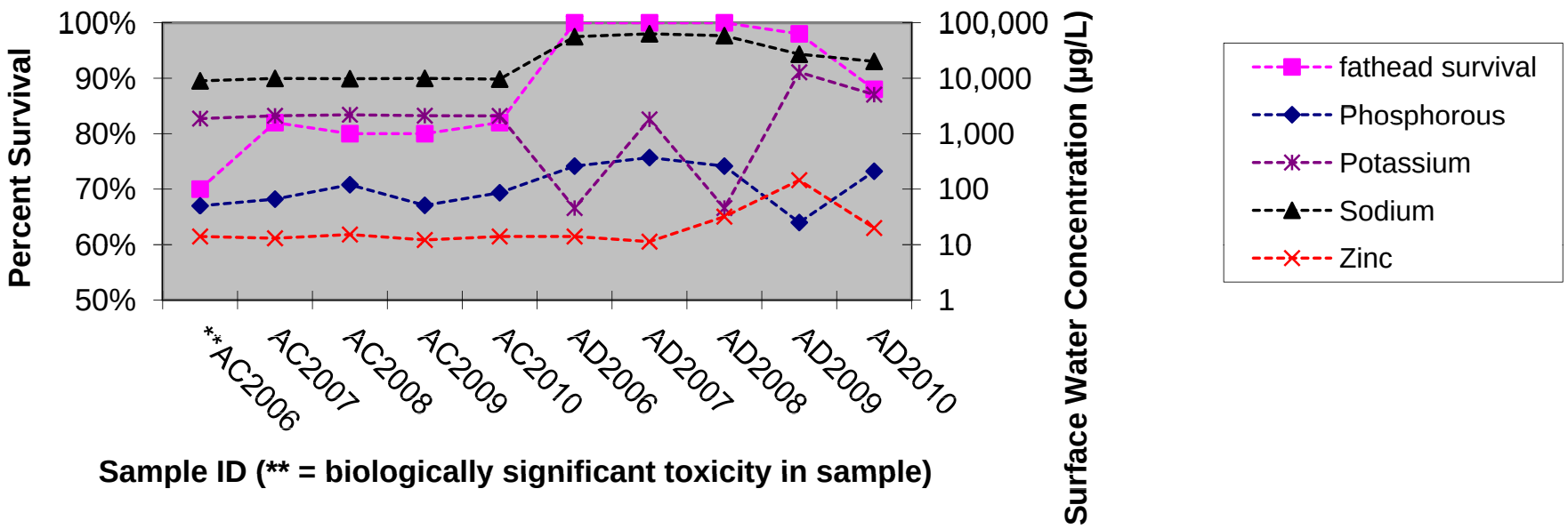


Figure 6-5

Water Flea Reproduction and Al, As, Ba, Ca Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

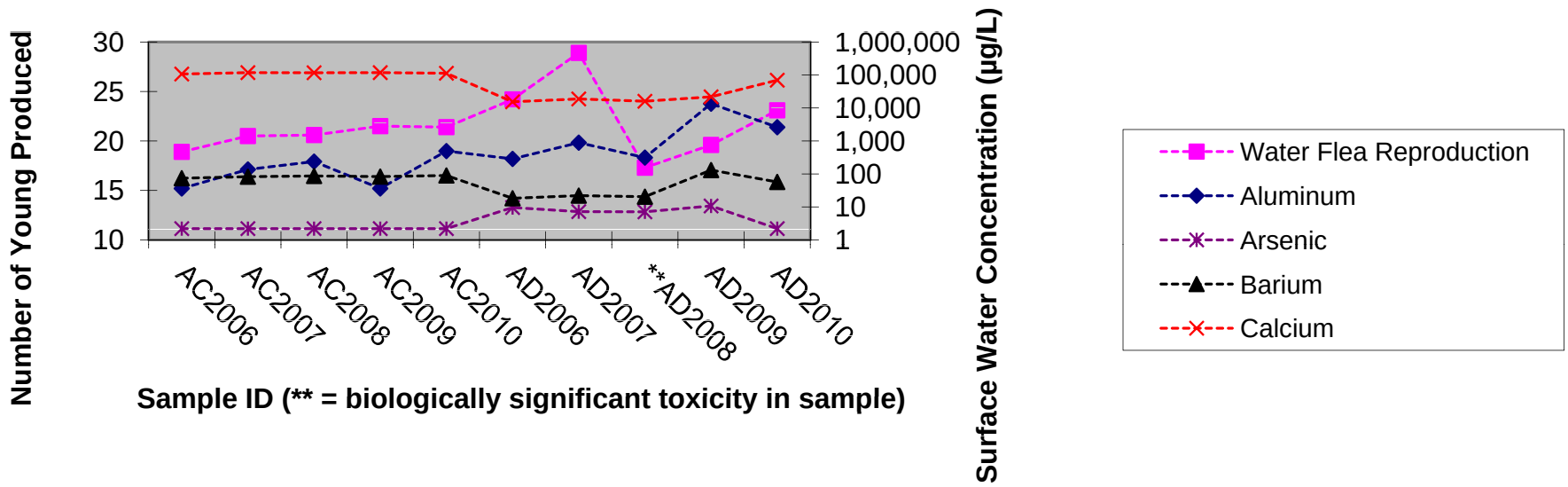


Figure 6-6

Water Flea Reproduction and Cr, Co, Cu, Fe Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

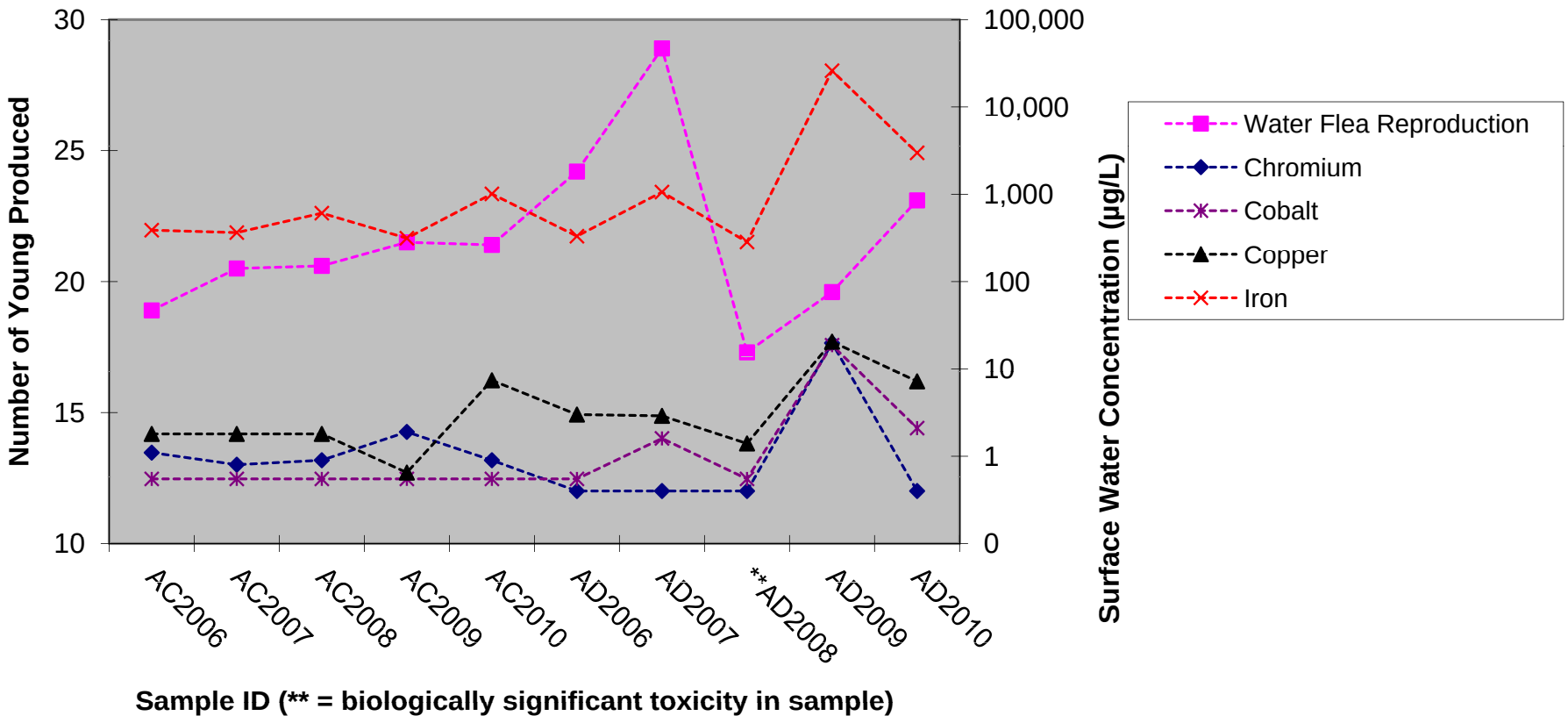


Figure 6-7

Water Flea Reproduction and Pb, Mg, Mn, Ni Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

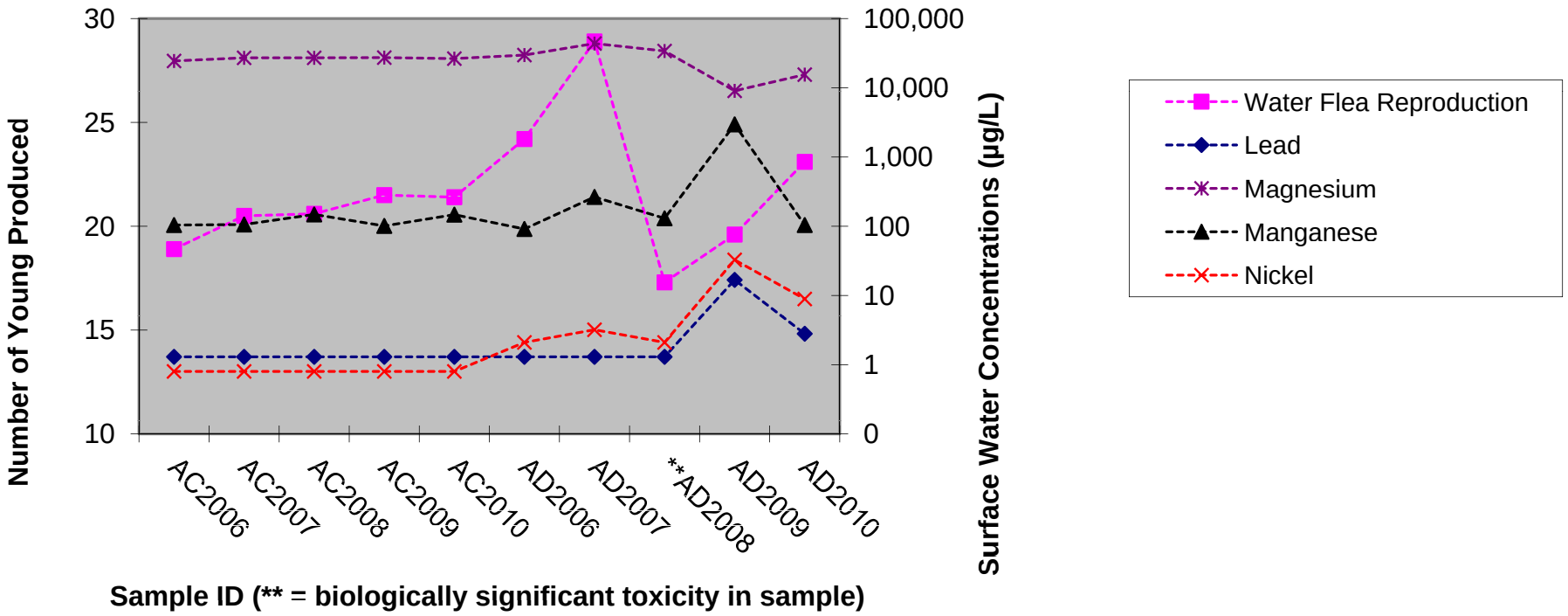


Figure 6-8

Water Flea Reproduction and P, K, Na, Zn Surface Water Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

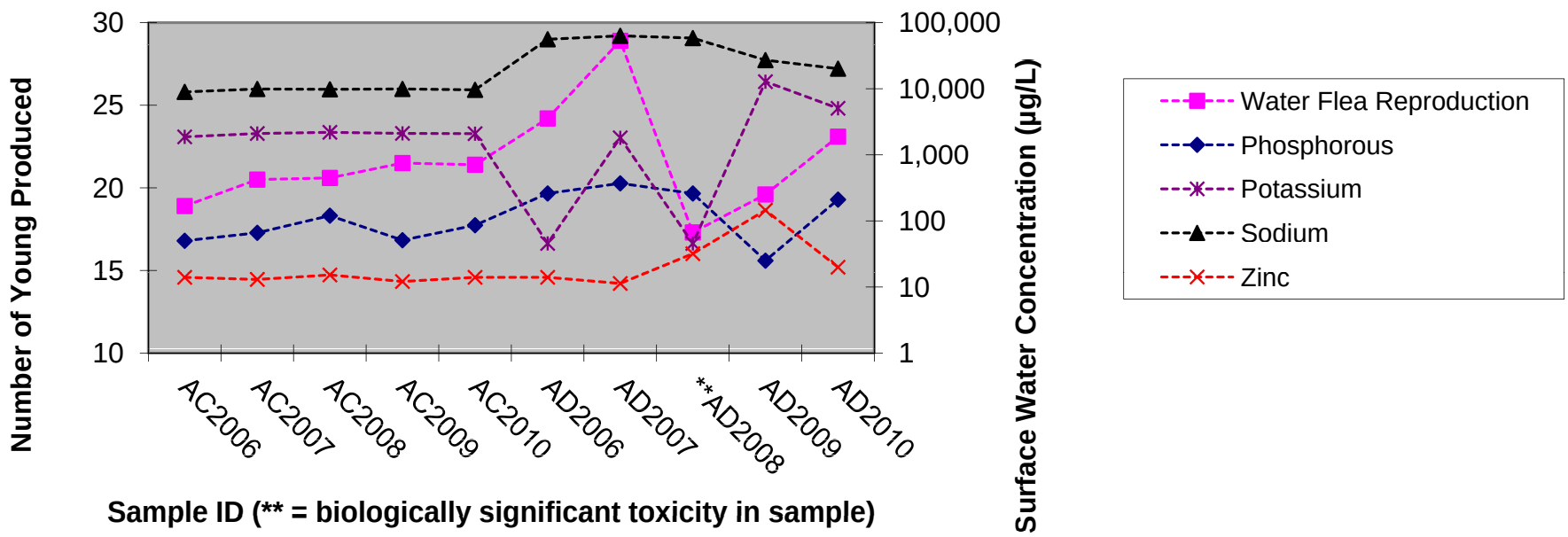


Figure 6-9

Amphipod Survival and Al, Sb, As, Ba Sediment Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

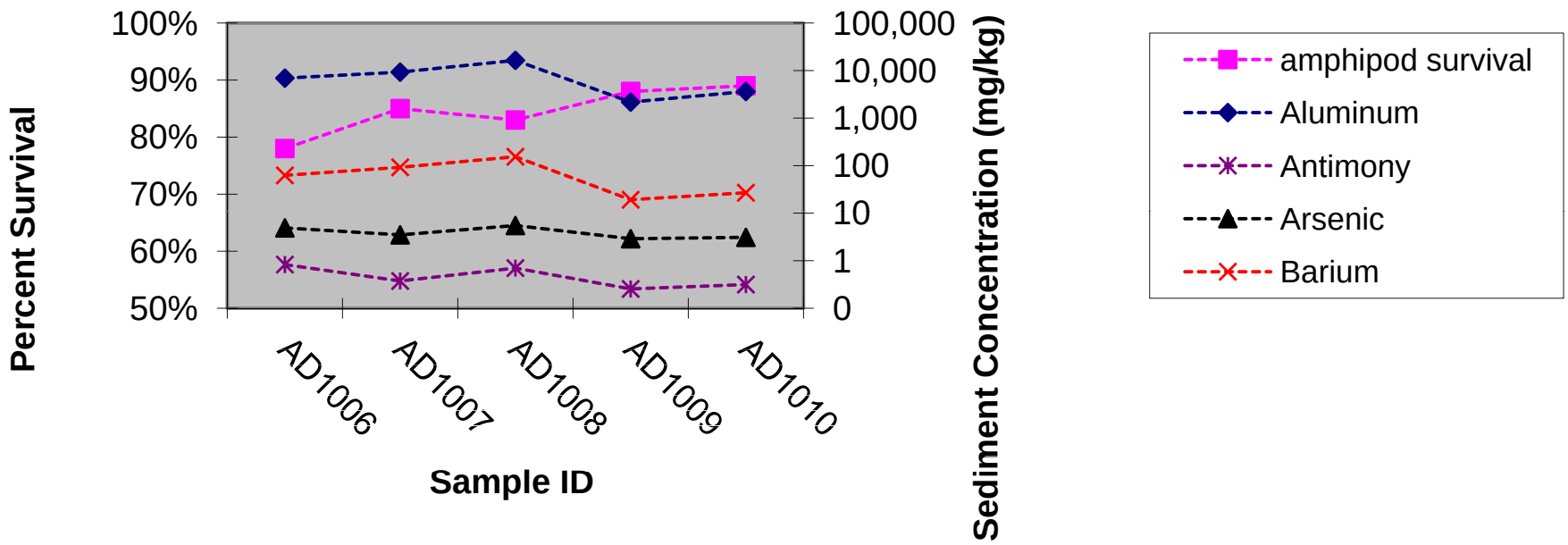


Figure 6-10

Amphipod Survival and Calcium Sediment Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

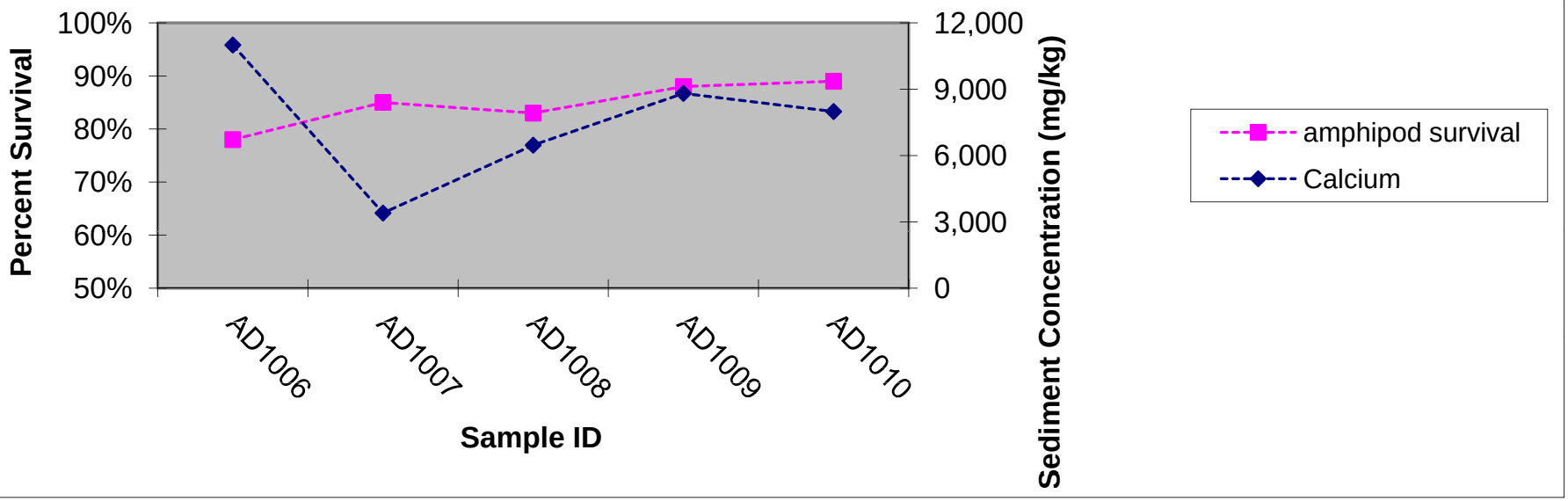


Figure 6-11

Amphipod Survival and Cr, Co, Cu, Fe Sediment Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

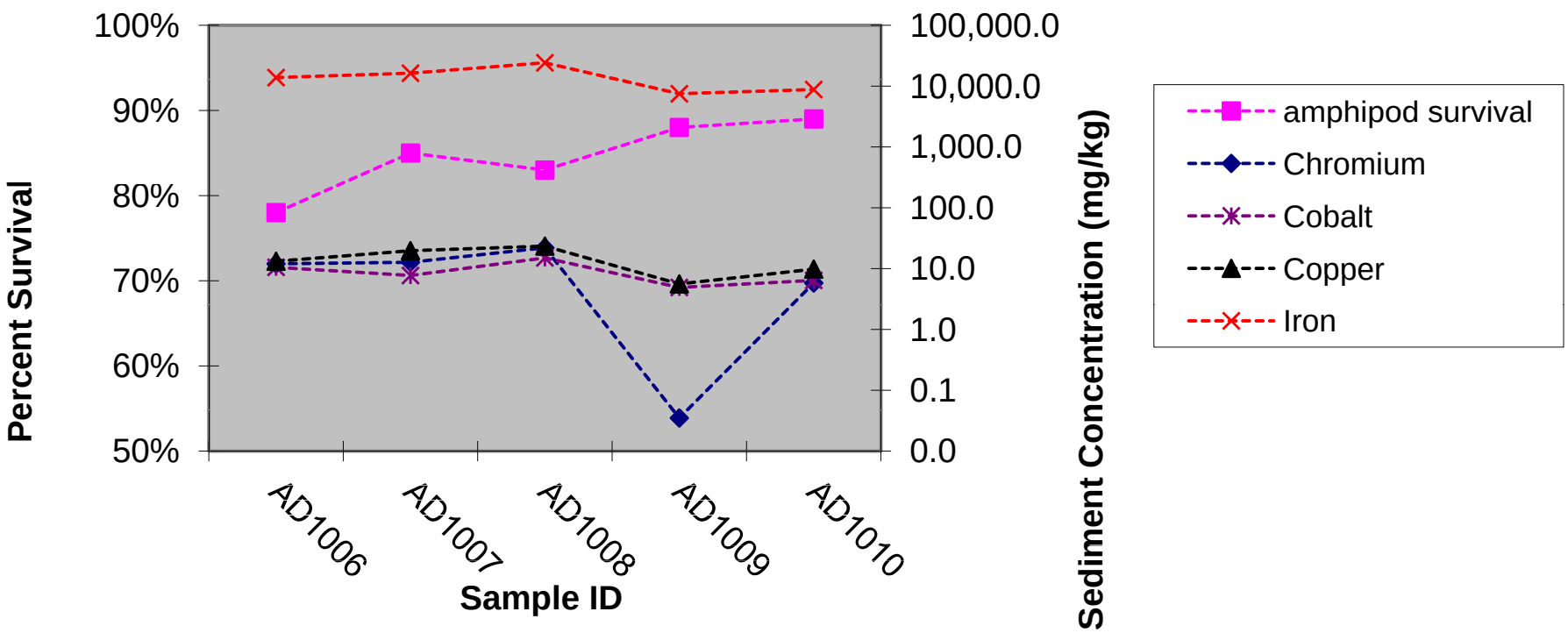


Figure 6-12

Amphipod Survival and Pb, Mg, Mn, Ni Sediment Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

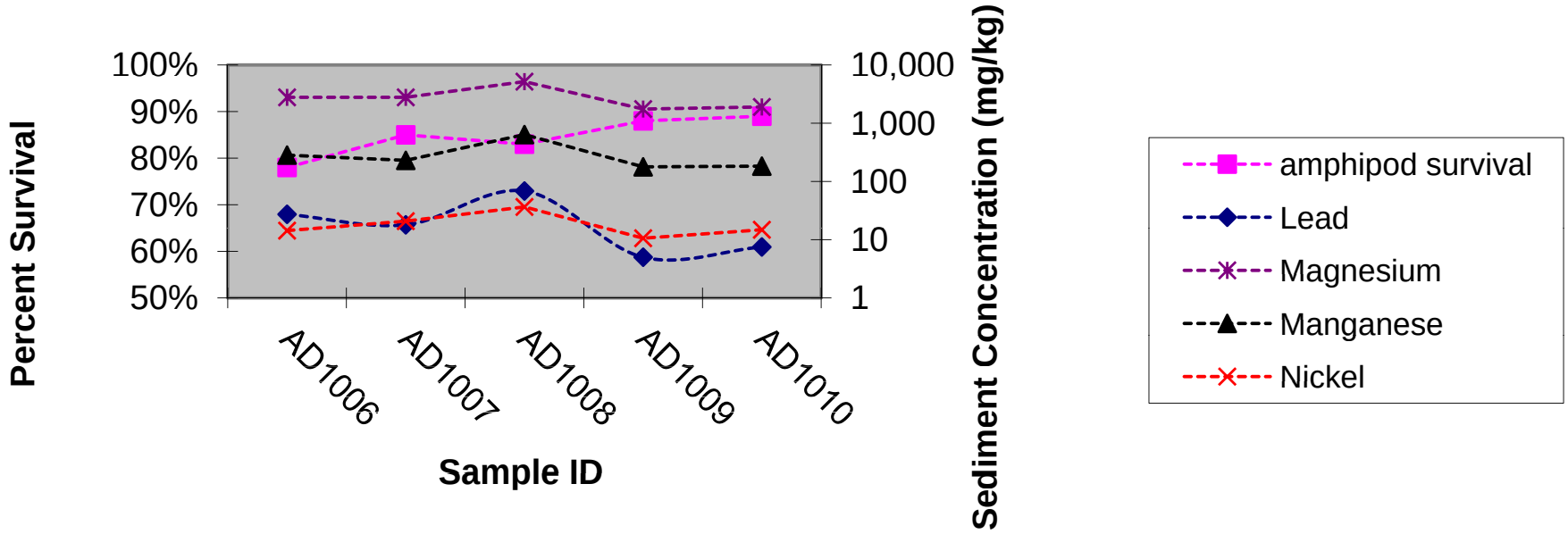


Figure 6-13

Amphipod Survival and P, K, Na, Zn Sediment Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

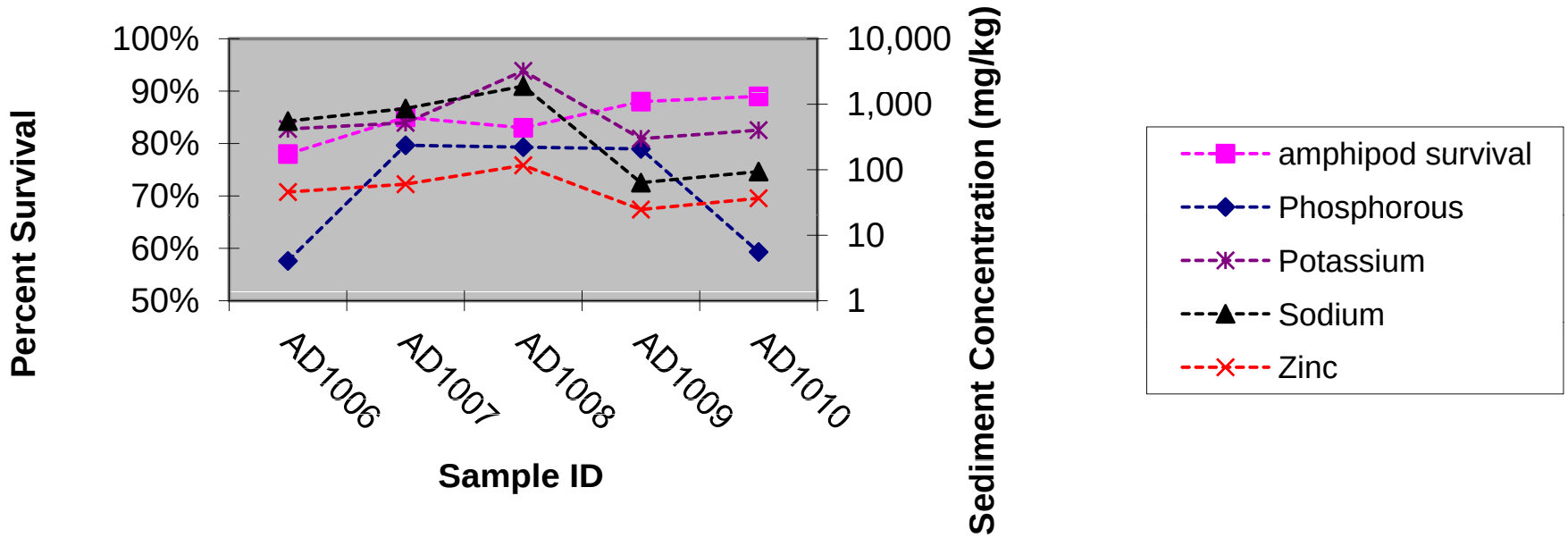


Figure 6-14

Earthworm Survival and Anthracene, B(a)P, B(b)F Soil Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

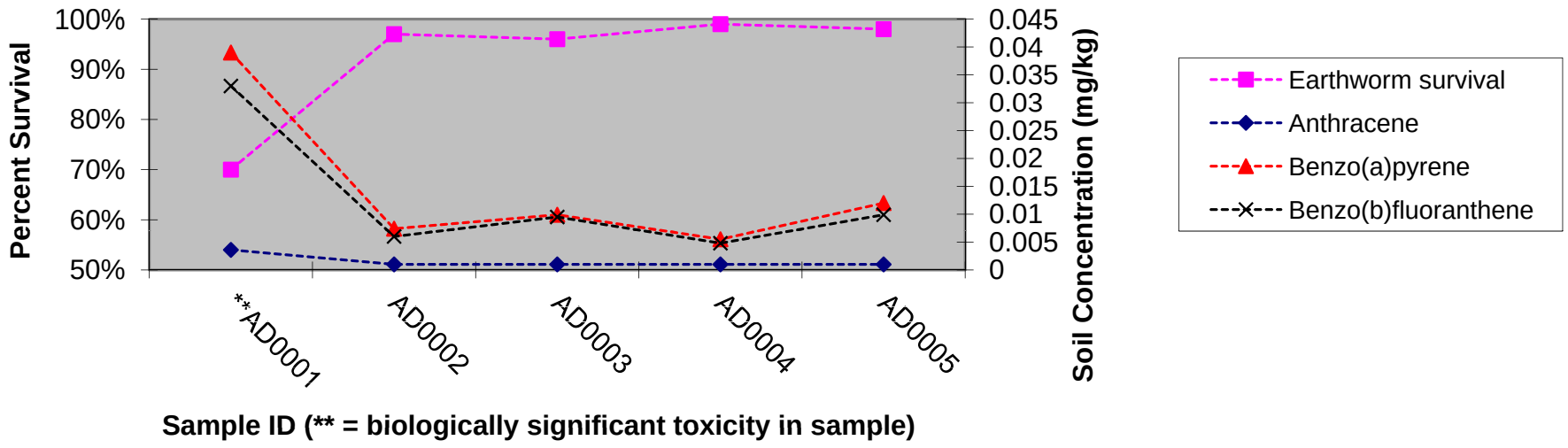


Figure 6-15

Earthworm Survival and B(ghi)P, B(k)F, Chrysene Soil Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio

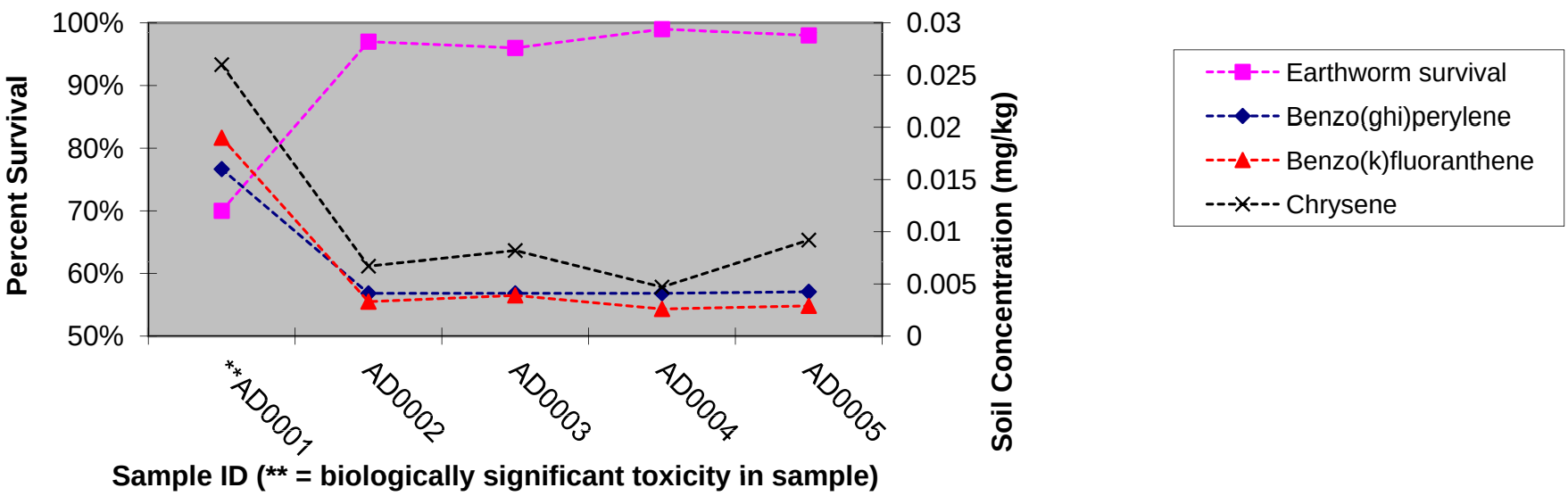
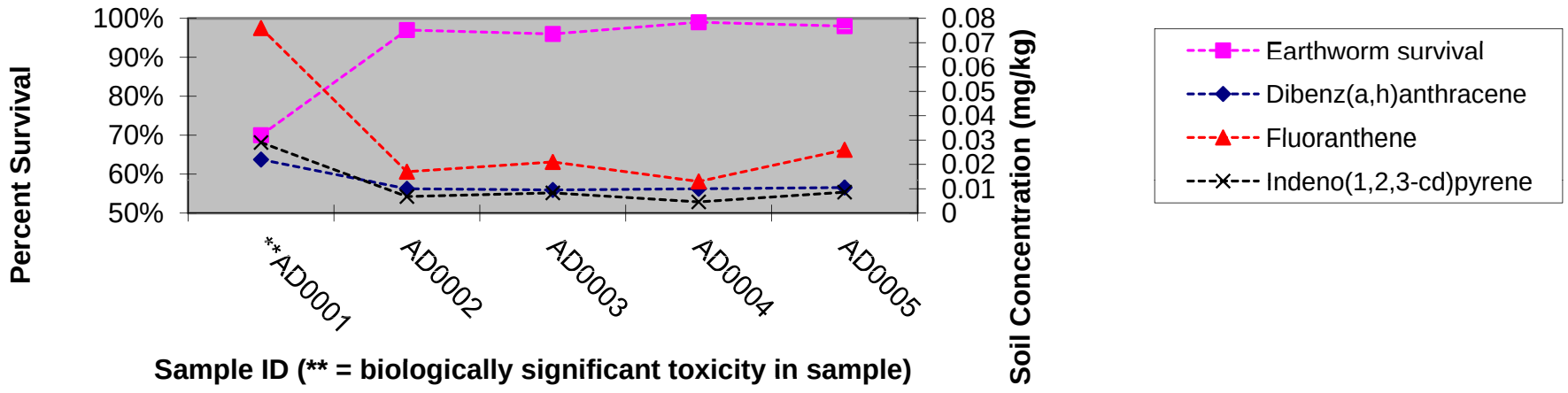


Figure 6-16

Earthworm Survival and D(ah)A, Fluoranthene, I(1,2,3cd)P Soil Concentrations
Red Water Ponds, PBOW, Sandusky, Ohio



APPENDIX A

FIELD VERIFICATION MEMORANDUM

IT Corporation

Memo

To: Mikael Spangberg, Lannae Long

From: Mark Weisberg

CC: Michael Gunderson, Knoxville Project Files-

Date: 7/18/00

Re: Former Plum Brook Ordnance Works, Red Water Ponds, Phase 2 Ecological Risk Assessment (BERA), Verification Site Visit Conducted June 29-30, 2000

This memo provides a summary of the Field Verification Site Visit for the former Plum Brook Ordnance Works (PBOW), Red Water Ponds (RWPs), Phase 2 Ecological Risk Assessment (ERA). This memo serves as Step 5 of the eight-step ERA process being performed for the sites. IT Corporation (IT) has provided an ecological risk professional (Mr. Weisberg) to the project to verify that methods and sampling efforts as described in Section 4.0 of the ERA Work Plan (IT, 2000) are actually feasible at the RWP sites.

Meeting Attendees
Mr. Mark Weisberg – IT
Ms. Linda Ingram – USACE Nashville
Captain John Osborn – USACE Huntington
Mr. David Kessler – IT
Mr. Keith Peecook – PBS (6/29/00 only)
Mr. John Blakeman – RAB (6/30/00 only)

Not Able to Attend
Ms. Laurie Moore – OEPA
Mr. Ron Nabors – OEPA
Mr. Richard Kunath – PBS

The meeting started at approximately 10:00 AM on June 29, 2000. Calls were placed to OEPA and it was determined that Ms. Moore and Mr. Nabors would not be attending. Mr. Weisberg presented the proposed Phase 2 ERA approach to the group present and answered questions.

It was discussed what should be done if proposed soil sample locations are inundated with surface water during the actual field sampling event (an unlikely but possible situation). The group decided that wet soil could be collected as is with appropriate notations on the sample collection log. Note: if proposed surface water/sediment locations are dry, no sample(s) will be collected.

The option of having the laboratory spike soil or sediment samples with particular chemical constituents was discussed, in the event targeted chemicals of concern (COC) are not detected in these media (see Work Plan Sections 4.2.1 and 6.0). The point was raised that if COCs such as a nitroaromatics could not be found at the resampled historic hotspot, spiking the sample with target COCs could be problematic, especially if bioavailability is artificially elevated compared with *in-situ* COC bioavailability. It should be noted that this relates only to the proposed uptake studies, not to the proposed toxicity studies as the toxicity studies must be started as soon as the samples (i.e., media) are received by the bioassay laboratory, whereas the uptake studies may be started later after the chemical analytical

results from the media are available. It is recommended that spiking media at the laboratory not be performed for COCs that have a low frequency of detection (below 5 percent; such as for 4-amino-2,6-DNT) because these constituents are unlikely to remain COCs in the Phase 2 ERA Report.

Potential sampling locations for background soil were discussed. Mr. Peecook suggested that as major portions of PBS are burned semi-annually to control vegetation, and as burning may result in the production of some chemicals such as polycyclic aromatic hydrocarbons (PAHs), background locations that are within the burned areas should be selected. This recommendation was accepted by the group. As the Pentolite Road RWP is within the prescribed burning area, three background soil samples were located and staked within a similarly burned area that has no history of PBS production or operation (an open field area about 300 feet from the PBS water tower and surrounded by Taylor Road, Maintenance Road, and Columbus Avenue approximately 2,500 feet east southeast of the Pentolite Road RWP). Since the West Area RWP is not within the prescribed PBS burning area, the background soil sample locations for this site were not selected to be within a burned area. For the West Area RWP, three background soil samples were located and staked in a pristine forested area approximately 600 feet due west of the RWP.

Other proposed sample locations (as presented in the Work Plan) were discussed and the general areas in which they are located were visited. It should be noted that some of the areas had historic sample locations surveyed in and flagged by surveyors that were at the site to assist in orientation. Enough surface water was available at the proposed surface water/sediment sites for sample collection (most likely due to the wet spring) and it appeared that viable fish habitat exists. Minnows were observed in the unnamed creek flowing along Pentolite Road at the Pentolite Road RWP, and a great blue heron was seen at the open water West Area RWP. The water at the West Area RWP had significant growth of submergent aquatic macrophytes, while the Pentolite Road flowage had filamentous green algae.

On the morning of June 30, 2000 the group met Mr. John Blakeman, a member of the citizen Restoration Advisory Board (RAB). Mr. Blakeman is a biologist and knows the botany of PBS very well. He gave the group a tour of significant PBS botanical sites, and commented that the vegetative assemblage at the proposed Pentolite Road RWP background sampling locations had different species than the RWP area itself, suggesting different soil types. He recommended comparing soil types from an Eire County soil survey map to ensure similar soil types are indeed present at both locations. He agreed with the proposed background soil sample locations at the West Area RWP. Mr. Blakeman noted that more recent unpublished soil survey data may be available at the USDA Soil Service Center in Sandusky, Ohio.

Mr. Weisberg visited the USDA Soil Service Center located at 2900 Columbus Avenue at 1:30 PM June 30, 2000 to obtain any recent unpublished soil survey data, however, the office was closed with staff out in the field. A copy of the 1971 Erie County Soil Survey was picked up and reviewed by Mr. Weisberg. The proposed background soil locations for the Pentolite Road RWP and the RWP itself are both within the Arkport Galen soil association (one of the 12 main soil associations identified for Erie County). Although specific soil types within the Arkport Galen soil type differ between the two areas, it may be difficult to match the exact soil type, especially as the Pentolite Road RWP area has at least five different sub-Arkport Galen soil types. It should be noted that background soil COCs are less important than background surface water and sediment COCs, due to fewer inorganic risk drivers in the soil media. It should also be noted that the existing background soil database consists of results from 12 to 26 soil samples, therefore the collection of six additional background soil samples is a minor point.

It was discussed how exact locations of proposed sample locations would be identified in the field during the sampling event. Proposed surface water, sediment, and fish locations within open water may not be able to be flagged by surveyors (due to the water depth), and a global positioning system (GPS) might have to be used to pinpoint the desired sample locations.

Site conditions and feasibility of the proposed approach are documented herein and are being sent to CELRN, PBS and OEPA. This memo confirms the proposed Work Plan sampling design.

At the conclusion of ERA Step 5, there is a scientific management decision point (SMDP). IT had assumed that a proposed field conference call would fulfill SMDP 5. However, as OEPA did not attend the site visit, final resolution on this SMDP cannot be made at this time. IT had assumed that this Field Verification Memorandum for the record would be sufficient documentation for this ERA Step. It is now proposed that upon receipt of OEPA comments on the work plan and this memo, this memo will be revised as appropriate, and in its revised form it will serve as sufficient documentation for this ERA Step.

Action Items

- OEPA to provide comments on draft Phase 2 ERA Work Plan.
- OEPA to approve proposed background soil sampling locations.
- OEPA to comment on the recommendation in this memo that it is unnecessary for the bioassay laboratory to spike COCs in collected media (for subsequent uptake studies) if chemical analysis shows target COCs are non detect and the COC has been shown to have an historical frequency of detection of less than 5 percent.

APPENDIX B

SAMPLE COLLECTION LOGS

IT CORPORATION
A P' ·f The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number:

Site: **Pentolite Road Red Water Ponds**
Location Code: **PRWP-SO001**
Sample Number: **AC0001**
Sample Name: **PBOW-00-SS-PRWP-SO001-AC0001-0000**
Sampling Method: **GRAB**

Collection Date: 9/15/00
Collection Time: 1500

Start Depth: 0.0 ft
End Depth: 1.0 ft

Sample Team: MW TT

QC Partners:
Trip Blank
Rinsate
Field Blank

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
BIOACC-SO	N	A	1	3	Gal	BKT
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

80 ft south of DP 09 by pond edge

Logged By / Date: [illegible] 9/15/00 *Reviewed By / Date:*

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

Site: **Pentolite Road Red Water Ponds**
Location Code: **PRWP-SO001**
Sample Number: **AC0001-MS**
Sample Name: **PBOW-00-SS-PRWP-SO001-AC0001-0000**
Sampling Method: **GRAB**

QC Partners: _____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

RFA / COC Number: _____
Collection Date: 9/15/00
Collection Time: 1500
Start Depth: 0.0 ft
End Depth: 1.0 ft
Sample Team: MW, TT

ERPIMS Values:
Sacode: _____
Lot Control#: _____
Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

~~[illegible]~~ 11

80 ft South of DP #9 by pond edge

Logged By / Date: [illegible] 9/15/00 *Reviewed By / Date:*

IT CORPORATION
A ... of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number:

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SO001**

Sample Number: **AC0001-MSD**

Sample Name: **PBOW-00-SS-PRWP-SO001-AC0001-0000**

Sampling Method: **GRAB**

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Collection Date: 9/15/00

Collection Time: 1500

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: MW, TT

ERPIMS Values:

Sacode:

Lot Control#:

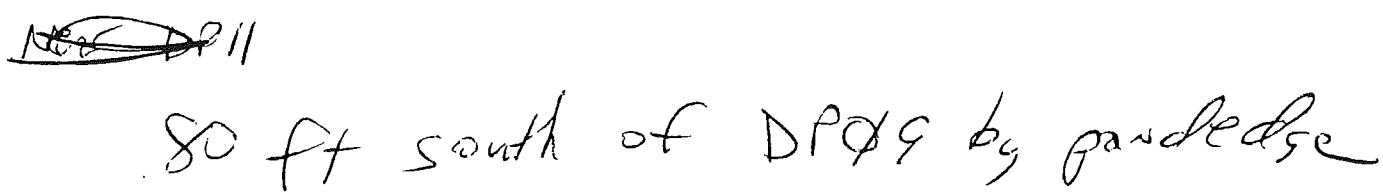
Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:



Logged By / Date: [signature] 9/15/00 *Reviewed By / Date:*

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number:

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SO002**

Sample Number: **AC0002**

Sample Name: **PBOW-00-SS-PRWP-SO002-AC0002-0000**

Sampling Method: **GRAB**

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Collection Date: 9/15/00

Collection Time: 1510

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: MW, TT

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
BIOACC-SO	N	A	1	3	Gal	BKT
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Right near DP 11 (1.0 ft NW)

Logged By / Date: Mark Weisberg 9/15/00 *Reviewed By / Date:*

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number:

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SO003**

Sample Number: **AC0003**

Sample Name: **PBOW-00-SS-PRWP-SO003-AC0003-0000**

Sampling Method: **GRAB**

QC Partners:

Trip Blank

Rinsate

Field Blank

Collection Date: 9/15/00

Collection Time: 1520

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: MW, TT

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
BIOACC-SO	N	A	1	3	Gal	BKT
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Near DP11 (5 ft south)

Logged By / Date: Mark Dailey 9/15/00 *Reviewed By / Date:*

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number:

Site: **Pentolite Road Red Water Ponds**
Location Code: **PRWP-SO004**
Sample Number: **AC0004**
Sample Name: **PBOW-00-SS-PRWP-SO004-AC0004-0000**
Sampling Method: **GRAB**

Collection Date: 9/15/00
Collection Time: 1530

Start Depth: 0.0 FT
End Depth: 1.0 FT

Sample Team: MW, TT

QC Partners:
Trip Blank
Rinsate
Field Blank

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
BIOACC-SO	N	A	1	3	Gal	BKT
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Near DP11 (5ft East)

Logged By / Date: Mark Wesley 9/15/00 *Reviewed By / Date:*

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

Site: **Pentolite Road Red Water Ponds**
Location Code: **PRWP-SO005**
Sample Number: **AC0005**
Sample Name: **PBOW-00-SS-PRWP-SO005-AC0005-0000**
Sampling Method: **GRAB**

QC Partners: _____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

RFA / COC Number: _____
Collection Date: 9/15/00
Collection Time: 1540
Start Depth: 0.0 ft
End Depth: 1.0 ft
Sample Team: MW, TT

ERPIMS Values:
Sacode: _____
Lot Control#: _____
Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
BIOACC-SO	N	A	1	3	Gal	BKT
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Near DP11 (5 ft north)

Logged By / Date: Mark Wesley 9/15/00 *Reviewed By / Date:*

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number:

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SO001** - DUP

Sample Number: **AC0006** - DUP

Sample Name: **PBOW-00-SS-PRWP-SO001-AC0006-0000**

Sampling Method: **GRAB**

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Collection Date: 9/15/00

Collection Time: 1500

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: MW, TT

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	B	1	4	oz	CWM

Comments:

Sketch Location:

80 ft south of DP09 by pond edge

Logged By / Date: Mike Wenberg 9/15/00 *Reviewed By / Date:*

IT CORPORATION
a of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015-EA(Bross.) 090015STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SD001**

Sample Number: **AC1001**

Sample Name: **PBOW-00-PRWP-SD001-AC1001-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1000

Start Depth: 0.0 ft

End Depth: 0.5 ft

Sample Team: MW, TT

QC Partners:

Trip Blank

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: sediment

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
SEMIVOLATILES3	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments:

Sketch Location: HS and work plan figure, just west of grass road in ditch SW 8-10' wide Mucky sediment / H_2S smell

Logged By / Date: Mark Wheeler 9/15/00 *Reviewed By / Date:* Chris Fashum 9/12/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA (Bioassay)

RFA / COC Number: 090015STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SD002**

Sample Number: **AC1002**

Sample Name: **PBOW-00-PRWP-SD002-AC1002-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1010

Start Depth: 0.0 FT

End Depth: 0.5 ft

Sample Team: MW, TT

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Sediment

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
SEMIVOLATILES3	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments:

Sketch Location: As on Work Plan Figure, just east of grass road in ditch SW 8-10' wide

Mucky sediment, H_2S smell

Logged By / Date: Mark Wesley 9/15/00 *Reviewed By / Date:* C. Fuchs 9/16/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA(bioassay

RFA / COC Number: 09150015STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SD003**

Sample Number: **AC1003**

Sample Name: **PBOW-00-PRWP-SD003-AC1003-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1130

Start Depth: 0.0 ft

End Depth: 0.5 ft

Sample Team: MW, TT

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: sediment

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
SEMIVOLATILES3	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments:

Sketch Location: At historic SW02/SD02 on ravine creek

Fibrous sediment, macrophyte roots

0.5-1.0' water depth

Logged By / Date: [illegible] 9/15/00 *Reviewed By / Date:* [illegible] 09/16/00

IT CORPORATION
r of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA (bioassay)

RFA / COC Number: 090015STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SD004**

Sample Number: **AC1004**

Sample Name: **PBOW-00-PRWP-SD004-AC1004-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1140

Start Depth: 0.0 ft

End Depth: 0.5 ft

Sample Team: MW, TT

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
SEMIVOLATILES3	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ 3	1	4	oz	CWM
✓BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments:

Sketch Location: 10 ft downstream of historic SW02/SD02 in ravine creek

Fibrous sediment, macrophyte roots

0.5 - 1.0 ft water depth

Logged By / Date: Mark Wesley 9/15/00 *Reviewed By / Date:*

IT CORPORATION
of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA(bioassay

RFA / COC Number: 090015STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SD005**

Sample Number: **AC1005**

Sample Name: **PBOW-00-PRWP-SD005-AC1005-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1150

Start Depth: 0.0 ft

End Depth: 0.5 ft

Sample Team: MW, TT

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Sediment

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
SEMIVOLATILES3	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments:

Sketch Location: 10 ft. upstream of historic SW02/SD02 in ravine creek.

Fibrous sediment, macrophyte roots

0.5-1.0 ft water depth

Logged By / Date: [illegible] 9/15/00 *Reviewed By / Date:*

IT CORPORATION
...er of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SW004**

Sample Number: **AC2004**

Sample Name: **PBOW-00-PRWP-SW004-AC2004-0000**

Sampling Method: **GRAB**

Collection Date: 9/14/00

Collection Time: 1155

Start Depth: —

End Depth: —

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Sample Team: T. Willard

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: water

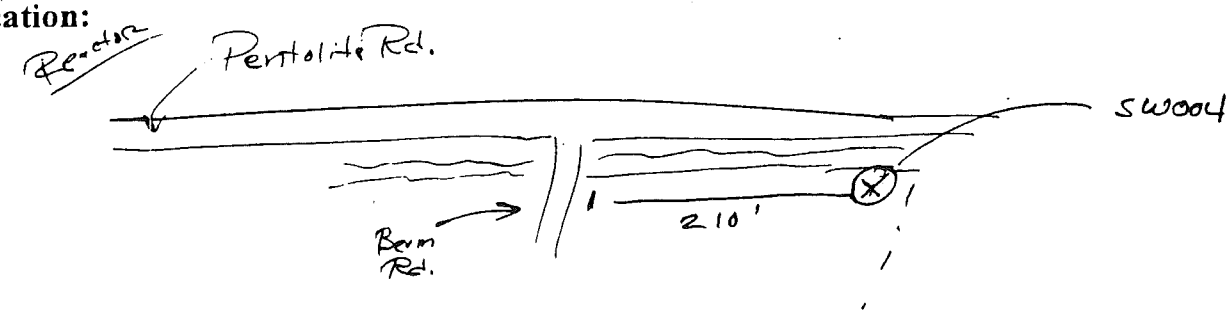
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:	-41.7	8.06	.942	12.0	8.6	18.9

Comments: Taken ≈ 210ft. from berm road near intermittent stream. Only sw sample taken at locations associated with fish collection activities. SW001, SW002, SW003, SW005 all not collected. Downgradient sample.

Sketch Location:



Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Freshman 9/14/00

IT CORPORATION
A The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 0900155TL 0900014EA (toxicity)

Site: **Pentolite Road Red Water Ponds**
Location Code: **PRWP-SW006**
Sample Number: **AC2006**
Sample Name: **PBOW-00-PRWP-SW006-AC2006-0000**
Sampling Method: **GRAB**
QC Partners:

Toxicity Only has already been sent!

Collection Date: 9/14/10
Collection Time: 1050
Start Depth: —
End Depth: —
Sample Team: T. Willard

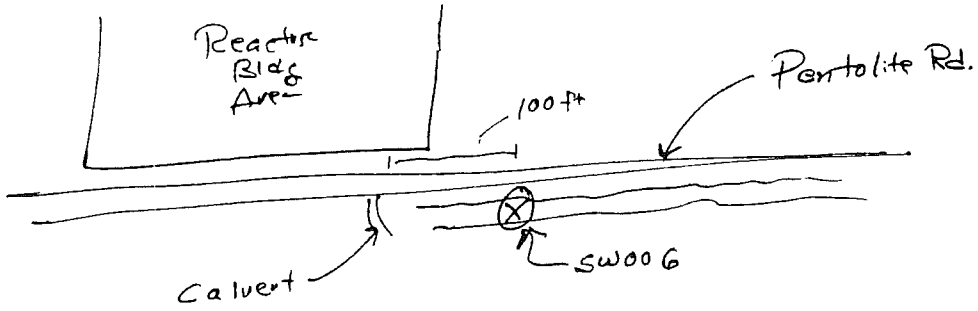
ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: Water

Analytical Suite	Flt	Frtn	Qty	Container Size		
METAL-ERA	N	A	1	1000	~~mL~~	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
TOXICITY-SW	N	C	3	1	Gal	HDPE

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
	26.3	7.92	.978	10	9.74	17.8

Comments: Background SW sample taken ≈ 100 ft. from calvert across from Reactor bldg. area. ~~SSAA Pa. 00~~

Sketch Location:



Logged By / Date: T. Willard 9/14/00 Reviewed By / Date: C. Freshwater 9/14/00

IT CORPORATION
a of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090016-STL 090014EA (toxicity)

Site: **Pentolite Road Red Water Ponds**
Location Code: **PRWP-SW007**
Sample Number: **AC2007**
Sample Name: **PBOW-00-PRWP-SW007-AC2007-0000**
Sampling Method: **GRAB**

Collection Date: 9/14/00
Collection Time: 1020
Start Depth: —
End Depth: —

QC Partners: _____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

Sample Team: T. Willard

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: Water

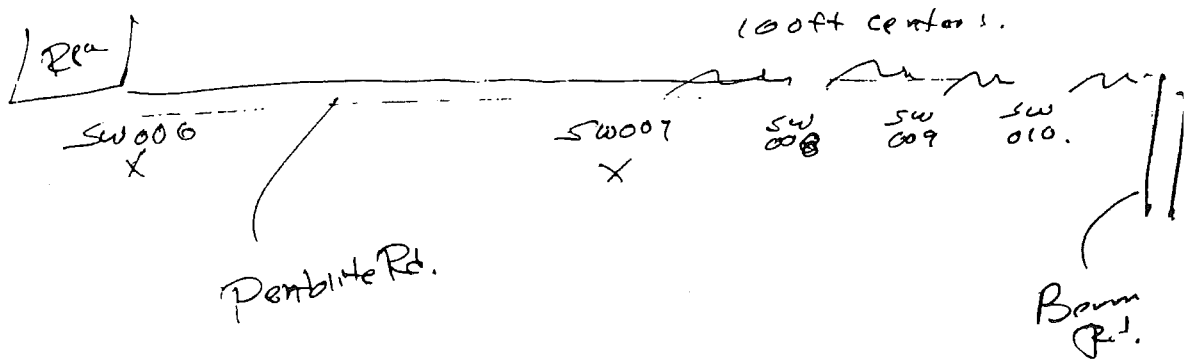
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
✓TOXICITY-SW	N	C	3	1	Gal	HDPE

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
	~~.968~~ -37.5	8.06	.968	10	10.1	17.3

Comments: 100ft. from SW006 (downstream of SW006)

Sketch Location:



Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Fredrin 9/14/00

IT CORPORATION
A (The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 0900155TL 0900 14EA (toxicity

Site: Pentolite Road Red Water Ponds
Location Code: PRWP-SW008
Sample Number: AC2008
Sample Name: PBOW-00-PRWP-SW008-AC2008-0000
Sampling Method: GRAB

Collection Date: 9/14/00
Collection Time: 1000
Start Depth: —
End Depth: —

QC Partners: _____ Trip Blank
_____ Rinsate
_____ Field Blank

Sample Team: T. Willard

ERPIMS Values:
Sacode: _____
Lot Control#: _____
Sample Matrix: Water

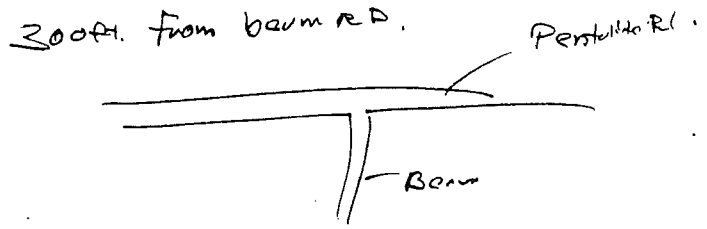
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
TOXICITY-SW	N	C	3	1	Gal	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:	-36.4	7.98	.956	10	9.8	17.3

Comments:

Sketch Location:



Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Freshman 9/14/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL 090014EA(toxicity)

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-SW009**

Sample Number: **AC2009**

Sample Name: **PBOW-00-PRWP-SW009-AC2009-0000**

Sampling Method: **GRAB**

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Collection Date: 9/14/00

Collection Time: 0940

Start Depth: —

End Depth: —

Sample Team: T. Willoud

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Water

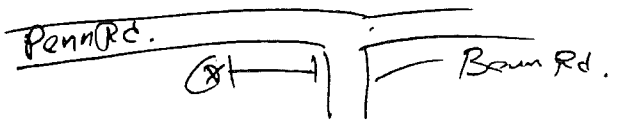
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
TOXICITY-SW	N	C	3	1	Gal	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:	-38.3	8.03	.956	10	10.1	17.2

Comments:

Sketch Location: 200 ft. from Barn Rd along Pentolite Rd.



Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Freshour 9/14/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL 090014EA (toxicity)

Site: Pentolite Road Red Water Ponds

Location Code: PRWP-SW010

Sample Number: AC2010

Sample Name: PBOW-00-PRWP-SW010-AC2010-0000

Sampling Method: GRAB

Collection Date: 9/14/00

Collection Time: 0918

Start Depth: —

End Depth: —

QC Partners: _____ Trip Blank

_____ Rinsate

_____ Field Blank

Sample Team: T. Willard

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Water

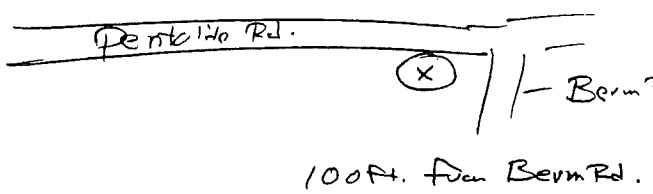
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
✓TOXICITY-SW	N	C	3	1	Gal	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:	-45.7	7.76	.951	—	9.1	17.8

Comments:

Sketch Location:



Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Fredman 9/14/00

IT CORPORATION
member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015-STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-BI001**

Sample Number: **AC4001**

Sample Name: **PBOW-00-BI-PRWP-BI001-AC4001-0000**

Sampling Method: **GRAB**

Collection Date: 9/14/00

Collection Time: 8:30 11:00 AM

Start Depth: NA

End Depth: NA

Sample Team: M. Weisberg, M. Johns.

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Fish

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: Run lab dup and MS/MSD and label as AC4001-DUP, AC4001-MS, and AC4001-MSD

Sketch Location:

Electroshock and seine along Pentolite Rd. Ditch Creek, downgradient from PRRWP site.

Logged By / Date: Mark Weisberg 9/14/00

Reviewed By / Date: C. Freeburn 9/15/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015-STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-BI002**

Sample Number: **AC4002**

Sample Name: **PBOW-00-BI-PRWP-BI002-AC4002-0000**

Sampling Method: **GRAB**

Collection Date: 9/14/00

Collection Time: 5:30 - 11:00 AM

Start Depth: NA

End Depth: NA

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Sample Team: M. Weisberg, M. Johnson

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Tadpoles

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: None

Sketch Location:

Electroshock and seine along pentolite Rd Ditch Creek, downgradient from PRWP site

Logged By / Date: Mark Weisberg 9/14/00 *Reviewed By / Date:* C. Freshwater 9/15/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015-STL

Site: **Pentolite Road Red Water Ponds**

Location Code: **PRWP-BI003**

Sample Number: **AC4003**

Sample Name: **PBOW-00-BI-PRWP-BI003-AC4003-0000**

Sampling Method: **GRAB**

Collection Date: 9/14/00

Collection Time: 8:30 - 11:00 AM

Start Depth: NA

End Depth: NA

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Sample Team: M. Weisberg, M. Johns

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Crayfish

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: None.

Sketch Location:

Electroshock and seine along Pentolite Rd Ditch Creek, downgradient from PRWP Site.

Logged By / Date: Mark Weisberg 9/14/00 *Reviewed By / Date:* C. Fredin 9/15/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: D900015-EA(bioassay) D900015STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SO001**

Sample Number: **AD0001**

Sample Name: **PBOW-00-WRWP-SO001-AD0001-0000**

Sampling Method: **GRAB**

Collection Date: 9·15·2000

Collection Time: 0955

Start Depth: 0'

End Depth: 1.0

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PAHS	N	A	1	4	oz	CWM
EXPLOSIVES	N	B	1	4	oz	CWM
BIOACC-SO	N	C	1	3	Gal	BKT

Comments:

Sketch Location:

W. Hamlope 9·15·2000
Logged By / Date:

Reviewed By / Date: C. Freshour 9/16/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SO002**

Sample Number: **AD0002**

Sample Name: **PBOW-00-WRWP-SO002-AD0002-0000**

Sampling Method: **GRAB**

Collection Date: 9.15.2000

Collection Time: 0845

Start Depth: 0'

End Depth: 1.0

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PAHS	N	A	1	4	oz	CWM
EXPLOSIVES	N	B	1	4	oz	CWM
BIOACC-SO	N	C	1	3	Gal	BKT

Comments:

Sketch Location:

W Stanhope 9.15.2000

Logged By / Date:

Reviewed By / Date: C. Fuehrer 9/16/00

IT CORPORATION
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Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 09150015STL

Site: West Area Red Water Ponds

Location Code: WRWP-SO003

Sample Number: AD0003

Sample Name: PBOW-00-WRWP-SO003-AD0003-0000

Sampling Method: GRAB

Collection Date: 09.15.2000

Collection Time: 0900

Start Depth: 0'

End Depth: 1.0'

Sample Team: WS / TW

QC Partners: _____ Trip Blank

_____ Rinsate

_____ Field Blank

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PAHS	N	A	1	4	oz	CWM
EXPLOSIVES	N	B	1	4	oz	CWM
BIOACC-SO	N	C	1	3	Gal	BKT

Comments:

Sketch Location:

W Stanhope 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Fleshing 9/15/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SO004**

Sample Number: **AD0004**

Sample Name: **PBOW-00-WRWP-SO004-AD0004-0000**

Sampling Method: **GRAB**

Collection Date: 09·15·2000

Collection Time: 0915

Start Depth: 0'

End Depth: 1.0'

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PAHS	N	A	1	4	oz	CWM
EXPLOSIVES	N	B	1	4	oz	CWM
BIOACC-SO	N	C	1	3	Gal	BKT

Comments:

Sketch Location:

W. Stanhope 9·15·2000
Logged By / Date:

Reviewed By / Date: C. Fashin 9/16/00

IT CORPORATION
The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SO005**

Sample Number: **AD0005**

Sample Name: **PBOW-00-WRWP-SO005-AD0005-0000**

Sampling Method: **GRAB**

Collection Date: 09.15.2000

Collection Time: 0930

Start Depth: 0'

End Depth: 1.5

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PAHS	N	A	1	4	oz	CWM
EXPLOSIVES	N	B	1	4	oz	CWM
BIOACC-SO	N	C	1	3	Gal	BKT

Comments:

Sketch Location:

W Sturhope 9.15.2000

Logged By / Date:

Reviewed By / Date: C. Fosbury 9/16/00

IT CORPORATION
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Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: West Area Red Water Ponds

Location Code: WRWP-SD001

Sample Number: AD1001

Sample Name: PBOW-00-WRWP-SD001-AD1001-0000

Sampling Method: GRAB

Collection Date: 09.14.2000

Collection Time: 1410

Start Depth: 0'

End Depth: 1.0'

QC Partners: None

Trip Blank

Rinsate

Field Blank

Sample Team: WS / TT

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	~~D~~ C	1	3	Gal	BKT
PHOSPHOROUS	N	~~E~~ D	1	4	oz	CWM

Comments: Sediment sample collected 2½ ft. below water surface.

Sketch Location:

W. Starhagen 9-14-2000
Logged By / Date:

Reviewed By / Date: C. Fashum 9/15/00

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA(bracket)

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD002**

Sample Number: **AD1002**

Sample Name: **PBOW-00-WRWP-SD002-AD1002-0000**

Sampling Method: **GRAB**

Collection Date: 09.14.2000

Collection Time: 1500

Start Depth: 0'

End Depth: 1.0'

Sample Team: WS / TT

QC Partners: None *Trip Blank*

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments: Sediment sample collected 2½ ft. below water ~~sample~~ surface

Sketch Location:

W. Stanhope 9-14-2000
Logged By / Date:

Reviewed By / Date: C. Fashner 9/16/00

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: West Area Red Water Ponds

Location Code: WRWP-SD00~~1~~2

Sample Number: AD100~~1~~2-MS

Sample Name: PBOW-00-WRWP-SD00~~1~~2-AD100~~1~~2-MS-0000

Sampling Method: GRAB

Collection Date: 09-14-2000

Collection Time: 1500

Start Depth: 0'

End Depth: 1.0'

QC Partners: None — *Trip Blank*; *Rinsate*; *Field Blank*

Sample Team: WS/TT

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~B	1	4	oz	CWM
PHOSPHOROUS	N	E	1	4	oz	CWM

~~BIOACCESSIBILITY 1 3 Gal BKT~~ WS

Comments: Sediment sample collected 2½ ft. below water surface

Sketch Location:

MS + MSD switched to SD002 + AB100Z-MS AB100Z-MSD

W. Stankiewicz 9-14-2000
Logged By / Date:

Reviewed By / Date: C. Fuchs 9/16/00

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD00~~1~~2**

Sample Number: **AD100~~1~~2-MSD**

Sample Name: **PBOW-00-WRWP-SD00~~1~~2-AD100~~1~~2-MSD-000**

Sampling Method: **GRAB**

Collection Date: 09.14.2000

Collection Time: 1500

Start Depth: 0'

End Depth: 1.0'

QC Partners: None *Trip Blank*

Rinsate

Field Blank

Sample Team: WS / TT

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~B	1	4	oz	CWM
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments: sediment sample collected 2½ ft. below water surface.

Sketch Location:

W. Stankiewicz 9-14-2000

Logged By / Date:

Reviewed By / Date: C. Fortman 9/16/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 09/5 0015 SIZ (09 0015-EA (bioaccum.))

Site: **West Area Red Water Ponds**
Location Code: **WRWP-SD003**
Sample Number: **AD1003**
Sample Name: **PBOW-00-WRWP-SD003-AD1003-0000**
Sampling Method: **GRAB**

Collection Date: ~~1330~~ 09.14.200.
Collection Time: 1330
Start Depth: 0'
End Depth: 1.0'
Sample Team: WS / TT

QC Partners: None *Trip Blank*
Rinsate
Field Blank

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments: Sediment sample collected 2½ ft. below water surface.

Sketch Location:

Logged By / Date: C. Stanhope 9-14-2000

Reviewed By / Date: C. Fuscher 9/15/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA(bioaccum)

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD004**

Sample Number: **AD1004**

Sample Name: **PBOW-00-WRWP-SD004-AD1004-0000**

Sampling Method: **GRAB**

Collection Date: 09.14.2000

Collection Time: 1055

Start Depth: 0'

End Depth: 1-0'

Sample Team: WS / TT

QC Partners: None *Trip Blank*

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments: Sediment sample collected 2½ ft. below water surface.

Sketch Location:

W. Shrhope 9-14-2000
Logged By / Date:

Reviewed By / Date: C. Fashum 9/11/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

090015-EA(bioaccum)

RFA / COC Number: 090015-STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD005**

Sample Number: **AD1005**

Sample Name: **PBOW-00-WRWP-SD005-AD1005-0000**

Sampling Method: **GRAB**

Collection Date: 09.14.2000

Collection Time: 1150

Start Depth: 0'

End Depth: 1.0'

Sample Team: WS / JT

QC Partners: None *Trip Blank*

↓ *Rinsate*

↓ *Field Blank*

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
BIOACC-SD	N	D	1	3	Gal	BKT
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments: sediment sample collected 2½ ft. below water surface.

Sketch Location:

Logged By / Date: W Stanberg 9.14.2000

Reviewed By / Date: C Frahm 9/16/00

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 09001500EA2 (TOX) 09001500STL

Site: West Area Red Water Ponds

Location Code: WRWP-SD006

Sample Number: AD1006

Sample Name: PBOW-00-WRWP-SD006-AD1006-0000

Sampling Method: GRAB

Collection Date: 09. 13. 2000

Collection Time: 1835

Start Depth: 0'

End Depth: 1.0

Sample Team: WS / MJ

QC Partners: None Trip Blank

None Rinsate

None Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
TOXICITY-SD	N	E	1	3	Gal	BKT
METAL-ERA	N	B	1	4	oz.	CWM
PHOSPHORUS	N		1	4	oz	CWM

Comments:

Sediment Sample collected 2½ ft. below water surface.

Sketch Location:

Metals + Phosphorus added to analy. suite. AD1006-1010

W. Attaway 9.14.2000

Logged By / Date:

Reviewed By / Date: C. Fuchs 9/16/00

IT CORPORATION
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Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 09001500EA2 (TOX) 09001 5STL

Site: **West Area Red Water Ponds**
Location Code: **WRWP-SD007**
Sample Number: **AD1007**
Sample Name: **PBOW-00-WRWP-SD007-AD1007-0000**
Sampling Method: **GRAB**

Collection Date: 09.14.2000
Collection Time: 0940
Start Depth: 0'
End Depth: 1.0
Sample Team: WS / TT

QC Partners: None *Trip Blank*
Rinsate
Field Blank

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
TOXICITY-SD	N	E	1	3	Gal	BKT
METAL-ERA			1	4	oz	CWM
PHOSPHORUS			1	4	oz	CWM

Comments:

Sediment sample collected 2½ ft. below water surface.

Sketch Location:

W. Stanhope 9.14.2000
Logged By / Date:

Reviewed By / Date: C. Fuhrer 9/16/00

IT CORPORATION
of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

09001500E+12(TOK)

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD008**

Sample Number: **AD1008**

Sample Name: **PBOW-00-WRWP-SD008-AD1008-0000**

Sampling Method: **GRAB**

Collection Date: 09.14.2000

Collection Time: 1240

Start Depth: 0'

End Depth: 1.0'

Sample Team: WS / TT

QC Partners: None *Trip Blank*

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
TOXICITY-SD	**N**	**E**	**1**	**3**	**Gal**	**BKT**
METAL-ERA			1	4	oz	CWM
PHOSPHORUS			1	4	oz	CWM

Comments:

Sediment sample collected 2½ ft. below water surface.

Sketch Location:

W. Stanhope 9.14.2000

Logged By / Date:

Reviewed By / Date: C. Fowler 9/16/00

IT CORPORATION
a of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

09001500EA2(TX)

RFA / COC Number: 090015STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD009**

Sample Number: **AD1009**

Sample Name: **PBOW-00-WRWP-SD009-AD1009-0000**

Sampling Method: **GRAB**

Collection Date: 09.13.2000

Collection Time: 1825

Start Depth: 0'

End Depth: 1.0'

Sample Team: MW / TW

QC Partners: None *Trip Blank*

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
TOXICITY-SD	N	E	1	3	Gal	BKT
METAL-ERA			1	4	oz	CWM
PHOSPHORUS			1	4	oz	CWM

Comments: Sediment samples collected 2½ ft. below water surface.

Sketch Location:

W. Stanhope 9.14.2000
Logged By / Date:

Reviewed By / Date: C. Fuller 9/16/00

IT CORPORATION
r of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **West Area Red Water Ponds**

Location Code: **WRWP-SD010**

Sample Number: **AD1010**

Sample Name: **PBOW-00-WRWP-SD010-AD1010-0000**

Sampling Method: **GRAB**

Collection Date: 09.13.2000

Collection Time: 1905

Start Depth: 0'

End Depth: 1.0'

Sample Team: MW / TW

QC Partners: None *Trip Blank*

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
TOXICITY-SD	**N**	**E**	**1**	**3**	**Gal**	**BKT**
METAL-ERA	1		1	4	oz	CWM
PHOSPHORUS			1	4	oz	CWM

Comments:

Sediment sample collected 2½ ft. below water surface.

Sketch Location:

W. Stanhope 9.14.2000
Logged By / Date:

Reviewed By / Date: C Faulkner 9/14/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

Site: **West Area Red Water Ponds**
Location Code: **WRWP-SD00~~1~~ 2**
Sample Number: **AD1011**
Sample Name: **PBOW-00-WRWP-SD00~~1~~ 3-AD1011-0000**
Sampling Method: **GRAB**

QC Partners: None *Trip Blank*
Rinsate
Field Blank

RFA / COC Number: 090015 STL
Collection Date: 09.14.2000
Collection Time: 1500
Start Depth: 0'
End Depth: 1.0'
Sample Team: WS / TT

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METAL-ERA	N	B	1	4	oz	CWM
TOC	N	~~C~~ B	1	4	oz	CWM
PHOSPHOROUS	N	E	1	4	oz	CWM

Comments: Sediment samples collected 2½ ft. below water surface.

Sketch Location:

W. Stanhope 9.14.2000
Logged By / Date:

Reviewed By / Date: C. Fuhrman 9/14/00

IT CORPORATION
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Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STB

Site: West Area Red Water Ponds

Location Code: WRWP-SW006

Sample Number: AD2006

Sample Name: PBOW-00-WRWP-SW006-AD2006-0000

Sampling Method: GRAB

Collection Date: 9/13/00

Collection Time: 11:10 a.m.

Start Depth: —

End Depth: —

QC Partners: Trip Blank, Rinsate, Field Blank

Sample Team: M. Weisburg, T. Willard

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: WATER

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
~~TOXICITY-SW~~	~~N~~	~~C~~	~~3~~	~~1~~	~~Gal~~	~~HDPE~~

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
	-119	9.51	0.492	15	7.81	23.0

Comments:

Sketch Location:

See W.P. Fig

Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Fuller 9/16/00

IT CORPORATION
ember of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: OGED15STL

Site: West Area Red Water Ponds

Location Code: WRWP-SW007

Sample Number: AD2007

Sample Name: PBOW-00-WRWP-SW007-AD2007-0000

Sampling Method: GRAB

Collection Date: 9/13/00

Collection Time: 10:45

Start Depth:

End Depth:

QC Partners:

Trip Blank

Rinsate

Field Blank

Sample Team: M. Weisburg, T. Willard

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: WATER

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
~~TOXICITY-SW~~	~~N~~	~~C~~	~~3~~	~~1~~	~~Gal~~	~~HDPE~~

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
	-84	8.35	.673	46	8.94	20.0

Comments:

Sketch Location:

See WP Figure.

Logged By / Date: [signature] 9/14/00

Reviewed By / Date: C. Fralen 9/11/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

Site: West Area Red Water Ponds
Location Code: WRWP-SW008
Sample Number: AD2008
Sample Name: PBOW-00-WRWP-SW008-AD2008-0000
Sampling Method: GRAB

QC Partners:
Trip Blank
Rinsate
Field Blank

RFA / COC Number: E90015572
Collection Date: 9/13/00
Collection Time: 11:33 a.m
Start Depth:
End Depth:
Sample Team: M. Weisburg, T. Willard

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: WATER

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
~~TOXICITY-SW~~	~~N~~	~~C~~	~~3~~	~~1~~	~~Gal~~	~~HDPE~~

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
	-126	9.54	0.533	23	7.7	23.8

Comments:

Sketch Location:

See W.P. Figure

Logged By / Date: [signature] 9/14/00 Reviewed By / Date: C. Fochum 9/14/1.

IT CORPORATION
er of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: E9001SSTL

Site: West Area Red Water Ponds

Location Code: WRWP-SW009

Sample Number: AD2009

Sample Name: PBOW-00-WRWP-SW009-AD2009-0000

Sampling Method: GRAB

Collection Date: 9/13/00

Collection Time: 12:30 p.m

Start Depth:

End Depth:

QC Partners: Trip Blank

Rinsate

Field Blank

Sample Team: LW/TJW

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: WATER

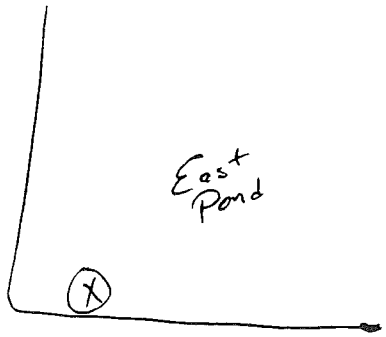
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
~~TOXICITY SW~~	~~N~~	~~C~~	~~3~~	~~1~~	~~Gal~~	~~HDPE~~

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:	-7.0	7.68	0.236	—	9.62	20.5

Comments:

Sketch Location:



Same as WP fig.

Logged By / Date: 9/14/00

Reviewed By / Date: 9/14/00

IT CORPORATION
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Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: West Area Red Water Ponds

Location Code: WRWP-SW010

Sample Number: AD2010

Sample Name: PBOW-00-WRWP-SW010-AD2010-0000

Sampling Method: GRAB

Collection Date: 9/12/00

Collection Time: 12:50 p.m

Start Depth:

End Depth:

QC Partners: Trip Blank

Rinsate

Field Blank

Sample Team: LW/TJW

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: WATER

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	1000	mL	HDPE
PHOSPHOROUS	N	B	1	125	mL	HDPE
~~TOXICITY-SW~~	~~N~~	~~C~~	~~3~~	~~1~~	~~Gal~~	~~HDPE~~

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
	-48.7	8.25	0.574	217	9.71	19.5

Comments:

Sketch Location:

See WP Fig

Logged By / Date: [signature] 9/14/00 Reviewed By / Date: C Fowler 9/15/00

IT CORPORATION
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Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015-~~EX~~ STL

Site: West Area Red Water Ponds

Location Code: WRWP-BI001

Sample Number: AD4001

Sample Name: PBOW-00-WRWP-BI001-AD4001-0000

Sampling Method: GRAB

Collection Date: 9/13/00

Collection Time: 12:30 AM - 3:00 PM

Start Depth: NA

End Depth: NA

QC Partners:

Trip Blank

Rinsate

Field Blank

Sample Team: M. Weisberg, M. Johnson

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Fish

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: Run lab dup and MS/MSD.

Sketch Location:

Entire large pond electroshocked.

Logged By / Date: Mark Weisberg 9/14/00

Reviewed By / Date: C. Fuslin 9/15/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

Site: West Area Red Water Ponds
Location Code: WRWP-BI002
Sample Number: AD4002
Sample Name: PBOW-00-WRWP-BI002-AD4002-0000
Sampling Method: GRAB

QC Partners: *Trip Blank* *Rinsate* *Field Blank*

RFA / COC Number: 090015-STL
Collection Date: 9/13/00
Collection Time: 12:30AM - 3:00PM
Start Depth: NA
End Depth: NA
Sample Team: M. Weisberg, M. Johnson

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: None

Sketch Location:

Entire large pond electroshocked

Logged By / Date: Mark Weisberg 9/14/00 *Reviewed By / Date:* C. Fraylen 9/15/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

Site: **West Area Red Water Ponds**
Location Code: **WRWP-BI003**
Sample Number: **AD4003**
Sample Name: **PBOW-00-WRWP-BI003-AD4003-0000**
Sampling Method: **GRAB**
QC Partners:

Trip Blank
Rinsate
Field Blank

RFA / COC Number: 090015-STL
Collection Date: 9/13/00
Collection Time: 12:30AM - 3:00 PM
Start Depth: NA
End Depth: NA
Sample Team: M. Weisberg, M. Johnson

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: Fish

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: None

Sketch Location:

Entire large Pond Electroshocked.

Logged By / Date: Mark Weisberg 9/14/00 *Reviewed By / Date:* C. Freshour 9/15/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

Site: West Area Red Water Ponds
Location Code: WRWP-BI004
Sample Number: AD4004
Sample Name: PBOW-00-WRWP-BI004-AD4004-0000
Sampling Method: GRAB

QC Partners: *Trip Blank* *Rinsate* *Field Blank*

RFA / COC Number: 090015-STL
Collection Date: 9/13/00
Collection Time: 12:30AM - 3:00PM
Start Depth: NA
End Depth: NA
Sample Team: M. Weisberg, M. Johnson

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: Fish

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
LIPIDS	N	A	1	0	None	FISH
METAL-ERA	N	A	1	0	None	FISH
PHOSPHOROUS	N	A	1	0	None	FISH

Comments: None

Sketch Location:

Entire large pond electroshocked

Logged By / Date: Mark Weisberg 9/14/00 *Reviewed By / Date:* C. Fuchs 9/15/00

IT CORPORATION
member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 09001557L

Site: **Background**

Location Code: **BCG-SO001**

Sample Number: **AE0001**

Sample Name: **PBOW-00-BCG-SO001-AE0001-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1710

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: TT

QC Partners:

Trip Blank

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: SOIL

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location: As per workplan

Parkside Rd.

Logged By / Date: [illegible] 9/14/00

Reviewed By / Date: C. Fosham 9/14/00

IT CORPORATION
a of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: D40015STL

Site: **Background**

Location Code: **BCG-SO001**

Sample Number: **AE0001-MS**

Sample Name: **PBOW-00-BCG-SO001-AE0001-MS-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1710

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location:

As per work plan

intake Rd

Logged By / Date: Mark Newsby 9/14/00

Reviewed By / Date: C. Fullum 9/16/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015-STL

Site: **Background**

Location Code: **BCG-SO001**

Sample Number: **AE0001-MSD**

Sample Name: **PBOW-00-BCG-SO001-AE0001-MSD-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1710

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: TT

QC Partners:

Trip Blank

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location:

As per work plan

Parallel Rd

Logged By / Date: Mark Neeley 9/14/00 *Reviewed By / Date:* C. Fashum 9/16/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

Site: Background
Location Code: BCG-SO002
Sample Number: AE0002
Sample Name: PBOW-00-BCG-SO002-AE0002-0000
Sampling Method: GRAB

QC Partners: _____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

RFA / COC Number: 090015 STC
Collection Date: 9/12/00
Collection Time: 1700

Start Depth: 0.0 ft
End Depth: 1.0 ft

Sample Team: TT

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix: soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location:

As per work plan

Portable Rd

Logged By / Date: Mark Neiberg 9/14/00 *Reviewed By / Date:* C. Parker 9/16/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 000015STL

Site: **Background**

Location Code: **BCG-SO003**

Sample Number: **AE0003**

Sample Name: **PBOW-00-BCG-SO003-AE0003-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1700

Start Depth: 0.0 ft

End Depth: 1.0 ft

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Sample Team: MW

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location: As per work plan

Pettis Rd

Logged By / Date: [illegible] 9/14/00

Reviewed By / Date: C. Fulton 9/16/00

IT CORPORATION
a of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Background**

Location Code: **BCG-SO004**

Sample Number: **AE0004**

Sample Name: **PBOW-00-BCG-SO004-AE0004-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1810

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: TN

QC Partners:

Trip Blank

Rinsate

Field Blank

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location: As per work plan

West Area

Logged By / Date: Mark Wesley 9/14/00

Reviewed By / Date: C Franklin 9/16/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: Background

Location Code: BCG-SO005

Sample Number: AE0005

Sample Name: PBOW-00-BCG-SO005-AE0005-0000

Sampling Method: GRAB

Collection Date: 9/12/00

Collection Time: 1820

Start Depth: 0.0

End Depth: 1.0

Sample Team: TW

QC Partners: _____ Trip Blank

_____ Rinsate

_____ Field Blank

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location:

As per work plan

West Area

Logged By / Date: Mike Spangberg 9/14/00

Reviewed By / Date: C. Fischer 9/14/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Background**

Location Code: **BCG-SO006**

Sample Number: **AE0006**

Sample Name: **PBOW-00-BCG-SO006-AE0006-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1825

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: IT

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix: Soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location:

As per work plan

West Area

Logged By / Date: Mark Welsby 9/14/00 *Reviewed By / Date:* C. Fuller 9/14/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **Background**

Location Code: **BCG-SO001** -FD

Sample Number: **AE0007**

Sample Name: **PBOW-00-BCG-SO001-AE0007-0000**

Sampling Method: **GRAB**

Collection Date: 9/12/00

Collection Time: 1710

Start Depth: 0.0 ft

End Depth: 1.0 ft

Sample Team: TT

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: Soil

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PAHS	N	B	1	4	oz	CWM
PHOSPHOROUS	N	C	1	4	oz	CWM

Comments:

Sketch Location: As per work plan

Forest Area

Logged By / Date: [illegible] 9/14/00

Reviewed By / Date: [illegible]

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 09001551L

Site: **Background**
Location Code: **BCG-SD001**
Sample Number: **AE1001**
Sample Name: **PBOW-00-BCG-SD001-AE1001-0000**
Sampling Method: **GRAB**

Collection Date: 9.15.2000
Collection Time: 1515

Start Depth: 0
End Depth: 1.0

QC Partners:
_____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

Sample Team: WS / TN

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PHOSPHOROUS	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Pentolite Rd Site

W. Stanhope 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Farlin 9/11/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Background**

Location Code: **BCG-SD002**

Sample Number: **AE1002**

Sample Name: **PBOW-00-BCG-SD002-AE1002-0000**

Sampling Method: **GRAB**

Collection Date: 9.15.2000

Collection Time: 1435

Start Depth: 0'

End Depth: 1.0'

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Sample Team: WS/TNN

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PHOSPHOROUS	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Portolite Rd Site

W. Stanhope 9/15/2000

Logged By / Date:

Reviewed By / Date: C. Fuelsen

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Background**

Location Code: **BCG-SD003**

Sample Number: **AE1003**

Sample Name: **PBOW-00-BCG-SD003-AE1003-0000**

Sampling Method: **GRAB**

Collection Date: 9.15.2000

Collection Time: 1455

Start Depth: 0

End Depth: 1.0'

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PHOSPHOROUS	N	B	1	4	oz	CWM

Comments:

Sketch Location:

Pentolite Rd Site

W. Stanhope 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Fisher 9/16/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 09001557L

Site: **Background**
Location Code: **BCG-SD004**
Sample Number: **AE1004**
Sample Name: **PBOW-00-BCG-SD004-AE1004-0000**
Sampling Method: **GRAB**

Collection Date: 9 15 2000
Collection Time: 1215

Start Depth: 0
End Depth: 0.5'

QC Partners: _____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

Sample Team: _____

ERPIMS Values:
Sacode: _____
Lot Control#: _____
Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PHOSPHOROUS	N	B	1	4	oz	CWM

Comments:

Sketch Location:

West Area RWP

W. Stanhope 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Franklin 9/11/00

IT CORPORATION
ber of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **Background**

Location Code: **BCG-SD005**

Sample Number: **AE1005**

Sample Name: **PBOW-00-BCG-SD005-AE1005-0000**

Sampling Method: **GRAB**

Collection Date: 9·15·2000

Collection Time: 1150

Start Depth: 0

End Depth: 0.5'

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

Sample Team: WS / TW

ERPIMS Values:

Sacode:

Lot Control#:

Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PHOSPHOROUS	N	B	1	4	oz	CWM

Comments: Sediment collected below surface water of approximately 0.5 ft.

Sketch Location:

West Area RWP Site

W. Hunlage 9·15·2000

Logged By / Date:

Reviewed By / Date: C Freeman 9/16/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **Background**

Location Code: **BCG-SD006**

Sample Number: **AE1006**

Sample Name: **PBOW-00-BCG-SD006-AE1006-0000**

Sampling Method: **GRAB**

Collection Date: 09.15.2000

Collection Time: 1130

Start Depth: 0'

End Depth: 0.5'

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
METAL-ERA	N	A	1	4	oz	CWM
PHOSPHOROUS	N	B	1	4	oz	CWM

Comments: Sediment collected below surface water ~~of~~ approx. 0.5 ft

Sketch Location:

West Area RCRA Site

W Stanhope 9.15.2000

Logged By / Date:

Reviewed By / Date: C. Freshour 9/16/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 0900155TL

Site: **Background**

Location Code: **BCG-SW001**

Sample Number: **AE2001**

Sample Name: **PBOW-00-BCG-SW001-AE2001-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1515

Start Depth: NA

End Depth: NA

Sample Team: WS | TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PHOSPHOROUS	N	A	1	125	mL	HDPE
METAL-ERA	N	B	1	1000	mL	HDPE

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
		8.03	0.7	10	11.7	15.6

Comments:

Sketch Location:

Pentolite RWP Site

W. Stanhope 07.15.2000

Logged By / Date:

Reviewed By / Date: C. Fuselier 9/11/00

IT CORPORATION
member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Background**

Location Code: **BCG-SW002**

Sample Number: **AE2002**

Sample Name: **PBOW-00-BCG-SW002-AE2002-0000**

Sampling Method: **GRAB**

Collection Date: 7/15/00

Collection Time: 1435

Start Depth: NA

End Depth: NA

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PHOSPHOROUS	N	A	1	125	mL	HDPE
METAL-ERA	N	B	1	1000	mL	HDPE

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
		8.18	0.794	114	10.5	17.8

Comments:

Sketch Location:

Pentoik Rd RWP Site.

W. Hanhope 07.15.2000

Logged By / Date:

Reviewed By / Date: C. Freeman 9/16/00

IT CORPORATION
Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015 STL

Site: **Background**

Location Code: **BCG-SW003**

Sample Number: **AE2003**

Sample Name: **PBOW-00-BCG-SW003-AE2003-0000**

Sampling Method: **GRAB**

Collection Date: 9/15/00

Collection Time: 1455

Start Depth: NA

End Depth: NA

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*

_____ *Rinsate*

_____ *Field Blank*

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PHOSPHOROUS	N	A	1	125	mL	HDPE
METAL-ERA	N	B	1	1000	mL	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:		8.27	0.786		10.4	17.5

Comments:

Sketch Location:

pentolite RWP site

W. Stuhage / 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Fuesler 9/15/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: D80015STC ~~09/15/00~~

Site: **Background**
Location Code: **BCG-SW004**
Sample Number: **AE2004**
Sample Name: **PBOW-00-BCG-SW004-AE2004-0000**
Sampling Method: **GRAB**

Collection Date: 9.15.2000
Collection Time: 1215

Start Depth: NA
End Depth: NA

Sample Team: WS / TW

QC Partners: _____ *Trip Blank*
_____ *Rinsate*
_____ *Field Blank*

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PHOSPHOROUS	N	A	1	125	mL	HDPE
METAL-ERA	N	B	1	1000	mL	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:						

Comments: conductivity = 0.719 mS/cm Turbidity = 10
DO = 10.2 mg/L Temp = 15.7°C pH = 8.22

Sketch Location:

West Area pump Site

W Stenlage 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Freshwater 9/11/00

IT CORPORATION
member of The IT Group

Sample Collection Log

Project: 807053 **PLUM BROOK ORDNANCE WK**

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: Background
Location Code: BCG-SW005
Sample Number: AE2005
Sample Name: PBOW-00-BCG-SW005-AE2005-0000
Sampling Method: GRAB

Collection Date: 9.15.2000
Collection Time: 1150

Start Depth: NA
End Depth: NA

QC Partners: _____ Trip Blank
_____ Rinsate
_____ Field Blank

Sample Team: WS / TW

ERPIMS Values:
Sacode:
Lot Control#:
Sample Matrix:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PHOSPHOROUS	N	A	1	125	mL	HDPE
METAL-ERA	N	B	1	1000	mL	HDPE

	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)
Surface Water Parameters:						

Comments: conductivity = 0.719 mS/cm Turbidity = 10
DO = 11.6 mg/L Temp = 15.8°C pH = 8.16

Sketch Location:

West Area RWP Site

W Stanhope 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Fuselier 9/15/00

IT CORPORATION
A Member of The IT Group

Sample Collection Log

Project: 807053 PLUM BROOK ORDNANCE WK

Manager: Mike Spangberg

RFA / COC Number: 090015STL

Site: **Background**

Location Code: **BCG-SW006**

Sample Number: **AE2006**

Sample Name: **PBOW-00-BCG-SW006-AE2006-0000**

Sampling Method: **GRAB**

Collection Date: 9.15.2000

Collection Time: 1130

Start Depth: (WS) ~~0~~ NA

End Depth: (WS) ~~0~~ NA

Sample Team: WS / TW

QC Partners: _____ Trip Blank

_____ Rinsate

_____ Field Blank

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Sample Matrix: _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
PHOSPHOROUS	N	A	1	125	mL	HDPE
METAL-ERA	N	B	1	1000	mL	HDPE

Surface Water Parameters:	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)

Comments: Conductivity = 0.744 mS/cm Turbidity = 10
DO = 11.0mg/L Temp = 16°C pH = 7.36
~~Sediment sample collected below water (6" depth)~~ (WS)

Sketch Location:

West Area RWP Site

W Stanhope 9.15.2000
Logged By / Date:

Reviewed By / Date: C. Fuslum 9/16/00

Plum Brook Ordnance Works

2000 Survey Data
West Area Redwater Pond
Pentolite Road Redwater Pond

THESE VALUES WERE SCALED TO THE OHIO STATE PLANE COORDINATE SYSTEM (NORTH ZONE). A COMBINED FACTOR OF 0.999927034 WAS USED IN THIS DETERMINATION. THESE COORDINATES A RE NAD 1983 DATUM EXPRESSED IN FEET. VERTICAL DATUM IS NGVD 1929

PENTOLITE ROAD RED WATER PONDS SURFACE WATER AND SEDIMENT SAMPLES

MHS PT #	N(y)	E(x)	ELEV	I.T. #
1248	625790.540	1919025.499	623.51	PRWP-BCG-SW001/SD1
SURFACE WATER ELEAVTION @ 1248			623.81	
1264	624229.532	1919071.931	626.55	PRWP-BCG-SW002/SD2
SURFACE WATER ELEVATION @ 1264			626.85	
1265	624089.637	1918967.757	626.54	PRWP-BCG-SW003/SD3
SURFACE WATER ELEVATION @ 1265			627.04	
1242	625767.936	1919924.681	628.69	PRWP-SD001
1241	625763.998	1919964.861	628.26	PRWP-SD002
1254	624944.167	1919717.818	625.57	PRWP-SD003
SURFACE WATER ELEVATION @ 1254			625.87	
1255	624952.328	1919724.394	625.26	PRWP-SD004
SURFACE WATER ELEVATION @ 1255			625.56	
1253	624935.079	1919712.765	625.39	PRWP-SD005
SURFACE WATER ELEVATION @ 1253			625.69	
1240	625730.245	1920162.969	622.00	PRWP-SW004
SURFACE WATER ELEVATION @ 1240			622.70	
1249	625794.806	1918924.447	622.73	PRWP-SW006
SURFACE WATER ELEVATION @ 1249			623.33	
1247	625769.375	1919576.195	622.81	PRWP-SW007
SURFACE WATER ELEVATION @ 1247			623.31	
1245	625769.731	1919689.439	627.93	PRWP-SW008
SURFACE WATER ELEVATION @ 1245			628.33	
1244	625766.305	1919791.762	621.76	PRWP-SW009
SURFACE WATER ELEVATION @ 1244			622.56	
1243	625772.784	1919871.889	622.06	PRWP-SW010
SURFACE WATER ELEVATION @ 1243			622.76	

PENTOLITE ROAD RED WATER PONDS SOIL SAMPLES

1259	625255.805	1919222.142	631.51	PRWP-SO001
1260	624842.147	1919353.783	631.88	PRWP-SO002
1261	624834.890	1919354.433	631.36	PRWP-SO003
1262	624839.507	1919361.239	631.97	PRWP-SO004
1263	624845.742	1919357.572	631.89	PRWP-SO005
1250	623922.153	1921225.543	631.06	PRWP-BCG-SO001
1251	623905.078	1921235.995	631.04	PRWP-BCG-SO002
1252	623906.444	1921209.533	631.37	PRWP-BCG-SO003

PLUM BROOK ORDNANCE WORKS (OCTOBER 2000): PAGE 2 OF 2

THESE VALUES WERE SCALED TO THE OHIO STATE PLANE COORDINATE SYSTEM (NORTH ZONE). A COMBINED FACTOR OF 0.999927034 WAS USED IN THIS DETERMINATION. THESE COORDINATES A RE NAD 1983 DATUM EXPRESSED IN FEET. VERTICAL DATUM IS NGVD 1929

WEST RED WATER PONDS SURFACE WATER AND SEDIMENT SAMPLES

MHS PT #	N(y)	E(x)	ELEV	I.T. #
1279	621741.791	1909381.587	625.84	WRWP-SW004/SD004
SURFACE WATER ELEVATION @ 1279			626.44	
1278	621904.624	1909665.351	625.44	WRWP-SW005/SD005
SURFACE WATER ELEVATION @ 1278			626.24	
1277	621935.233	1909788.712	626.01	WRWP-SW006/SD006
SURFACE WATER ELEVATION @ 1277			626.31	
1276	621940.318	1909813.281	625.53	WRWP-SD009
SURFACE WATER ELEVATION @ 1276			626.53	
1273	622552.444	1910819.107	623.76	WRWP-SD010
SURFACE WATER ELEVATION @ 1273			624.31	
1274	622096.030	1910284.181	631.25	WRWP-SW009
SURFACE WATER ELEVATION @ 1274			631.40	
1275	621939.163	1909816.278	625.35	WRWP-SW010
SURFACE WATER ELEVATION @ 1275			626.35	

NOTE: THE FOLLOWING **SURFACE WATER AND SEDIM ENT SAMPLES** WERE LOCATED BY INTERSECTING ANGLES. NO E LEVATIONS WERE OBTAINED DUE TO THE INACCESABILITY OF THE POND.

AA1	622373.02	1910098.81	WRWP-SD001
AA2	622412.12	1910149.66	WRWP-SD002
AA3	622363.10	1910147.66	WRWP-SD003
AA4	622219.00	1910095.22	WRWP-SD004
AA5	622215.31	1910145.63	WRWP-SD005
AA6	622445.49	1910096.10	WRWP-SD006
AA7	622270.10	1910097.57	WRWP-SD007
AA8	622262.59	1910147.10	WRWP-SD008
AA9	622428.55	1909926.55	WRWP-SW006
AA10	622446.94	1910167.98	WRWP-SW007
AA11	622250.51	1910107.94	WRWP-SW008

WEST RED WATER PONDS SOIL SAMPLES

1266	622545.636	1910219.243	637.81	WRWP-SO001
1267	622430.464	1910396.226	633.15	WRWP-SO002
1268	622428.070	1910400.060	633.66	WRWP-SO003
1269	622423.734	1910399.044	633.12	WRWP-SO004
1270	622423.901	1910393.033	633.10	WRWP-SO005
1283	622541.020	1909337.954	644.52	WRWP-BCG-SO004
1284	622554.925	1909358.256	643.69	WRWP-BCG-SO005
1285	622527.543	1909353.783	644.92	WRWP-BCG-SO006

APPENDIX C

C-1 CHEMICAL ANALYTICAL DATA
C-2 DATA VALIDATION SUMMARY

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Acenaphthene	83-32-9	0.2	U	UJ	mg/kg	0.2	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Acenaphthene	83-32-9	0.38		B	mg/kg	0.17	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Acenaphthene	83-32-9	0.84		B	mg/kg	0.17	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Acenaphthene	83-32-9	0.38		B	mg/kg	0.17	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Acenaphthene	83-32-9	0.36		B	mg/kg	0.17	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Acenaphthylene	208-96-8	0.74		B	mg/kg	0.098	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Acenaphthylene	208-96-8	0.24		B	mg/kg	0.084	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Acenaphthylene	208-96-8	0.37		B	mg/kg	0.092	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Acenaphthylene	208-96-8	0.29		B	mg/kg	0.09	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Acenaphthylene	208-96-8	0.74		B	mg/kg	0.08	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI001	AD4001	13-Sep-00			Aluminum	7429-90-5	106	*	J	mg/kg	8.5	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Aluminum	7429-90-5	25	*	J	mg/kg	8.4	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Aluminum	7429-90-5	11.8	B*	J	mg/kg	8.5	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Aluminum	7429-90-5	61.9	*	J	mg/kg	8.5	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Aluminum	7429-90-5	70.1			mg/kg	2.2	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Aluminum	7429-90-5	25.5			mg/kg	2.2	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Aluminum	7429-90-5	17.6	B	J	mg/kg	2.2	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Aluminum	7429-90-5	47.8			mg/kg	2.2	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Aluminum	7429-90-5	17.1	B	J	mg/kg	2.2	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Anthracene	120-12-7	0.0039	U	UJ	mg/kg	0.0039	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Anthracene	120-12-7	0.0034	U	UJ	mg/kg	0.0034	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Anthracene	120-12-7	0.0037	U	UJ	mg/kg	0.0037	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Anthracene	120-12-7	0.0036	U	UJ	mg/kg	0.0036	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Anthracene	120-12-7	0.0032	U	UJ	mg/kg	0.0032	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI001	AD4001	13-Sep-00			Antimony	7440-36-0	0.09	B	B	mg/kg	0.07	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Antimony	7440-36-0	0.09	B	B	mg/kg	0.07	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Antimony	7440-36-0	0.1	B	B	mg/kg	0.07	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Antimony	7440-36-0	0.14	B	B	mg/kg	0.07	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Antimony	7440-36-0	0.25	U	U	mg/kg	0.25	METALS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Antimony	7440-36-0	0.25	U	U	mg/kg	0.25	METALS	BI	N	N	200144

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Antimony	7440-36-0	0.25	U	U	mg/kg	0.25	METALS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Antimony	7440-36-0	0.25	U	U	mg/kg	0.25	METALS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Antimony	7440-36-0	0.25	U	U	mg/kg	0.25	METALS	BI	N	N	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Arsenic	7440-38-2	0.53	U	U	mg/kg	0.53	METALS	BI	N	N	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Arsenic	7440-38-2	0.53	U	U	mg/kg	0.53	METALS	BI	N	N	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Arsenic	7440-38-2	0.53	U	U	mg/kg	0.53	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Arsenic	7440-38-2	0.53	U	U	mg/kg	0.53	METALS	BI	N	N	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Arsenic	7440-38-2	2	B	B	mg/kg	0.28	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Arsenic	7440-38-2	1.5	B	B	mg/kg	0.28	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Arsenic	7440-38-2	2	B	B	mg/kg	0.28	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Arsenic	7440-38-2	2.9	B	B	mg/kg	0.28	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Arsenic	7440-38-2	2.1	B	B	mg/kg	0.28	METALS	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Barium	7440-39-3	10.1	B	J	mg/kg	0.59	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Barium	7440-39-3	1.2	B	J	mg/kg	0.59	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Barium	7440-39-3	0.59	U	U	mg/kg	0.59	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Barium	7440-39-3	5.7	B	J	mg/kg	0.59	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Barium	7440-39-3	58.9		B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Barium	7440-39-3	65.8		B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Barium	7440-39-3	69.1		B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Barium	7440-39-3	72.8		B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Barium	7440-39-3	50		B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Benzo(a)anthracene	56-55-3	0.0098	U	UJ	mg/kg	0.0098	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Benzo(a)anthracene	56-55-3	0.0084	U	UJ	mg/kg	0.0084	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Benzo(a)anthracene	56-55-3	0.0092	U	UJ	mg/kg	0.0092	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Benzo(a)anthracene	56-55-3	0.009	U	UJ	mg/kg	0.009	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Benzo(a)anthracene	56-55-3	0.008	U	UJ	mg/kg	0.008	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Benzo(a)pyrene	50-32-8	0.0098	U	UJ	mg/kg	0.0098	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Benzo(a)pyrene	50-32-8	0.0084	U	UJ	mg/kg	0.0084	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Benzo(a)pyrene	50-32-8	0.0092	U	UJ	mg/kg	0.0092	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Benzo(a)pyrene	50-32-8	0.009	U	UJ	mg/kg	0.009	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Benzo(a)pyrene	50-32-8	0.008	U	UJ	mg/kg	0.008	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Benzo(b)fluoranthene	205-99-2	0.0039	U	UJ	mg/kg	0.0039	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Benzo(b)fluoranthene	205-99-2	0.0034	U	UJ	mg/kg	0.0034	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Benzo(b)fluoranthene	205-99-2	0.0037	U	UJ	mg/kg	0.0037	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Benzo(b)fluoranthene	205-99-2	0.0036	U	UJ	mg/kg	0.0036	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Benzo(b)fluoranthene	205-99-2	0.0032	U	UJ	mg/kg	0.0032	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Benzo(ghi)perylene	191-24-2	0.016	U	UJ	mg/kg	0.016	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Benzo(ghi)perylene	191-24-2	0.013	U	UJ	mg/kg	0.013	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Benzo(ghi)perylene	191-24-2	0.015	U	UJ	mg/kg	0.015	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Benzo(ghi)perylene	191-24-2	0.014	U	UJ	mg/kg	0.014	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Benzo(ghi)perylene	191-24-2	0.013	U	UJ	mg/kg	0.013	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Benzo(k)fluoranthene	207-08-9	0.0039	U	UJ	mg/kg	0.0039	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Benzo(k)fluoranthene	207-08-9	0.0034	U	UJ	mg/kg	0.0034	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Benzo(k)fluoranthene	207-08-9	0.0037	U	UJ	mg/kg	0.0037	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Benzo(k)fluoranthene	207-08-9	0.0036	U	UJ	mg/kg	0.0036	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Benzo(k)fluoranthene	207-08-9	0.0032	U	UJ	mg/kg	0.0032	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Cadmium	7440-43-9	0.05	B	B	mg/kg	0.04	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Cadmium	7440-43-9	0.04	B	B	mg/kg	0.04	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Cadmium	7440-43-9	0.06	B	B	mg/kg	0.04	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Cadmium	7440-43-9	0.05	B	B	mg/kg	0.04	METALS	BI	N	Y	200144

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Cadmium	7440-43-9	0.04	U	U	mg/kg	0.04	METALS	BI	N	N	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Calcium	7440-70-2	9160			mg/kg	62.4	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Calcium	7440-70-2	12200			mg/kg	62.2	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Calcium	7440-70-2	5900			mg/kg	62.2	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Calcium	7440-70-2	6980			mg/kg	62.4	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Calcium	7440-70-2	236		B	mg/kg	4.3	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Calcium	7440-70-2	170	B	B	mg/kg	4.3	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Calcium	7440-70-2	182	B	B	mg/kg	4.3	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Calcium	7440-70-2	205		B	mg/kg	4.3	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Calcium	7440-70-2	215		B	mg/kg	4.3	METALS	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Chromium	7440-47-3	0.21	B	J	mg/kg	0.1	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Chromium	7440-47-3	0.12	B	J	mg/kg	0.099	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Chromium	7440-47-3	0.1	U	U	mg/kg	0.1	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Chromium	7440-47-3	0.11	B	J	mg/kg	0.1	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Chromium	7440-47-3	0.33	B	B	mg/kg	0.13	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Chromium	7440-47-3	0.27	B	B	mg/kg	0.13	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Chromium	7440-47-3	0.28	B	B	mg/kg	0.13	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Chromium	7440-47-3	0.26	B	B	mg/kg	0.13	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Chromium	7440-47-3	0.13	B	B	mg/kg	0.13	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Chrysene	218-01-9	0.0098	U	UJ	mg/kg	0.0098	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Chrysene	218-01-9	0.0084	U	UJ	mg/kg	0.0084	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Chrysene	218-01-9	0.0092	U	UJ	mg/kg	0.0092	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Chrysene	218-01-9	0.009	U	UJ	mg/kg	0.009	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Chrysene	218-01-9	0.008	U	UJ	mg/kg	0.008	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI001	AD4001	13-Sep-00			Cobalt	7440-48-4	0.38	U	U	mg/kg	0.38	METALS	BI	N	N	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Cobalt	7440-48-4	0.38	U	U	mg/kg	0.38	METALS	BI	N	N	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Cobalt	7440-48-4	0.38	U	U	mg/kg	0.38	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Cobalt	7440-48-4	0.38	U	U	mg/kg	0.38	METALS	BI	N	N	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Cobalt	7440-48-4	0.28	B	B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Cobalt	7440-48-4	0.21	B	B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Cobalt	7440-48-4	0.18	B	B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Cobalt	7440-48-4	0.31	B	B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Cobalt	7440-48-4	0.38	B	B	mg/kg	0.05	METALS	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Copper	7440-50-8	2			mg/kg	0.42	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Copper	7440-50-8	0.42	U	U	mg/kg	0.42	METALS	BI	N	N	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Copper	7440-50-8	0.42	U	U	mg/kg	0.42	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Copper	7440-50-8	0.44	B	J	mg/kg	0.42	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Copper	7440-50-8	3	*	B	mg/kg	0.46	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Copper	7440-50-8	4.5	*	B	mg/kg	0.46	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Copper	7440-50-8	2.9	*	B	mg/kg	0.46	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Copper	7440-50-8	3.2	*	B	mg/kg	0.46	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Copper	7440-50-8	3.7	*	B	mg/kg	0.46	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Dibenz(a,h)anthracene	53-70-3	0.039	U	UJ	mg/kg	0.039	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Dibenz(a,h)anthracene	53-70-3	0.034	U	UJ	mg/kg	0.034	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Dibenz(a,h)anthracene	53-70-3	0.037	U	UJ	mg/kg	0.037	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Dibenz(a,h)anthracene	53-70-3	0.036	U	UJ	mg/kg	0.036	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Dibenz(a,h)anthracene	53-70-3	0.032	U	UJ	mg/kg	0.032	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Fluoranthene	206-44-0	0.0098	U	UJ	mg/kg	0.0098	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Fluoranthene	206-44-0	0.0084	U	UJ	mg/kg	0.0084	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Fluoranthene	206-44-0	0.0092	U	UJ	mg/kg	0.0092	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Fluoranthene	206-44-0	0.009	U	UJ	mg/kg	0.009	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Fluoranthene	206-44-0	0.008	U	UJ	mg/kg	0.008	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Fluorene	86-73-7	0.018	J	B	mg/kg	0.02	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Fluorene	86-73-7	0.019		B	mg/kg	0.017	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Fluorene	86-73-7	0.047		B	mg/kg	0.018	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Fluorene	86-73-7	0.037		B	mg/kg	0.018	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Fluorene	86-73-7	0.032		B	mg/kg	0.016	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	HMX	2691-41-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	HMX	2691-41-0	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	HMX	2691-41-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	HMX	2691-41-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	HMX	2691-41-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	HMX	2691-41-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	HMX	2691-41-0	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	HMX	2691-41-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	HMX	2691-41-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	HMX	2691-41-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Indeno(1,2,3-cd)pyrene	193-39-5	0.008	J	B	mg/kg	0.0098	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Indeno(1,2,3-cd)pyrene	193-39-5	0.0084	U	UJ	mg/kg	0.0084	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Indeno(1,2,3-cd)pyrene	193-39-5	0.0092	U	UJ	mg/kg	0.0092	SEMIVOLATILES	BI	N	N	200145

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Indeno(1,2,3-cd)pyrene	193-39-5	0.009	U	UJ	mg/kg	0.009	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Indeno(1,2,3-cd)pyrene	193-39-5	0.0044	J	B	mg/kg	0.008	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI001	AD4001	13-Sep-00			Iron	7439-89-6	234	*	J	mg/kg	13.7	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Iron	7439-89-6	37.6	BN*	J	mg/kg	13.7	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Iron	7439-89-6	20.8	B*	J	mg/kg	13.7	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Iron	7439-89-6	144	N*	J	mg/kg	13.7	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Iron	7439-89-6	824		B	mg/kg	1.9	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Iron	7439-89-6	445		B	mg/kg	2	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Iron	7439-89-6	534		B	mg/kg	1.9	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Iron	7439-89-6	694		B	mg/kg	1.9	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Iron	7439-89-6	346		B	mg/kg	1.9	METALS	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Lead	7439-92-1	0.52	B	B	mg/kg	0.22	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Lead	7439-92-1	0.22	U	U	mg/kg	0.22	METALS	BI	N	N	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Lead	7439-92-1	0.29	B	B	mg/kg	0.22	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Lead	7439-92-1	0.39	B	B	mg/kg	0.22	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Lead	7439-92-1	0.88	B	J	mg/kg	0.099	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Lead	7439-92-1	0.31	B	J	mg/kg	0.1	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Lead	7439-92-1	0.56	B	J	mg/kg	0.099	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Lead	7439-92-1	0.43	B	J	mg/kg	0.099	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Lead	7439-92-1	0.25	B	J	mg/kg	0.099	METALS	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Magnesium	7439-95-4	456			mg/kg	49.3	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Magnesium	7439-95-4	411			mg/kg	49.1	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Magnesium	7439-95-4	277			mg/kg	49.2	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Magnesium	7439-95-4	377			mg/kg	49.3	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Magnesium	7439-95-4	214		B	mg/kg	1.2	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Magnesium	7439-95-4	168	B	B	mg/kg	1.2	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Magnesium	7439-95-4	171	B	B	mg/kg	1.2	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Magnesium	7439-95-4	189	B	B	mg/kg	1.2	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Magnesium	7439-95-4	149	B	B	mg/kg	1.2	METALS	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Manganese	7439-96-5	14.7			mg/kg	1	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Manganese	7439-96-5	6			mg/kg	1	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Manganese	7439-96-5	4	B	J	mg/kg	1	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Manganese	7439-96-5	11			mg/kg	1	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Manganese	7439-96-5	5.4		B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Manganese	7439-96-5	2.4	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Manganese	7439-96-5	3.3	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Manganese	7439-96-5	4	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Manganese	7439-96-5	2.3	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Naphthalene	91-20-3	0.098	U	UJ	mg/kg	0.098	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Naphthalene	91-20-3	0.084	U	UJ	mg/kg	0.084	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Naphthalene	91-20-3	0.092	U	UJ	mg/kg	0.092	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Naphthalene	91-20-3	0.09	U	UJ	mg/kg	0.09	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Naphthalene	91-20-3	0.08	U	UJ	mg/kg	0.08	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI001	AD4001	13-Sep-00			Nickel	7440-02-0	0.29	U	U	mg/kg	0.29	METALS	BI	N	N	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Nickel	7440-02-0	0.29	U	U	mg/kg	0.29	METALS	BI	N	N	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Nickel	7440-02-0	0.29	U	U	mg/kg	0.29	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Nickel	7440-02-0	0.29	U	U	mg/kg	0.29	METALS	BI	N	N	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Nickel	7440-02-0	0.37	B	J	mg/kg	0.19	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Nickel	7440-02-0	0.45	B	J	mg/kg	0.19	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Nickel	7440-02-0	0.27	B	J	mg/kg	0.19	METALS	BI	N	Y	200144

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Nickel	7440-02-0	0.27	B	J	mg/kg	0.19	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Nickel	7440-02-0	0.29	B	J	mg/kg	0.19	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Nitrobenzene	98-95-3	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Nitrobenzene	98-95-3	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Nitrobenzene	98-95-3	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Nitrobenzene	98-95-3	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Nitrobenzene	98-95-3	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Nitrobenzene	98-95-3	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Nitrobenzene	98-95-3	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Nitrobenzene	98-95-3	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Nitrobenzene	98-95-3	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Nitrobenzene	98-95-3	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Nitrotoluene, 2-	88-72-2	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Nitrotoluene, 2-	88-72-2	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Nitrotoluene, 2-	88-72-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Nitrotoluene, 2-	88-72-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Nitrotoluene, 2-	88-72-2	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Nitrotoluene, 2-	88-72-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Nitrotoluene, 2-	88-72-2	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Nitrotoluene, 2-	88-72-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Nitrotoluene, 2-	88-72-2	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Nitrotoluene, 2-	88-72-2	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Nitrotoluene, 3-	99-08-1	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Nitrotoluene, 3-	99-08-1	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Nitrotoluene, 3-	99-08-1	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Nitrotoluene, 3-	99-08-1	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Nitrotoluene, 3-	99-08-1	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Nitrotoluene, 3-	99-08-1	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Nitrotoluene, 3-	99-08-1	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Nitrotoluene, 3-	99-08-1	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Nitrotoluene, 3-	99-08-1	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Nitrotoluene, 3-	99-08-1	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Nitrotoluene, 4-	99-99-0	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Nitrotoluene, 4-	99-99-0	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Nitrotoluene, 4-	99-99-0	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Nitrotoluene, 4-	99-99-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Nitrotoluene, 4-	99-99-0	0.53	U	UJ	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Nitrotoluene, 4-	99-99-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Nitrotoluene, 4-	99-99-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Nitrotoluene, 4-	99-99-0	0.48	U	UJ	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			PERCENT LIPIDS	LIPIDS	1.4			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			PERCENT LIPIDS	LIPIDS	3.9			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			PERCENT LIPIDS	LIPIDS	2.5			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			PERCENT LIPIDS	LIPIDS	1.5			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Phenanthrene	85-01-8	0.099		B	mg/kg	0.0067	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Phenanthrene	85-01-8	0.032		B	mg/kg	0.0067	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Phenanthrene	85-01-8	0.017		B	mg/kg	0.0067	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Phenanthrene	85-01-8	0.016		B	mg/kg	0.0067	SEMIVOLATILES	BI	N	Y	200145

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Phenanthrene	85-01-8	0.048		B	mg/kg	0.0067	SEMIVOLATILES	BI	N	Y	200145
WARP	WRWP-BI001	AD4001	13-Sep-00			Phosphorous	7723-14-0	129		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Phosphorous	7723-14-0	37.8		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Phosphorous	7723-14-0	54.6		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Phosphorous	7723-14-0	152		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Phosphorous	7723-14-0	0.037		B	mg/kg	0.0045	GEN CHEMISTRY	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Phosphorous	7723-14-0	0.056		B	mg/kg	0.0045	GEN CHEMISTRY	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Phosphorous	7723-14-0	0.047		B	mg/kg	0.0045	GEN CHEMISTRY	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Phosphorous	7723-14-0	0.098		B	mg/kg	0.0045	GEN CHEMISTRY	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Phosphorous	7723-14-0	0.146		B	mg/kg	0.0045	GEN CHEMISTRY	BI	N	Y	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Potassium	2023695	2460			mg/kg	138	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Potassium	2023695	2800			mg/kg	137	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Potassium	2023695	2600			mg/kg	137	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Potassium	2023695	2380			mg/kg	138	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Potassium	2023695	1170		B	mg/kg	3.6	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Potassium	2023695	1300		B	mg/kg	3.6	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Potassium	2023695	1230		B	mg/kg	3.6	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Potassium	2023695	1350		B	mg/kg	3.6	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Potassium	2023695	821		B	mg/kg	3.6	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Pyrene	129-00-0	0.02	U	UJ	mg/kg	0.02	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Pyrene	129-00-0	0.017	U	UJ	mg/kg	0.017	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Pyrene	129-00-0	0.018	U	UJ	mg/kg	0.018	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Pyrene	129-00-0	0.018	U	UJ	mg/kg	0.018	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Pyrene	129-00-0	0.016	U	UJ	mg/kg	0.016	SEMIVOLATILES	BI	N	N	200145
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	RDX	121-82-4	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	RDX	121-82-4	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	RDX	121-82-4	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	RDX	121-82-4	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	RDX	121-82-4	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	RDX	121-82-4	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	RDX	121-82-4	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	RDX	121-82-4	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	RDX	121-82-4	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	RDX	121-82-4	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Sodium	7440-23-5	749	B	J	mg/kg	245	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Sodium	7440-23-5	1030			mg/kg	243	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Sodium	7440-23-5	1020			mg/kg	244	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Sodium	7440-23-5	681	B	J	mg/kg	244	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Sodium	7440-23-5	624	B	B	mg/kg	243	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Sodium	7440-23-5	689	B	B	mg/kg	244	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Sodium	7440-23-5	658	B	B	mg/kg	243	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Sodium	7440-23-5	753	B	B	mg/kg	243	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Sodium	7440-23-5	353	B	B	mg/kg	243	METALS	BI	N	Y	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Tetryl	479-45-8	0.71	U	U	mg/kg	0.71	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Tetryl	479-45-8	0.79	U	U	mg/kg	0.79	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Tetryl	479-45-8	0.75	U	U	mg/kg	0.75	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Tetryl	479-45-8	0.75	U	U	mg/kg	0.75	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Tetryl	479-45-8	0.71	U	U	mg/kg	0.71	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Tetryl	479-45-8	0.75	U	U	mg/kg	0.75	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Tetryl	479-45-8	0.79	U	U	mg/kg	0.79	NITROAROMATICS	BI	N	N	200144

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Tetryl	479-45-8	0.75	U	U	mg/kg	0.75	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Tetryl	479-45-8	0.71	U	U	mg/kg	0.71	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Tetryl	479-45-8	0.71	U	U	mg/kg	0.71	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.26	U	U	mg/kg	0.26	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.24	U	U	mg/kg	0.24	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI011	AD4011	28-Nov-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI012	AD4012	28-Nov-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI013	AD4013	28-Nov-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI014	AD4014	28-Nov-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI015	AD4015	28-Nov-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200145
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.53	U	U	mg/kg	0.53	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.48	U	U	mg/kg	0.48	NITROAROMATICS	BI	N	N	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Vanadium	7440-62-2	0.44	B	J	mg/kg	0.28	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Vanadium	7440-62-2	0.28	U	U	mg/kg	0.28	METALS	BI	N	N	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Vanadium	7440-62-2	0.28	U	U	mg/kg	0.28	METALS	BI	N	N	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Vanadium	7440-62-2	0.28	U	U	mg/kg	0.28	METALS	BI	N	N	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Vanadium	7440-62-2	0.33	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Vanadium	7440-62-2	0.04	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Vanadium	7440-62-2	0.17	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Vanadium	7440-62-2	0.15	B	B	mg/kg	0.03	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Vanadium	7440-62-2	0.03	U	U	mg/kg	0.03	METALS	BI	N	N	200144
WARP	WRWP-BI001	AD4001	13-Sep-00			Zinc	7440-66-6	46.9			mg/kg	9.8	METALS	BI	N	Y	1227
WARP	WRWP-BI002	AD4002	13-Sep-00			Zinc	7440-66-6	13.1	B	J	mg/kg	9.8	METALS	BI	N	Y	1227
WARP	WRWP-BI003	AD4003	13-Sep-00			Zinc	7440-66-6	21.3	B	J	mg/kg	9.8	METALS	BI	N	Y	1227
WARP	WRWP-BI004	AD4004	13-Sep-00			Zinc	7440-66-6	36.3			mg/kg	9.7	METALS	BI	N	Y	1227
WARP	WRWP-BI016	AD4016	1-Dec-00	0	0	Zinc	7440-66-6	28.5		B	mg/kg	0.45	METALS	BI	N	Y	200144
WARP	WRWP-BI017	AD4017	1-Dec-00	0	0	Zinc	7440-66-6	33.9		B	mg/kg	0.45	METALS	BI	N	Y	200144
WARP	WRWP-BI018	AD4018	1-Dec-00	0	0	Zinc	7440-66-6	31		B	mg/kg	0.45	METALS	BI	N	Y	200144
WARP	WRWP-BI019	AD4019	1-Dec-00	0	0	Zinc	7440-66-6	35		B	mg/kg	0.45	METALS	BI	N	Y	200144
WARP	WRWP-BI020	AD4020	1-Dec-00	0	0	Zinc	7440-66-6	24.5	B	B	mg/kg	0.45	METALS	BI	N	Y	200144
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	% Solids	38992	52.2			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	% Solids	38992	59.3			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	% Solids	38992	52			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	% Solids	38992	58.1			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	% Solids	38992	47.2			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	% Solids	38992	46.4			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	% Solids	38992	53.7			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	% Solids	38992	31.1			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	% Solids	38992	79			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	% Solids	38992	66.2			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	% Solids	38992	58.5			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Aluminum	7429-90-5	9150			mg/kg	10.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Aluminum	7429-90-5	8690			mg/kg	9.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Aluminum	7429-90-5	17600			mg/kg	11.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Aluminum	7429-90-5	10600			mg/kg	9.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Aluminum	7429-90-5	12300			mg/kg	11.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Aluminum	7429-90-5	6930			mg/kg	11	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Aluminum	7429-90-5	9270			mg/kg	9.9	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Aluminum	7429-90-5	16400			mg/kg	18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Aluminum	7429-90-5	2170			mg/kg	6.7	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Aluminum	7429-90-5	3630			mg/kg	8.3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Aluminum	7429-90-5	7800			mg/kg	9.3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Antimony	7440-36-0	0.76	U	UJ	mg/kg	0.76	METALS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Antimony	7440-36-0	0.7	U	UJ	mg/kg	0.7	METALS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Antimony	7440-36-0	0.85	U	UJ	mg/kg	0.85	METALS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Antimony	7440-36-0	0.69	U	UJ	mg/kg	0.69	METALS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Antimony	7440-36-0	0.84	U	UJ	mg/kg	0.84	METALS	SD	N	N	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Antimony	7440-36-0	0.83		J	mg/kg	0.83	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Antimony	7440-36-0	0.75	U	UJ	mg/kg	0.75	METALS	SD	N	N	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Antimony	7440-36-0	1.4	U	UJ	mg/kg	1.4	METALS	SD	N	N	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Antimony	7440-36-0	0.51	U	UJ	mg/kg	0.51	METALS	SD	N	N	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Antimony	7440-36-0	0.63	U	UJ	mg/kg	0.63	METALS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Antimony	7440-36-0	0.71	U	UJ	mg/kg	0.71	METALS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Arsenic	7440-38-2	5.1			mg/kg	0.61	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Arsenic	7440-38-2	3.6			mg/kg	0.56	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Arsenic	7440-38-2	7.7			mg/kg	0.68	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Arsenic	7440-38-2	4.3			mg/kg	0.55	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Arsenic	7440-38-2	4.9			mg/kg	0.67	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Arsenic	7440-38-2	4.9			mg/kg	0.67	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Arsenic	7440-38-2	3.5			mg/kg	0.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Arsenic	7440-38-2	5.5			mg/kg	1.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Arsenic	7440-38-2	2.9			mg/kg	0.41	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Arsenic	7440-38-2	3.1			mg/kg	0.5	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Arsenic	7440-38-2	3.4			mg/kg	0.57	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Barium	7440-39-3	83.9			mg/kg	0.04	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Barium	7440-39-3	46			mg/kg	0.04	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Barium	7440-39-3	126			mg/kg	0.05	METALS	SD	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Barium	7440-39-3	94.4			mg/kg	0.04	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Barium	7440-39-3	102			mg/kg	0.05	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Barium	7440-39-3	62.5			mg/kg	0.05	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Barium	7440-39-3	92.2			mg/kg	0.04	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Barium	7440-39-3	154			mg/kg	0.07	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Barium	7440-39-3	19.2			mg/kg	0.03	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Barium	7440-39-3	26.9			mg/kg	0.03	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Barium	7440-39-3	46.1			mg/kg	0.04	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Calcium	7440-70-2	3220			mg/kg	10	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Calcium	7440-70-2	2710			mg/kg	9.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Calcium	7440-70-2	2890			mg/kg	11.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Calcium	7440-70-2	2880			mg/kg	9	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Calcium	7440-70-2	3570			mg/kg	11	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Calcium	7440-70-2	11000			mg/kg	10.9	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Calcium	7440-70-2	3400			mg/kg	9.8	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Calcium	7440-70-2	6470			mg/kg	17.8	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Calcium	7440-70-2	8810			mg/kg	6.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Calcium	7440-70-2	7990			mg/kg	8.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Calcium	7440-70-2	3650			mg/kg	9.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Chromium	7440-47-3	12.9			mg/kg	0.11	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Chromium	7440-47-3	11.7			mg/kg	0.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Chromium	7440-47-3	22.3			mg/kg	0.12	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Chromium	7440-47-3	13.9			mg/kg	0.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Chromium	7440-47-3	16.5			mg/kg	0.12	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Chromium	7440-47-3	12			mg/kg	0.12	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Chromium	7440-47-3	12.7			mg/kg	0.11	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Chromium	7440-47-3	22			mg/kg	0.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Chromium	7440-47-3	3.7		B	mg/kg	0.07	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Chromium	7440-47-3	5.8			mg/kg	0.09	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Chromium	7440-47-3	10.6			mg/kg	0.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Cobalt	7440-48-4	8.9			mg/kg	0.15	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Cobalt	7440-48-4	6.4			mg/kg	0.14	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Cobalt	7440-48-4	11.3			mg/kg	0.17	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Cobalt	7440-48-4	13.1			mg/kg	0.14	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Cobalt	7440-48-4	15.2			mg/kg	0.17	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Cobalt	7440-48-4	10.5			mg/kg	0.17	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Cobalt	7440-48-4	7.7			mg/kg	0.15	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Cobalt	7440-48-4	15			mg/kg	0.27	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Cobalt	7440-48-4	4.9			mg/kg	0.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Cobalt	7440-48-4	6.4			mg/kg	0.13	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Cobalt	7440-48-4	5.5			mg/kg	0.14	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Copper	7440-50-8	12.5			mg/kg	0.18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Copper	7440-50-8	9.2			mg/kg	0.16	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Copper	7440-50-8	18.3			mg/kg	0.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Copper	7440-50-8	15.5			mg/kg	0.16	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Copper	7440-50-8	17.6			mg/kg	0.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Copper	7440-50-8	13.2			mg/kg	0.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Copper	7440-50-8	19.7			mg/kg	0.18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Copper	7440-50-8	23.4			mg/kg	0.32	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Copper	7440-50-8	5.6			mg/kg	0.12	METALS	SD	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Copper	7440-50-8	9.8			mg/kg	0.15	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Copper	7440-50-8	9.4			mg/kg	0.17	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	HMX	2691-41-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	HMX	2691-41-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Iron	7439-89-6	18000			mg/kg	3.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Iron	7439-89-6	14100			mg/kg	3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Iron	7439-89-6	29300			mg/kg	3.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Iron	7439-89-6	17600			mg/kg	2.9	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Iron	7439-89-6	20900			mg/kg	3.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Iron	7439-89-6	13800			mg/kg	3.5	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Iron	7439-89-6	16300			mg/kg	3.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Iron	7439-89-6	24200			mg/kg	5.8	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Iron	7439-89-6	7490			mg/kg	2.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Iron	7439-89-6	8790			mg/kg	2.7	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Iron	7439-89-6	13200			mg/kg	3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Lead	7439-92-1	25		J	mg/kg	0.36	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Lead	7439-92-1	14.1		J	mg/kg	0.33	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Lead	7439-92-1	23.4		J	mg/kg	0.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Lead	7439-92-1	14.7		J	mg/kg	0.32	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Lead	7439-92-1	19.8		J	mg/kg	0.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Lead	7439-92-1	27.3		J	mg/kg	0.39	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Lead	7439-92-1	18		J	mg/kg	0.35	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Lead	7439-92-1	68.5		J	mg/kg	0.64	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Lead	7439-92-1	5		J	mg/kg	0.24	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Lead	7439-92-1	7.5		J	mg/kg	0.3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Lead	7439-92-1	17			mg/kg	0.33	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Magnesium	7439-95-4	2630			mg/kg	10.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Magnesium	7439-95-4	2390			mg/kg	9.2	METALS	SD	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Magnesium	7439-95-4	3880			mg/kg	11.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Magnesium	7439-95-4	2900			mg/kg	9.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Magnesium	7439-95-4	3460			mg/kg	11.1	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Magnesium	7439-95-4	2780			mg/kg	11	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Magnesium	7439-95-4	2780			mg/kg	9.9	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Magnesium	7439-95-4	5170			mg/kg	18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Magnesium	7439-95-4	1750			mg/kg	6.7	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Magnesium	7439-95-4	1900			mg/kg	8.3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Magnesium	7439-95-4	2390			mg/kg	9.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Manganese	7439-96-5	301			mg/kg	0.19	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Manganese	7439-96-5	142			mg/kg	0.18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Manganese	7439-96-5	371			mg/kg	0.22	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Manganese	7439-96-5	321			mg/kg	0.17	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Manganese	7439-96-5	347			mg/kg	0.21	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Manganese	7439-96-5	283			mg/kg	0.21	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Manganese	7439-96-5	230			mg/kg	0.19	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Manganese	7439-96-5	637			mg/kg	0.35	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Manganese	7439-96-5	178			mg/kg	0.13	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Manganese	7439-96-5	183			mg/kg	0.16	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Manganese	7439-96-5	157			mg/kg	0.18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Nickel	7440-02-0	16.7		J	mg/kg	0.22	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Nickel	7440-02-0	12.3		J	mg/kg	0.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Nickel	7440-02-0	29		J	mg/kg	0.25	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Nickel	7440-02-0	23.6		J	mg/kg	0.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Nickel	7440-02-0	23.6		J	mg/kg	0.24	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Nickel	7440-02-0	14.3		J	mg/kg	0.24	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Nickel	7440-02-0	20.8		J	mg/kg	0.22	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Nickel	7440-02-0	36.5		J	mg/kg	0.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Nickel	7440-02-0	10.6		J	mg/kg	0.15	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Nickel	7440-02-0	14.8		J	mg/kg	0.18	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Nickel	7440-02-0	11			mg/kg	0.21	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Nitrobenzene	98-95-3	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Nitrobenzene	98-95-3	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Nitrobenzene	98-95-3	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.49	U	U	mg/kg	0.49	NITROAROMATICS	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.49	U	U	mg/kg	0.49	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Phosphorous	7723-14-0	17.5			mg/kg	8.1	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Phosphorous	7723-14-0	6.1	U	U	mg/kg	6.1	GEN CHEMISTRY	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Phosphorous	7723-14-0	29.9			mg/kg	8.4	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Phosphorous	7723-14-0	6.5	U	U	mg/kg	6.5	GEN CHEMISTRY	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Phosphorous	7723-14-0	35.2			mg/kg	8.4	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Phosphorous	7723-14-0	8.1	U	U	mg/kg	8.1	GEN CHEMISTRY	SD	N	N	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Phosphorous	7723-14-0	236			mg/kg	28.4	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Phosphorous	7723-14-0	221			mg/kg	16.7	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Phosphorous	7723-14-0	208			mg/kg	39.6	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Phosphorous	7723-14-0	11.1	U	U	mg/kg	11.1	GEN CHEMISTRY	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Phosphorous	7723-14-0	5	U	U	mg/kg	5	GEN CHEMISTRY	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Potassium	2023695	1070		B	mg/kg	12.7	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Potassium	2023695	937		B	mg/kg	11.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Potassium	2023695	2420		J	mg/kg	14	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Potassium	2023695	1490		B	mg/kg	11.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Potassium	2023695	1880		J	mg/kg	13.9	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Potassium	2023695	838		B	mg/kg	13.8	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Potassium	2023695	1040		B	mg/kg	12.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Potassium	2023695	3230		J	mg/kg	22.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Potassium	2023695	596		B	mg/kg	8.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Potassium	2023695	804		B	mg/kg	10.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Potassium	2023695	855			mg/kg	11.7	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	RDX	121-82-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	RDX	121-82-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	RDX	121-82-4	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Sodium	7440-23-5	549			mg/kg	38	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Sodium	7440-23-5	268			mg/kg	34.7	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Sodium	7440-23-5	488			mg/kg	42.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Sodium	7440-23-5	420			mg/kg	34.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Sodium	7440-23-5	426			mg/kg	41.8	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Sodium	7440-23-5	553			mg/kg	41.6	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Sodium	7440-23-5	860			mg/kg	37.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Sodium	7440-23-5	1890			mg/kg	67.8	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Sodium	7440-23-5	63.5			mg/kg	25.3	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Sodium	7440-23-5	93.7			mg/kg	31.4	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Sodium	7440-23-5	755			mg/kg	35.2	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Total organic carbon	10-35-5	17300			mg/kg	1160	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Total organic carbon	10-35-5	17300			mg/kg	1320	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Total organic carbon	10-35-5	17100			mg/kg	1370	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Total organic carbon	10-35-5	36600			mg/kg	4080	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Total organic carbon	10-35-5	38000			mg/kg	5130	GEN CHEMISTRY	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SD	N	N	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Vanadium	7440-62-2	20.2		B	mg/kg	0.29	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Vanadium	7440-62-2	18		B	mg/kg	0.27	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Vanadium	7440-62-2	36.5		B	mg/kg	0.32	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Vanadium	7440-62-2	20.5		B	mg/kg	0.26	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Vanadium	7440-62-2	24.8		B	mg/kg	0.32	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Vanadium	7440-62-2	15.7		B	mg/kg	0.32	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Vanadium	7440-62-2	18.7		B	mg/kg	0.29	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Vanadium	7440-62-2	30.1		B	mg/kg	0.52	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Vanadium	7440-62-2	6.4		B	mg/kg	0.19	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Vanadium	7440-62-2	9.4		B	mg/kg	0.24	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Vanadium	7440-62-2	16.6		B	mg/kg	0.27	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1001	14-Sep-00	0	1	Zinc	7440-66-6	56.8			mg/kg	0.08	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD002	AD1002	14-Sep-00	0	1	Zinc	7440-66-6	47.2			mg/kg	0.08	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD003	AD1003	14-Sep-00	0	1	Zinc	7440-66-6	94.6			mg/kg	0.09	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD004	AD1004	14-Sep-00	0	1	Zinc	7440-66-6	77.6			mg/kg	0.07	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD005	AD1005	14-Sep-00	0	1	Zinc	7440-66-6	77.2			mg/kg	0.09	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD006	AD1006	13-Sep-00	0	1	Zinc	7440-66-6	45.7			mg/kg	0.09	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD007	AD1007	14-Sep-00	0	1	Zinc	7440-66-6	60.2			mg/kg	0.08	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD008	AD1008	14-Sep-00	0	1	Zinc	7440-66-6	117			mg/kg	0.15	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD009	AD1009	13-Sep-00	0	1	Zinc	7440-66-6	24.7			mg/kg	0.06	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD010	AD1010	13-Sep-00	0	1	Zinc	7440-66-6	36.7			mg/kg	0.07	METALS	SD	N	Y	9A09G601
WARP	WRWP-SD001	AD1011	14-Sep-00	0	1	Zinc	7440-66-6	42.7		J	mg/kg	0.08	METALS	SD	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	% Solids	38992	82.4			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	% Solids	38992	80.4			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	% Solids	38992	80.5			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	% Solids	38992	81			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	% Solids	38992	77.9			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Acenaphthene	83-32-9	0.099	U	U	mg/kg	0.099	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Acenaphthylene	208-96-8	0.049	U	U	mg/kg	0.049	SEMIVOLATILES	SO	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Acenaphthylene	208-96-8	0.051	U	U	mg/kg	0.051	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Acenaphthylene	208-96-8	0.051	U	U	mg/kg	0.051	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Acenaphthylene	208-96-8	0.051	U	U	mg/kg	0.051	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Acenaphthylene	208-96-8	0.053	U	U	mg/kg	0.053	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Anthracene	120-12-7	0.0036			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Anthracene	120-12-7	0.002	U	U	mg/kg	0.002	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Anthracene	120-12-7	0.002	U	U	mg/kg	0.002	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Anthracene	120-12-7	0.002	U	U	mg/kg	0.002	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Anthracene	120-12-7	0.001	J	J	mg/kg	0.0021	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.025			mg/kg	0.0049	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.049	J	J	mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.0059			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.0036	J	J	mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Benzo(a)anthracene	56-55-3	0.0066			mg/kg	0.0053	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.039			mg/kg	0.0049	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0074			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0099			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0055			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Benzo(a)pyrene	50-32-8	0.012			mg/kg	0.0053	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.033			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.006			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0095			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0048			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Benzo(b)fluoranthene	205-99-2	0.0099			mg/kg	0.0021	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.016			mg/kg	0.0079	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0082	U	U	mg/kg	0.0082	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0082	U	U	mg/kg	0.0082	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0082	U	U	mg/kg	0.0082	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Benzo(ghi)perylene	191-24-2	0.0085	U	U	mg/kg	0.0085	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.019	D		mg/kg	0.0099	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0033			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0039			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0026			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Benzo(k)fluoranthene	207-08-9	0.0029			mg/kg	0.0021	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Chrysene	218-01-9	0.026			mg/kg	0.0049	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Chrysene	218-01-9	0.0067			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Chrysene	218-01-9	0.0082			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Chrysene	218-01-9	0.0047	J	J	mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Chrysene	218-01-9	0.0092			mg/kg	0.0053	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.022			mg/kg	0.02	SEMIVOLATILES	SO	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.02	U	U	mg/kg	0.02	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.0095	J	J	mg/kg	0.02	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.02	U	U	mg/kg	0.02	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Dibenz(a,h)anthracene	53-70-3	0.021	U	U	mg/kg	0.021	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Dinitrotoluene, 2,4-	121-14-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Fluoranthene	206-44-0	0.076			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Fluoranthene	206-44-0	0.017			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Fluoranthene	206-44-0	0.021			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Fluoranthene	206-44-0	0.013			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Fluoranthene	206-44-0	0.026			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Fluorene	86-73-7	0.0099	U	U	mg/kg	0.0099	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Fluorene	86-73-7	0.006	J	J	mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Fluorene	86-73-7	0.0074	J	J	mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Fluorene	86-73-7	0.0069	J	J	mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Fluorene	86-73-7	0.01	U	U	mg/kg	0.01	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.029			mg/kg	0.0049	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0068			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0083			mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0046	J	J	mg/kg	0.0051	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Indeno(1,2,3-cd)pyrene	193-39-5	0.0086			mg/kg	0.0053	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Naphthalene	91-20-3	0.049	U	U	mg/kg	0.049	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Naphthalene	91-20-3	0.051	U	U	mg/kg	0.051	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Naphthalene	91-20-3	0.051	U	U	mg/kg	0.051	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Naphthalene	91-20-3	0.051	U	U	mg/kg	0.051	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Naphthalene	91-20-3	0.053	U	U	mg/kg	0.053	SEMIVOLATILES	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Phenanthrene	85-01-8	0.032			mg/kg	0.004	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Phenanthrene	85-01-8	0.033			mg/kg	0.0041	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Phenanthrene	85-01-8	0.04			mg/kg	0.0041	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Phenanthrene	85-01-8	0.04			mg/kg	0.0041	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Phenanthrene	85-01-8	0.032			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Pyrene	129-00-0	0.055			mg/kg	0.0099	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Pyrene	129-00-0	0.12			mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Pyrene	129-00-0	0.015			mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Pyrene	129-00-0	0.009	J	J	mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Pyrene	129-00-0	0.02			mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Tetryl	479-45-8	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO001	AD0001	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO002	AD0002	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO003	AD0003	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO004	AD0004	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SO005	AD0005	15-Sep-00	0	1.5	Trinitrotoluene, 2,4,6-	118-96-7	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G601
WARP	WRWP-SW006	AD2006	13-Sep-00			Aluminum	7429-90-5	286			ug/L	72.7	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Aluminum	7429-90-5	888			ug/L	72.7	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Aluminum	7429-90-5	313			ug/L	72.7	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Aluminum	7429-90-5	13500			ug/L	72.7	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Aluminum	7429-90-5	2610			ug/L	72.7	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
WARP	WRWP-SW007	AD2007	13-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Arsenic	7440-38-2	9.6			ug/L	4.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Arsenic	7440-38-2	7.2			ug/L	4.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Arsenic	7440-38-2	7.1			ug/L	4.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Arsenic	7440-38-2	10.7			ug/L	4.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Barium	7440-39-3	18.3			ug/L	0.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Barium	7440-39-3	22			ug/L	0.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Barium	7440-39-3	20.4			ug/L	0.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Barium	7440-39-3	131			ug/L	0.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Barium	7440-39-3	57.1			ug/L	0.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Calcium	7440-70-2	15400			ug/L	71.9	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Calcium	7440-70-2	18800			ug/L	71.9	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Calcium	7440-70-2	16000			ug/L	71.9	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Calcium	7440-70-2	21800			ug/L	71.9	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Calcium	7440-70-2	69600			ug/L	71.9	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Chromium	7440-47-3	0.8	U	U	ug/L	0.8	METALS	SW	N	N	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Chromium	7440-47-3	2.5		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Chromium	7440-47-3	1.2		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Chromium	7440-47-3	19.8			ug/L	0.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Chromium	7440-47-3	3.3		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Cobalt	7440-48-4	1.6			ug/L	1.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Cobalt	7440-48-4	18.7			ug/L	1.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Cobalt	7440-48-4	2.1			ug/L	1.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Copper	7440-50-8	3			ug/L	1.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Copper	7440-50-8	2.9			ug/L	1.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Copper	7440-50-8	1.4			ug/L	1.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Copper	7440-50-8	20.5			ug/L	1.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Copper	7440-50-8	7.2			ug/L	1.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Iron	7439-89-6	331			ug/L	23.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Iron	7439-89-6	1060			ug/L	23.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Iron	7439-89-6	284			ug/L	23.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Iron	7439-89-6	26000			ug/L	23.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Iron	7439-89-6	2980			ug/L	23.3	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Lead	7439-92-1	16.8			ug/L	2.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Lead	7439-92-1	2.8			ug/L	2.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Magnesium	7439-95-4	29700			ug/L	72.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Magnesium	7439-95-4	43600			ug/L	72.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Magnesium	7439-95-4	34000			ug/L	72.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Magnesium	7439-95-4	9040			ug/L	72.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Magnesium	7439-95-4	15500			ug/L	72.8	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Manganese	7439-96-5	91.3			ug/L	1.4	METALS	SW	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
WARP	WRWP-SW007	AD2007	13-Sep-00			Manganese	7439-96-5	265			ug/L	1.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Manganese	7439-96-5	130			ug/L	1.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Manganese	7439-96-5	2960			ug/L	1.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Manganese	7439-96-5	104			ug/L	1.4	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Nickel	7440-02-0	2.1			ug/L	1.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Nickel	7440-02-0	3.2			ug/L	1.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Nickel	7440-02-0	2.1			ug/L	1.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Nickel	7440-02-0	32.7			ug/L	1.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Nickel	7440-02-0	8.9			ug/L	1.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Phosphorous	7723-14-0	0.26			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Phosphorous	7723-14-0	0.37			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Phosphorous	7723-14-0	0.26			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Phosphorous	7723-14-0	0.05	U	U	mg/L	0.05	GEN CHEMISTRY	SW	N	N	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Phosphorous	7723-14-0	0.21			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Potassium	2023695	878		B	ug/L	91.2	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Potassium	2023695	1810			ug/L	91.2	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Potassium	2023695	726		B	ug/L	91.2	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Potassium	2023695	12800			ug/L	91.2	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Potassium	2023695	5060			ug/L	91.2	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Sodium	7440-23-5	56000			ug/L	274	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Sodium	7440-23-5	63200			ug/L	274	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Sodium	7440-23-5	58400			ug/L	274	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Sodium	7440-23-5	27100			ug/L	274	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Sodium	7440-23-5	20100			ug/L	274	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Vanadium	7440-62-2	7.5		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Vanadium	7440-62-2	9.7		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Vanadium	7440-62-2	7.9		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Vanadium	7440-62-2	32.7		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Vanadium	7440-62-2	7.6		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW006	AD2006	13-Sep-00			Zinc	7440-66-6	14			ug/L	0.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW007	AD2007	13-Sep-00			Zinc	7440-66-6	11.3			ug/L	0.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW008	AD2008	13-Sep-00			Zinc	7440-66-6	31.9			ug/L	0.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW009	AD2009	13-Sep-00			Zinc	7440-66-6	145			ug/L	0.6	METALS	SW	N	Y	9A09G602
WARP	WRWP-SW010	AD2010	13-Sep-00			Zinc	7440-66-6	19.9			ug/L	0.6	METALS	SW	N	Y	9A09G602
PRRP	PRWP-BI001	AC4001	14-Sep-00			Aluminum	7429-90-5	148	*	J	mg/kg	8.4	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Aluminum	7429-90-5	541	*	J	mg/kg	8.5	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Aluminum	7429-90-5	183	*	J	mg/kg	8.4	METALS	BI	N	Y	1227
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI001	AC4001	14-Sep-00			Antimony	7440-36-0	0.16	B	B	mg/kg	0.069	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Antimony	7440-36-0	0.13	B	B	mg/kg	0.07	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Antimony	7440-36-0	0.08	B	B	mg/kg	0.07	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Arsenic	7440-38-2	0.53	U	U	mg/kg	0.53	METALS	BI	N	N	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Arsenic	7440-38-2	1.5	B	J	mg/kg	0.53	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Arsenic	7440-38-2	0.53	U	U	mg/kg	0.53	METALS	BI	N	N	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Barium	7440-39-3	5.9	B	J	mg/kg	0.59	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Barium	7440-39-3	24			mg/kg	0.59	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Barium	7440-39-3	21.3			mg/kg	0.59	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Calcium	7440-70-2	8310			mg/kg	62.1	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Calcium	7440-70-2	9670			mg/kg	62.4	METALS	BI	N	Y	1227

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
PRRP	PRWP-BI003	AC4003	14-Sep-00			Calcium	7440-70-2	23200			mg/kg	62.2	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Chromium	7440-47-3	0.72	B	J	mg/kg	0.099	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Chromium	7440-47-3	1.2			mg/kg	0.1	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Chromium	7440-47-3	0.56	B	J	mg/kg	0.099	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Cobalt	7440-48-4	0.38	U	U	mg/kg	0.38	METALS	BI	N	N	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Cobalt	7440-48-4	1	B	B	mg/kg	0.38	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Cobalt	7440-48-4	0.38	U	U	mg/kg	0.38	METALS	BI	N	N	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Copper	7440-50-8	0.43	B	J	mg/kg	0.42	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Copper	7440-50-8	1.7			mg/kg	0.42	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Copper	7440-50-8	16.6			mg/kg	0.42	METALS	BI	N	Y	1227
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Dinitrobenzene, 1,3-	99-65-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	HMX	2691-41-0	0.5	U	UJ	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI001	AC4001	14-Sep-00			Iron	7439-89-6	442	N*	J	mg/kg	13.6	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Iron	7439-89-6	2900	N*	J	mg/kg	13.7	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Iron	7439-89-6	696	N*	J	mg/kg	13.7	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Lead	7439-92-1	0.36	B	B	mg/kg	0.22	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Lead	7439-92-1	1.4		B	mg/kg	0.22	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Lead	7439-92-1	0.55	B	B	mg/kg	0.22	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Magnesium	7439-95-4	541			mg/kg	49	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Magnesium	7439-95-4	1360			mg/kg	49.3	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Magnesium	7439-95-4	642			mg/kg	49.1	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Manganese	7439-96-5	16.3			mg/kg	1	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Manganese	7439-96-5	68.8			mg/kg	1	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Manganese	7439-96-5	89.7			mg/kg	1	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Nickel	7440-02-0	0.58	B	J	mg/kg	0.29	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Nickel	7440-02-0	2.2			mg/kg	0.29	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Nickel	7440-02-0	0.66	B	J	mg/kg	0.29	METALS	BI	N	Y	1227
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Nitrobenzene	98-95-3	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Nitrotoluene, 2-	88-72-2	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Nitrotoluene, 3-	99-08-1	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI001	AC4001	14-Sep-00			PERCENT LIPIDS	LIPIDS	1.4			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			PERCENT LIPIDS	LIPIDS	1.3			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			PERCENT LIPIDS	LIPIDS	0.69			Percent	0.1	GEN CHEMISTRY	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Phosphorous	7723-14-0	124		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Phosphorous	7723-14-0	162		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Phosphorous	7723-14-0	173		J	mg/kg	5	GEN CHEMISTRY	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Potassium	2023695	2440			mg/kg	137	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Potassium	2023695	1840			mg/kg	138	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Potassium	2023695	2120			mg/kg	137	METALS	BI	N	Y	1227
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	RDX	121-82-4	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI001	AC4001	14-Sep-00			Sodium	7440-23-5	727	B	J	mg/kg	243	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Sodium	7440-23-5	1140			mg/kg	244	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Sodium	7440-23-5	1620			mg/kg	243	METALS	BI	N	Y	1227
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Tetryl	479-45-8	0.75	U	U	mg/kg	0.75	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Trinitrobenzene, 1,3,5-	99-35-4	0.25	U	U	mg/kg	0.25	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI011	AC4011	28-Nov-00	0	0	Trinitrotoluene, 2,4,6-	118-96-7	0.5	U	U	mg/kg	0.5	NITROAROMATICS	BI	N	N	200145
PRRP	PRWP-BI001	AC4001	14-Sep-00			Vanadium	7440-62-2	0.58	B	J	mg/kg	0.28	METALS	BI	N	Y	1227

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-BI002	AC4002	14-Sep-00			Vanadium	7440-62-2	1.2	B	J	mg/kg	0.28	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Vanadium	7440-62-2	0.38	B	J	mg/kg	0.28	METALS	BI	N	Y	1227
PRRP	PRWP-BI001	AC4001	14-Sep-00			Zinc	7440-66-6	27.3			mg/kg	9.8	METALS	BI	N	Y	1227
PRRP	PRWP-BI002	AC4002	14-Sep-00			Zinc	7440-66-6	26			mg/kg	9.7	METALS	BI	N	Y	1227
PRRP	PRWP-BI003	AC4003	14-Sep-00			Zinc	7440-66-6	19.3	B	J	mg/kg	9.7	METALS	BI	N	Y	1227
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	% Solids	38992	43.6			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	% Solids	38992	60			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	% Solids	38992	72			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	% Solids	38992	74.3			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	% Solids	38992	60.7			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Acenaphthene	83-32-9	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Acenaphthene	83-32-9	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Acenaphthene	83-32-9	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Acenaphthene	83-32-9	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Acenaphthene	83-32-9	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Acenaphthylene	208-96-8	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Acenaphthylene	208-96-8	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Acenaphthylene	208-96-8	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Acenaphthylene	208-96-8	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Acenaphthylene	208-96-8	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Aluminum	7429-90-5	6520			mg/kg	12.7	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Aluminum	7429-90-5	5570			mg/kg	9.1	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Aluminum	7429-90-5	8420			mg/kg	8.3	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Aluminum	7429-90-5	5840			mg/kg	7.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Aluminum	7429-90-5	6880			mg/kg	9.5	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Anthracene	120-12-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Anthracene	120-12-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Anthracene	120-12-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Anthracene	120-12-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Anthracene	120-12-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Antimony	7440-36-0	0.96	U	UJ	mg/kg	0.96	METALS	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Antimony	7440-36-0	0.69	U	UJ	mg/kg	0.69	METALS	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Antimony	7440-36-0	0.63	U	UJ	mg/kg	0.63	METALS	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Antimony	7440-36-0	0.56	U	UJ	mg/kg	0.56	METALS	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Antimony	7440-36-0	0.72	U	UJ	mg/kg	0.72	METALS	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Arsenic	7440-38-2	5.7			mg/kg	0.77	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Arsenic	7440-38-2	5.6			mg/kg	0.55	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Arsenic	7440-38-2	5			mg/kg	0.51	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Arsenic	7440-38-2	6.3			mg/kg	0.45	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Arsenic	7440-38-2	7.7			mg/kg	0.58	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Barium	7440-39-3	100			mg/kg	0.05	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Barium	7440-39-3	63.3			mg/kg	0.04	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Barium	7440-39-3	62.5			mg/kg	0.03	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Barium	7440-39-3	55.1			mg/kg	0.03	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Barium	7440-39-3	49			mg/kg	0.04	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzo(a)anthracene	56-55-3	0.067	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzo(a)anthracene	56-55-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzo(a)anthracene	56-55-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzo(a)anthracene	56-55-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzo(a)anthracene	56-55-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzo(a)pyrene	50-32-8	0.082	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzo(a)pyrene	50-32-8	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzo(a)pyrene	50-32-8	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzo(a)pyrene	50-32-8	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzo(a)pyrene	50-32-8	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzo(b)fluoranthene	205-99-2	0.1	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzo(b)fluoranthene	205-99-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzo(b)fluoranthene	205-99-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzo(b)fluoranthene	205-99-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzo(b)fluoranthene	205-99-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzo(ghi)perylene	191-24-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzo(ghi)perylene	191-24-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzo(ghi)perylene	191-24-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzo(ghi)perylene	191-24-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzo(ghi)perylene	191-24-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzo(k)fluoranthene	207-08-9	0.068	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzo(k)fluoranthene	207-08-9	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzo(k)fluoranthene	207-08-9	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzo(k)fluoranthene	207-08-9	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzo(k)fluoranthene	207-08-9	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzoic acid	65-85-0	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzoic acid	65-85-0	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzoic acid	65-85-0	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzoic acid	65-85-0	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzoic acid	65-85-0	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Benzyl alcohol	100-51-6	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Benzyl alcohol	100-51-6	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Benzyl alcohol	100-51-6	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Benzyl alcohol	100-51-6	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Benzyl alcohol	100-51-6	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Bis(2-chloroethoxy)methane	111-91-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Bis(2-chloroethoxy)methane	111-91-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Bis(2-chloroethoxy)methane	111-91-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Bis(2-chloroethoxy)methane	111-91-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Bis(2-chloroethoxy)methane	111-91-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Bis(2-chloroethyl)ether	111-44-4	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Bis(2-chloroethyl)ether	111-44-4	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Bis(2-chloroethyl)ether	111-44-4	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Bis(2-chloroethyl)ether	111-44-4	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Bis(2-chloroethyl)ether	111-44-4	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Bis(2-chloroisopropyl)ether	108-60-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Bis(2-chloroisopropyl)ether	108-60-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Bis(2-chloroisopropyl)ether	108-60-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Bis(2-chloroisopropyl)ether	108-60-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Bis(2-chloroisopropyl)ether	108-60-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Bis(2-ethylhexyl)phthalate	117-81-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Bis(2-ethylhexyl)phthalate	117-81-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Bis(2-ethylhexyl)phthalate	117-81-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Bis(2-ethylhexyl)phthalate	117-81-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Bis(2-ethylhexyl)phthalate	117-81-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Bromophenyl phenyl ether, 4-	101-55-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Bromophenyl phenyl ether, 4-	101-55-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Bromophenyl phenyl ether, 4-	101-55-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Bromophenyl phenyl ether, 4-	101-55-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Bromophenyl phenyl ether, 4-	101-55-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Butyl benzyl phthalate	85-68-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Butyl benzyl phthalate	85-68-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Butyl benzyl phthalate	85-68-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Butyl benzyl phthalate	85-68-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Butyl benzyl phthalate	85-68-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Calcium	7440-70-2	93400			mg/kg	12.6	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Calcium	7440-70-2	44500			mg/kg	9	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Calcium	7440-70-2	48700			mg/kg	8.3	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Calcium	7440-70-2	39400			mg/kg	7.3	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Calcium	7440-70-2	27500			mg/kg	9.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Carbazole	86-74-8	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Carbazole	86-74-8	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Carbazole	86-74-8	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Carbazole	86-74-8	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Carbazole	86-74-8	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chloro-3-methylphenol, 4-	59-50-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chloro-3-methylphenol, 4-	59-50-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chloro-3-methylphenol, 4-	59-50-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chloro-3-methylphenol, 4-	59-50-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chloro-3-methylphenol, 4-	59-50-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chloroaniline, 4-	106-47-8	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chloroaniline, 4-	106-47-8	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chloroaniline, 4-	106-47-8	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chloroaniline, 4-	106-47-8	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chloroaniline, 4-	106-47-8	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chloronaphthalene, 2-	91-58-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chloronaphthalene, 2-	91-58-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chloronaphthalene, 2-	91-58-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chloronaphthalene, 2-	91-58-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chloronaphthalene, 2-	91-58-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chlorophenol, 2-	95-57-8	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chlorophenol, 2-	95-57-8	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chlorophenol, 2-	95-57-8	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chlorophenol, 2-	95-57-8	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chlorophenol, 2-	95-57-8	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chlorophenyl phenyl ether, 4-	7005-72-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chlorophenyl phenyl ether, 4-	7005-72-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chlorophenyl phenyl ether, 4-	7005-72-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chlorophenyl phenyl ether, 4-	7005-72-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chlorophenyl phenyl ether, 4-	7005-72-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chromium	7440-47-3	12.6			mg/kg	0.14	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chromium	7440-47-3	10.1			mg/kg	0.1	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chromium	7440-47-3	13.8			mg/kg	0.09	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chromium	7440-47-3	10.3			mg/kg	0.08	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chromium	7440-47-3	12.2			mg/kg	0.1	METALS	SD	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Chrysene	218-01-9	0.1	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Chrysene	218-01-9	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Chrysene	218-01-9	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Chrysene	218-01-9	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Chrysene	218-01-9	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Cobalt	7440-48-4	6.7			mg/kg	0.19	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Cobalt	7440-48-4	6.2			mg/kg	0.14	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Cobalt	7440-48-4	8.8			mg/kg	0.13	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Cobalt	7440-48-4	7			mg/kg	0.11	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Cobalt	7440-48-4	6.7			mg/kg	0.14	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Copper	7440-50-8	17.2			mg/kg	0.23	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Copper	7440-50-8	14.8			mg/kg	0.16	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Copper	7440-50-8	19.6			mg/kg	0.15	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Copper	7440-50-8	13.9			mg/kg	0.13	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Copper	7440-50-8	13.7			mg/kg	0.17	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dibenz(a,h)anthracene	53-70-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dibenz(a,h)anthracene	53-70-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dibenz(a,h)anthracene	53-70-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dibenz(a,h)anthracene	53-70-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dibenz(a,h)anthracene	53-70-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dibenzofuran	132-64-9	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dibenzofuran	132-64-9	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dibenzofuran	132-64-9	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dibenzofuran	132-64-9	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dibenzofuran	132-64-9	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dichlorobenzene, 1,2-	95-50-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dichlorobenzene, 1,2-	95-50-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dichlorobenzene, 1,2-	95-50-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dichlorobenzene, 1,2-	95-50-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dichlorobenzene, 1,2-	95-50-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dichlorobenzene, 1,3-	541-73-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dichlorobenzene, 1,3-	541-73-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dichlorobenzene, 1,3-	541-73-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dichlorobenzene, 1,3-	541-73-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dichlorobenzene, 1,3-	541-73-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dichlorobenzene, 1,4-	106-46-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dichlorobenzene, 1,4-	106-46-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dichlorobenzene, 1,4-	106-46-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dichlorobenzene, 1,4-	106-46-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dichlorobenzene, 1,4-	106-46-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dichlorobenzidine, 3,3'-	91-94-1	0.66	U	U	mg/kg	0.66	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dichlorobenzidine, 3,3'-	91-94-1	1.1	U	U	mg/kg	1.1	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dichlorobenzidine, 3,3'-	91-94-1	0.92	U	U	mg/kg	0.92	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dichlorobenzidine, 3,3'-	91-94-1	0.89	U	U	mg/kg	0.89	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dichlorobenzidine, 3,3'-	91-94-1	1.1	U	U	mg/kg	1.1	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dichlorophenol, 2,4-	120-83-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dichlorophenol, 2,4-	120-83-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dichlorophenol, 2,4-	120-83-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dichlorophenol, 2,4-	120-83-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dichlorophenol, 2,4-	120-83-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Diethyl phthalate	84-66-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Diethyl phthalate	84-66-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Diethyl phthalate	84-66-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Diethyl phthalate	84-66-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Diethyl phthalate	84-66-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dimethyl phthalate	131-11-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dimethyl phthalate	131-11-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dimethyl phthalate	131-11-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dimethyl phthalate	131-11-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dimethyl phthalate	131-11-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dimethylphenol, 2,4-	105-67-9	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dimethylphenol, 2,4-	105-67-9	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dimethylphenol, 2,4-	105-67-9	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dimethylphenol, 2,4-	105-67-9	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dimethylphenol, 2,4-	105-67-9	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Di-n-butyl phthalate	84-74-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Di-n-butyl phthalate	84-74-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Di-n-butyl phthalate	84-74-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Di-n-butyl phthalate	84-74-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Di-n-butyl phthalate	84-74-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dinitro-2-methylphenol, 4,6-	534-52-1	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dinitro-2-methylphenol, 4,6-	534-52-1	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dinitro-2-methylphenol, 4,6-	534-52-1	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dinitro-2-methylphenol, 4,6-	534-52-1	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dinitro-2-methylphenol, 4,6-	534-52-1	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dinitrophenol, 2,4-	51-28-5	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dinitrophenol, 2,4-	51-28-5	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dinitrophenol, 2,4-	51-28-5	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dinitrophenol, 2,4-	51-28-5	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dinitrophenol, 2,4-	51-28-5	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dinitrotoluene, 2,4-	121-14-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dinitrotoluene, 2,4-	121-14-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dinitrotoluene, 2,4-	121-14-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dinitrotoluene, 2,4-	121-14-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dinitrotoluene, 2,4-	121-14-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Dinitrotoluene, 2,6-	606-20-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Dinitrotoluene, 2,6-	606-20-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Dinitrotoluene, 2,6-	606-20-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Dinitrotoluene, 2,6-	606-20-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Dinitrotoluene, 2,6-	606-20-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Di-n-octyl phthalate	117-84-0	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Di-n-octyl phthalate	117-84-0	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Di-n-octyl phthalate	117-84-0	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Di-n-octyl phthalate	117-84-0	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Di-n-octyl phthalate	117-84-0	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Fluoranthene	206-44-0	0.14	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Fluoranthene	206-44-0	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Fluoranthene	206-44-0	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Fluoranthene	206-44-0	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Fluoranthene	206-44-0	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Fluorene	86-73-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Fluorene	86-73-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Fluorene	86-73-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Fluorene	86-73-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Fluorene	86-73-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Hexachlorobenzene	118-74-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Hexachlorobenzene	118-74-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Hexachlorobenzene	118-74-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Hexachlorobenzene	118-74-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Hexachlorobenzene	118-74-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Hexachlorobutadiene	87-68-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Hexachlorobutadiene	87-68-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Hexachlorobutadiene	87-68-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Hexachlorobutadiene	87-68-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Hexachlorobutadiene	87-68-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Hexachlorocyclopentadiene	77-47-4	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Hexachlorocyclopentadiene	77-47-4	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Hexachlorocyclopentadiene	77-47-4	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Hexachlorocyclopentadiene	77-47-4	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Hexachlorocyclopentadiene	77-47-4	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Hexachloroethane	67-72-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Hexachloroethane	67-72-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Hexachloroethane	67-72-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Hexachloroethane	67-72-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Hexachloroethane	67-72-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Indeno(1,2,3-cd)pyrene	193-39-5	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Indeno(1,2,3-cd)pyrene	193-39-5	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Indeno(1,2,3-cd)pyrene	193-39-5	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Indeno(1,2,3-cd)pyrene	193-39-5	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Indeno(1,2,3-cd)pyrene	193-39-5	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Iron	7439-89-6	15500			mg/kg	4.1	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Iron	7439-89-6	13700			mg/kg	2.9	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Iron	7439-89-6	19800			mg/kg	2.7	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Iron	7439-89-6	15800			mg/kg	2.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Iron	7439-89-6	18100			mg/kg	3	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Isophorone	78-59-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Isophorone	78-59-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Isophorone	78-59-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Isophorone	78-59-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Isophorone	78-59-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Lead	7439-92-1	9.8	J		mg/kg	0.46	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Lead	7439-92-1	9.4	J		mg/kg	0.33	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Lead	7439-92-1	9.5	J		mg/kg	0.3	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Lead	7439-92-1	7.2	J		mg/kg	0.26	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Lead	7439-92-1	9	J		mg/kg	0.34	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Magnesium	7439-95-4	11200			mg/kg	12.7	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Magnesium	7439-95-4	9140			mg/kg	9.1	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Magnesium	7439-95-4	15900			mg/kg	8.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Magnesium	7439-95-4	12400			mg/kg	7.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Magnesium	7439-95-4	6920			mg/kg	9.5	METALS	SD	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Manganese	7439-96-5	491			mg/kg	0.25	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Manganese	7439-96-5	310			mg/kg	0.18	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Manganese	7439-96-5	461			mg/kg	0.16	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Manganese	7439-96-5	361			mg/kg	0.14	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Manganese	7439-96-5	1050			mg/kg	0.18	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Methylnaphthalene, 2-	91-57-6	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Methylnaphthalene, 2-	91-57-6	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Methylnaphthalene, 2-	91-57-6	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Methylnaphthalene, 2-	91-57-6	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Methylnaphthalene, 2-	91-57-6	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Methylphenol, 2-	95-48-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Methylphenol, 2-	95-48-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Methylphenol, 2-	95-48-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Methylphenol, 2-	95-48-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Methylphenol, 2-	95-48-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Methylphenol, 4-	106-44-5	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Methylphenol, 4-	106-44-5	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Methylphenol, 4-	106-44-5	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Methylphenol, 4-	106-44-5	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Methylphenol, 4-	106-44-5	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Naphthalene	91-20-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Naphthalene	91-20-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Naphthalene	91-20-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Naphthalene	91-20-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Naphthalene	91-20-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nickel	7440-02-0	16.2		J	mg/kg	0.28	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nickel	7440-02-0	15.1		J	mg/kg	0.2	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nickel	7440-02-0	22.9		J	mg/kg	0.18	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nickel	7440-02-0	17.1		J	mg/kg	0.16	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nickel	7440-02-0	16.6		J	mg/kg	0.21	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nitroaniline, 2-	88-74-4	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nitroaniline, 2-	88-74-4	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nitroaniline, 2-	88-74-4	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nitroaniline, 2-	88-74-4	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nitroaniline, 2-	88-74-4	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nitroaniline, 3-	99-09-2	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nitroaniline, 3-	99-09-2	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nitroaniline, 3-	99-09-2	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nitroaniline, 3-	99-09-2	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nitroaniline, 3-	99-09-2	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nitroaniline, 4-	100-01-6	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nitroaniline, 4-	100-01-6	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nitroaniline, 4-	100-01-6	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nitroaniline, 4-	100-01-6	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nitroaniline, 4-	100-01-6	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nitrobenzene	98-95-3	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nitrobenzene	98-95-3	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nitrobenzene	98-95-3	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nitrobenzene	98-95-3	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nitrobenzene	98-95-3	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nitrophenol, 2-	88-75-5	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nitrophenol, 2-	88-75-5	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nitrophenol, 2-	88-75-5	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nitrophenol, 2-	88-75-5	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nitrophenol, 2-	88-75-5	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Nitrophenol, 4-	100-02-7	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Nitrophenol, 4-	100-02-7	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Nitrophenol, 4-	100-02-7	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Nitrophenol, 4-	100-02-7	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Nitrophenol, 4-	100-02-7	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	n-Nitroso-di-n-propylamine	621-64-7	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	n-Nitroso-di-n-propylamine	621-64-7	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	n-Nitroso-di-n-propylamine	621-64-7	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	n-Nitroso-di-n-propylamine	621-64-7	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	n-Nitroso-di-n-propylamine	621-64-7	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	n-Nitrosodiphenylamine	86-30-6	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	n-Nitrosodiphenylamine	86-30-6	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	n-Nitrosodiphenylamine	86-30-6	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	n-Nitrosodiphenylamine	86-30-6	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	n-Nitrosodiphenylamine	86-30-6	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Pentachlorophenol	87-86-5	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Pentachlorophenol	87-86-5	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Pentachlorophenol	87-86-5	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Pentachlorophenol	87-86-5	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Pentachlorophenol	87-86-5	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Phenanthrene	85-01-8	0.096	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Phenanthrene	85-01-8	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Phenanthrene	85-01-8	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Phenanthrene	85-01-8	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Phenanthrene	85-01-8	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Phenol	108-95-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Phenol	108-95-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Phenol	108-95-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Phenol	108-95-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Phenol	108-95-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Phosphorous	7723-14-0	138			mg/kg	9.4	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Phosphorous	7723-14-0	7.3	U	U	mg/kg	7.3	GEN CHEMISTRY	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Phosphorous	7723-14-0	4.9	U	U	mg/kg	4.9	GEN CHEMISTRY	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Phosphorous	7723-14-0	3.7	U	U	mg/kg	3.7	GEN CHEMISTRY	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Phosphorous	7723-14-0	87.4			mg/kg	4.7	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Potassium	2023695	1530		B	mg/kg	16	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Potassium	2023695	1170		B	mg/kg	11.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Potassium	2023695	2480		J	mg/kg	10.5	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Potassium	2023695	1650		J	mg/kg	9.2	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Potassium	2023695	1520		B	mg/kg	11.9	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Pyrene	129-00-0	0.19	J	J	mg/kg	0.33	SEMIVOLATILES	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Pyrene	129-00-0	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Pyrene	129-00-0	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Pyrene	129-00-0	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Pyrene	129-00-0	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Sodium	7440-23-5	158			mg/kg	48	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Sodium	7440-23-5	113			mg/kg	34.3	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Sodium	7440-23-5	174			mg/kg	31.4	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Sodium	7440-23-5	138			mg/kg	27.7	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Sodium	7440-23-5	118			mg/kg	35.8	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Total organic carbon	10-35-5	24800			mg/kg	1980	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Total organic carbon	10-35-5	25900			mg/kg	2780	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Total organic carbon	10-35-5	9040			mg/kg	2600	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Total organic carbon	10-35-5	5190			mg/kg	2000	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Total organic carbon	10-35-5	10400			mg/kg	1000	GEN CHEMISTRY	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Trichlorobenzene, 1,2,4-	120-82-1	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Trichlorobenzene, 1,2,4-	120-82-1	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Trichlorobenzene, 1,2,4-	120-82-1	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Trichlorobenzene, 1,2,4-	120-82-1	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Trichlorobenzene, 1,2,4-	120-82-1	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Trichlorophenol, 2,4,5-	95-95-4	1.6	U	U	mg/kg	1.6	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Trichlorophenol, 2,4,5-	95-95-4	2.8	U	U	mg/kg	2.8	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Trichlorophenol, 2,4,5-	95-95-4	2.3	U	U	mg/kg	2.3	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Trichlorophenol, 2,4,5-	95-95-4	2.2	U	U	mg/kg	2.2	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Trichlorophenol, 2,4,5-	95-95-4	2.7	U	U	mg/kg	2.7	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Trichlorophenol, 2,4,6-	88-06-2	0.33	U	U	mg/kg	0.33	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Trichlorophenol, 2,4,6-	88-06-2	0.55	U	U	mg/kg	0.55	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Trichlorophenol, 2,4,6-	88-06-2	0.46	U	U	mg/kg	0.46	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Trichlorophenol, 2,4,6-	88-06-2	0.45	U	U	mg/kg	0.45	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Trichlorophenol, 2,4,6-	88-06-2	0.54	U	U	mg/kg	0.54	SEMIVOLATILES	SD	N	N	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Vanadium	7440-62-2	19.3		B	mg/kg	0.37	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Vanadium	7440-62-2	16.5		B	mg/kg	0.26	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Vanadium	7440-62-2	23.5		B	mg/kg	0.24	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Vanadium	7440-62-2	19.9		B	mg/kg	0.21	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Vanadium	7440-62-2	22.3		B	mg/kg	0.27	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD001	AC1001	15-Sep-00	0	0	Zinc	7440-66-6	130			mg/kg	0.11	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD002	AC1002	15-Sep-00	0	0.5	Zinc	7440-66-6	135			mg/kg	0.08	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD003	AC1003	15-Sep-00	0	0.5	Zinc	7440-66-6	47.8			mg/kg	0.07	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD004	AC1004	15-Sep-00	0	0.5	Zinc	7440-66-6	36.2			mg/kg	0.06	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SD005	AC1005	15-Sep-00	0	0.5	Zinc	7440-66-6	50.5			mg/kg	0.08	METALS	SD	N	Y	9A09G601
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Amino-2,6-dinitrotoluene, 4-	19406-51-0	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.099	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Amino-4,6-dinitrotoluene, 2-	35572-78-2	0.2	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Dinitrobenzene, 1,3-	99-65-0	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	1.2			mg/kg	0.2	NITROAROMATICS	SO	N	Y	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Dinitrotoluene, 2,4-	121-14-2	0.68			mg/kg	0.2	NITROAROMATICS	SO	N	Y	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Dinitrotoluene, 2,6-	606-20-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	HMX	2691-41-0	0.24	U	U	mg/kg	0.24	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	HMX	2691-41-0	0.25	U	U	mg/kg	0.25	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Nitrobenzene	98-95-3	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Nitrotoluene, 2-	88-72-2	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Nitrotoluene, 3-	99-08-1	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.49	U	U	mg/kg	0.49	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.49	U	U	mg/kg	0.49	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Nitrotoluene, 4-	99-99-0	0.5	U	U	mg/kg	0.5	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	RDX	121-82-4	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	RDX	121-82-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	RDX	121-82-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	RDX	121-82-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Tetryl	479-45-8	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Tetryl	479-45-8	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Tetryl	479-45-8	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Tetryl	479-45-8	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Tetryl	479-45-8	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Tetryl	479-45-8	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.099	U	U	mg/kg	0.099	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.098	U	U	mg/kg	0.098	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Trinitrobenzene, 1,3,5-	99-35-4	0.1	U	U	mg/kg	0.1	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0001	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO002	AC0002	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO003	AC0003	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO004	AC0004	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO005	AC0005	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SO001	AC0006	15-Sep-00	0	1	Trinitrotoluene, 2,4,6-	118-96-7	0.2	U	U	mg/kg	0.2	NITROAROMATICS	SO	N	N	9A09G609
PRRP	PRWP-SW004	AC2004	14-Sep-00			Aluminum	7429-90-5	712			ug/L	72.7	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Aluminum	7429-90-5	72.7	U	U	ug/L	72.7	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Aluminum	7429-90-5	137			ug/L	72.7	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Aluminum	7429-90-5	237			ug/L	72.7	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Aluminum	7429-90-5	72.7	U	U	ug/L	72.7	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Aluminum	7429-90-5	494			ug/L	72.7	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Barium	7440-39-3	88.6			ug/L	0.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Barium	7440-39-3	74.1			ug/L	0.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Barium	7440-39-3	82.5			ug/L	0.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Barium	7440-39-3	86.9			ug/L	0.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Barium	7440-39-3	83.1			ug/L	0.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Barium	7440-39-3	89.7			ug/L	0.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Calcium	7440-70-2	109000			ug/L	71.9	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Calcium	7440-70-2	107000			ug/L	71.9	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Calcium	7440-70-2	118000			ug/L	71.9	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Calcium	7440-70-2	117000			ug/L	71.9	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Calcium	7440-70-2	118000			ug/L	71.9	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Calcium	7440-70-2	113000			ug/L	71.9	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Chromium	7440-47-3	1.2			ug/L	0.8	METALS	SW	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
PRRP	PRWP-SW006	AC2006	14-Sep-00			Chromium	7440-47-3	1.1			ug/L	0.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Chromium	7440-47-3	0.8			ug/L	0.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Chromium	7440-47-3	0.9			ug/L	0.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Chromium	7440-47-3	1.9			ug/L	0.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Chromium	7440-47-3	0.9			ug/L	0.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Cobalt	7440-48-4	1.8			ug/L	1.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Copper	7440-50-8	2.4			ug/L	1.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Copper	7440-50-8	1.8			ug/L	1.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Copper	7440-50-8	1.8			ug/L	1.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Copper	7440-50-8	1.8			ug/L	1.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Copper	7440-50-8	1.3	U	U	ug/L	1.3	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Copper	7440-50-8	7.4			ug/L	1.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Iron	7439-89-6	1220			ug/L	23.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Iron	7439-89-6	388			ug/L	23.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Iron	7439-89-6	364			ug/L	23.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Iron	7439-89-6	608			ug/L	23.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Iron	7439-89-6	314			ug/L	23.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Iron	7439-89-6	1010			ug/L	23.3	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Magnesium	7439-95-4	26000			ug/L	72.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Magnesium	7439-95-4	24400			ug/L	72.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Magnesium	7439-95-4	27100			ug/L	72.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Magnesium	7439-95-4	27100			ug/L	72.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Magnesium	7439-95-4	27300			ug/L	72.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Magnesium	7439-95-4	26400			ug/L	72.8	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Manganese	7439-96-5	149			ug/L	1.4	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Manganese	7439-96-5	104			ug/L	1.4	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Manganese	7439-96-5	106			ug/L	1.4	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Manganese	7439-96-5	148			ug/L	1.4	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Manganese	7439-96-5	101			ug/L	1.4	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Manganese	7439-96-5	147			ug/L	1.4	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Nickel	7440-02-0	1.7			ug/L	1.6	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Phosphorous	7723-14-0	0.05	U	U	mg/L	0.05	GEN CHEMISTRY	SW	N	N	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Phosphorous	7723-14-0	0.05			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Phosphorous	7723-14-0	0.066			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G601

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
PRRP	PRWP-SW008	AC2008	14-Sep-00			Phosphorous	7723-14-0	0.12			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Phosphorous	7723-14-0	0.051			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Phosphorous	7723-14-0	0.086			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Potassium	2023695	2330			ug/L	91.2	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Potassium	2023695	1870			ug/L	91.2	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Potassium	2023695	2100			ug/L	91.2	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Potassium	2023695	2190			ug/L	91.2	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Potassium	2023695	2110			ug/L	91.2	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Potassium	2023695	2090			ug/L	91.2	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Sodium	7440-23-5	9510			ug/L	274	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Sodium	7440-23-5	8950			ug/L	274	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Sodium	7440-23-5	9910			ug/L	274	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Sodium	7440-23-5	9790			ug/L	274	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Sodium	7440-23-5	9920			ug/L	274	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Sodium	7440-23-5	9620			ug/L	274	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Vanadium	7440-62-2	7.2		B	ug/L	2.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Vanadium	7440-62-2	3.6		B	ug/L	2.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Vanadium	7440-62-2	4.1		B	ug/L	2.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Vanadium	7440-62-2	5		B	ug/L	2.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Vanadium	7440-62-2	4.4		B	ug/L	2.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Vanadium	7440-62-2	4.3		B	ug/L	2.1	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW004	AC2004	14-Sep-00			Zinc	7440-66-6	54.3		J	ug/L	0.6	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW006	AC2006	14-Sep-00			Zinc	7440-66-6	14		J	ug/L	0.6	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW007	AC2007	14-Sep-00			Zinc	7440-66-6	13		J	ug/L	0.6	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW008	AC2008	14-Sep-00			Zinc	7440-66-6	15.2		J	ug/L	0.6	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW009	AC2009	14-Sep-00			Zinc	7440-66-6	12.1		J	ug/L	0.6	METALS	SW	N	Y	9A09G601
PRRP	PRWP-SW010	AC2010	14-Sep-00			Zinc	7440-66-6	14		J	ug/L	0.6	METALS	SW	N	Y	9A09G601
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	% Solids	38992	40.9			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	% Solids	38992	14.8			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	% Solids	38992	39.5			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	% Solids	38992	63.1			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	% Solids	38992	60.8			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	% Solids	38992	71			Percent	0.1	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Aluminum	7429-90-5	6190		J	mg/kg	9.5	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Aluminum	7429-90-5	11400		J	mg/kg	27.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Aluminum	7429-90-5	10400		J	mg/kg	9.6	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Aluminum	7429-90-5	4920		J	mg/kg	7.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Aluminum	7429-90-5	7680		J	mg/kg	6.4	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Aluminum	7429-90-5	6260		J	mg/kg	6.4	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Antimony	7440-36-0	0.72	U	UJ	mg/kg	0.72	METALS	SD	N	N	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Antimony	7440-36-0	2.1	U	UJ	mg/kg	2.1	METALS	SD	N	N	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Antimony	7440-36-0	0.73	U	UJ	mg/kg	0.73	METALS	SD	N	N	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Antimony	7440-36-0	0.53	U	UJ	mg/kg	0.53	METALS	SD	N	N	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Antimony	7440-36-0	0.48	U	UJ	mg/kg	0.48	METALS	SD	N	N	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Antimony	7440-36-0	0.48	U	UJ	mg/kg	0.48	METALS	SD	N	N	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Arsenic	7440-38-2	7.4		J	mg/kg	0.57	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Arsenic	7440-38-2	3.4		J	mg/kg	1.7	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Arsenic	7440-38-2	6.1		J	mg/kg	0.58	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Arsenic	7440-38-2	3.9		J	mg/kg	0.43	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Arsenic	7440-38-2	5.2		J	mg/kg	0.39	METALS	SD	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Arsenic	7440-38-2	3.5		J	mg/kg	0.39	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Barium	7440-39-3	51.5		J	mg/kg	0.04	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Barium	7440-39-3	86.2		J	mg/kg	0.11	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Barium	7440-39-3	58.3		J	mg/kg	0.04	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Barium	7440-39-3	40		J	mg/kg	0.03	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Barium	7440-39-3	48		J	mg/kg	0.03	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Barium	7440-39-3	40		J	mg/kg	0.03	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Calcium	7440-70-2	34500		J	mg/kg	9.4	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Calcium	7440-70-2	79100		J	mg/kg	27	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Calcium	7440-70-2	47900		J	mg/kg	9.5	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Calcium	7440-70-2	10900		J	mg/kg	7	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Calcium	7440-70-2	9750		J	mg/kg	6.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Calcium	7440-70-2	8190		J	mg/kg	6.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Chromium	7440-47-3	13.7		J	mg/kg	0.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Chromium	7440-47-3	17.1		J	mg/kg	0.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Chromium	7440-47-3	15.5		J	mg/kg	0.11	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Chromium	7440-47-3	7.4		J	mg/kg	0.08	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Chromium	7440-47-3	10.5		J	mg/kg	0.07	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Chromium	7440-47-3	8.7		J	mg/kg	0.07	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Cobalt	7440-48-4	6.6		J	mg/kg	0.14	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Cobalt	7440-48-4	8.1		J	mg/kg	0.41	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Cobalt	7440-48-4	9.5		J	mg/kg	0.15	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Cobalt	7440-48-4	8.2		J	mg/kg	0.11	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Cobalt	7440-48-4	9.3		J	mg/kg	0.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Cobalt	7440-48-4	7.6		J	mg/kg	0.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Copper	7440-50-8	16.9			mg/kg	0.17	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Copper	7440-50-8	21			mg/kg	0.49	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Copper	7440-50-8	20.3			mg/kg	0.17	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Copper	7440-50-8	12.1			mg/kg	0.13	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Copper	7440-50-8	13.6			mg/kg	0.11	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Copper	7440-50-8	11.6			mg/kg	0.11	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Iron	7439-89-6	14100		J	mg/kg	3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Iron	7439-89-6	20900		J	mg/kg	8.7	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Iron	7439-89-6	19500		J	mg/kg	3.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Iron	7439-89-6	11400		J	mg/kg	2.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Iron	7439-89-6	14700		J	mg/kg	2	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Iron	7439-89-6	11700		J	mg/kg	2.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Lead	7439-92-1	13.1		J	mg/kg	0.34	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Lead	7439-92-1	18.9		J	mg/kg	0.98	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Lead	7439-92-1	15		J	mg/kg	0.34	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Lead	7439-92-1	9.1		J	mg/kg	0.25	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Lead	7439-92-1	12.2		J	mg/kg	0.23	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Lead	7439-92-1	9.9		J	mg/kg	0.23	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Magnesium	7439-95-4	10300		J	mg/kg	9.5	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Magnesium	7439-95-4	7940		J	mg/kg	27.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Magnesium	7439-95-4	8480		J	mg/kg	9.6	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Magnesium	7439-95-4	2200		J	mg/kg	7.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Magnesium	7439-95-4	3070		J	mg/kg	6.4	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Magnesium	7439-95-4	2340		J	mg/kg	6.4	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Manganese	7439-96-5	275		J	mg/kg	0.18	METALS	SD	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Manganese	7439-96-5	1330		J	mg/kg	0.53	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Manganese	7439-96-5	575		J	mg/kg	0.19	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Manganese	7439-96-5	390		J	mg/kg	0.14	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Manganese	7439-96-5	321		J	mg/kg	0.12	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Manganese	7439-96-5	279		J	mg/kg	0.12	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Nickel	7440-02-0	16.2		J	mg/kg	0.21	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Nickel	7440-02-0	22.5		J	mg/kg	0.6	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Nickel	7440-02-0	23		J	mg/kg	0.21	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Nickel	7440-02-0	20.2		J	mg/kg	0.16	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Nickel	7440-02-0	21.7		J	mg/kg	0.14	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Nickel	7440-02-0	17.6		J	mg/kg	0.14	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Phosphorous	7723-14-0	12.1	U	U	mg/kg	12.1	GEN CHEMISTRY	SD	N	N	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Phosphorous	7723-14-0	530			mg/kg	48.9	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Phosphorous	7723-14-0	7.3	U	U	mg/kg	7.3	GEN CHEMISTRY	SD	N	N	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Phosphorous	7723-14-0	5.2	U	U	mg/kg	5.2	GEN CHEMISTRY	SD	N	N	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Phosphorous	7723-14-0	12.3			mg/kg	7.3	GEN CHEMISTRY	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Phosphorous	7723-14-0	5.5	U	U	mg/kg	5.5	GEN CHEMISTRY	SD	N	N	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Potassium	2023695	1210		J	mg/kg	11.9	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Potassium	2023695	3240		J	mg/kg	34.2	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Potassium	2023695	2110		J	mg/kg	12.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Potassium	2023695	916		J	mg/kg	8.9	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Potassium	2023695	1440		J	mg/kg	8	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Potassium	2023695	1140		J	mg/kg	8	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Sodium	7440-23-5	776			mg/kg	35.6	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Sodium	7440-23-5	1060			mg/kg	103	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Sodium	7440-23-5	955			mg/kg	36.3	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Sodium	7440-23-5	513			mg/kg	26.6	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Sodium	7440-23-5	744			mg/kg	24.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Sodium	7440-23-5	605			mg/kg	24.1	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Vanadium	7440-62-2	18.9		J	mg/kg	0.27	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Vanadium	7440-62-2	26.2		J	mg/kg	0.79	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Vanadium	7440-62-2	26.4		J	mg/kg	0.28	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Vanadium	7440-62-2	11.2		J	mg/kg	0.2	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Vanadium	7440-62-2	17		J	mg/kg	0.18	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Vanadium	7440-62-2	14.2		J	mg/kg	0.18	METALS	SD	N	Y	9A09G602
BCG	BCG-SD001	AE1001	15-Sep-00	0	1	Zinc	7440-66-6	96		J	mg/kg	0.08	METALS	SD	N	Y	9A09G602
BCG	BCG-SD002	AE1002	15-Sep-00	0	1	Zinc	7440-66-6	118		J	mg/kg	0.23	METALS	SD	N	Y	9A09G602
BCG	BCG-SD003	AE1003	15-Sep-00	0	1	Zinc	7440-66-6	66		J	mg/kg	0.08	METALS	SD	N	Y	9A09G602
BCG	BCG-SD004	AE1004	15-Sep-00	0	0.5	Zinc	7440-66-6	45.6		J	mg/kg	0.06	METALS	SD	N	Y	9A09G602
BCG	BCG-SD005	AE1005	15-Sep-00	0	0.5	Zinc	7440-66-6	56.3		J	mg/kg	0.05	METALS	SD	N	Y	9A09G602
BCG	BCG-SD006	AE1006	15-Sep-00	0	0.5	Zinc	7440-66-6	44.3		J	mg/kg	0.05	METALS	SD	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	% Solids	38992	72.4			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	% Solids	38992	75			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	% Solids	38992	66.8			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	% Solids	38992	80.8			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	% Solids	38992	79.7			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	% Solids	38992	80.8			Percent	0.1	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Acenaphthene	83-32-9	0.11	U	U	mg/kg	0.11	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Acenaphthene	83-32-9	0.11	U	U	mg/kg	0.11	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Acenaphthene	83-32-9	0.12	U	U	mg/kg	0.12	SEMIVOLATILES	SO	N	N	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Acenaphthene	83-32-9	0.1	U	U	mg/kg	0.1	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Acenaphthylene	208-96-8	0.057	U	U	mg/kg	0.057	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Acenaphthylene	208-96-8	0.054	U	U	mg/kg	0.054	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Acenaphthylene	208-96-8	0.062	U	U	mg/kg	0.062	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Acenaphthylene	208-96-8	0.05	U	U	mg/kg	0.05	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Acenaphthylene	208-96-8	0.05	U	U	mg/kg	0.05	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Acenaphthylene	208-96-8	0.05	U	U	mg/kg	0.05	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Aluminum	7429-90-5	10600		J	mg/kg	5.7	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Aluminum	7429-90-5	10400		J	mg/kg	5.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Aluminum	7429-90-5	7900		J	mg/kg	7.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Aluminum	7429-90-5	8280		J	mg/kg	5.8	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Aluminum	7429-90-5	6970		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Aluminum	7429-90-5	6330		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Anthracene	120-12-7	0.0023	U	U	mg/kg	0.0023	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Anthracene	120-12-7	0.00087	J	J	mg/kg	0.0022	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Anthracene	120-12-7	0.001	J	J	mg/kg	0.0025	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Anthracene	120-12-7	0.002	U	U	mg/kg	0.002	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Anthracene	120-12-7	0.002	U	U	mg/kg	0.002	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Anthracene	120-12-7	0.002	U	U	mg/kg	0.002	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Antimony	7440-36-0	0.43	U	UJ	mg/kg	0.43	METALS	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Antimony	7440-36-0	0.4	U	UJ	mg/kg	0.4	METALS	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Antimony	7440-36-0	0.53	U	UJ	mg/kg	0.53	METALS	SO	N	N	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Antimony	7440-36-0	0.44	U	UJ	mg/kg	0.44	METALS	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Antimony	7440-36-0	0.45	U	UJ	mg/kg	0.45	METALS	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Antimony	7440-36-0	0.45	U	UJ	mg/kg	0.45	METALS	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Arsenic	7440-38-2	9.3		J	mg/kg	0.35	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Arsenic	7440-38-2	4.5		J	mg/kg	0.32	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Arsenic	7440-38-2	5.1		J	mg/kg	0.43	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Arsenic	7440-38-2	2.3		J	mg/kg	0.35	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Arsenic	7440-38-2	2.6		J	mg/kg	0.36	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Arsenic	7440-38-2	2		J	mg/kg	0.36	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Barium	7440-39-3	104		J	mg/kg	0.02	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Barium	7440-39-3	48.8		J	mg/kg	0.02	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Barium	7440-39-3	110		J	mg/kg	0.03	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Barium	7440-39-3	39.2		J	mg/kg	0.02	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Barium	7440-39-3	34.4		J	mg/kg	0.02	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Barium	7440-39-3	44.3		J	mg/kg	0.02	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.0071			mg/kg	0.0057	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.0059			mg/kg	0.0054	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.01			mg/kg	0.0062	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.005	U	U	mg/kg	0.005	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.0049	J	J	mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Benzo(a)anthracene	56-55-3	0.0048	J	J	mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.01			mg/kg	0.0057	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0087			mg/kg	0.0054	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.016			mg/kg	0.0062	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0038	J	J	mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0078			mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Benzo(a)pyrene	50-32-8	0.0078			mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.01			mg/kg	0.0023	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0081			mg/kg	0.0022	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0078			mg/kg	0.0025	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0036			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0078			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Benzo(b)fluoranthene	205-99-2	0.0074			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0091	U	U	mg/kg	0.0091	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0086	U	U	mg/kg	0.0086	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0099	U	U	mg/kg	0.0099	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.008	U	U	mg/kg	0.008	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0081	U	U	mg/kg	0.0081	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Benzo(ghi)perylene	191-24-2	0.0081	U	U	mg/kg	0.0081	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.004			mg/kg	0.0023	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0038			mg/kg	0.0022	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0062			mg/kg	0.0025	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0018	J	J	mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0035			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Benzo(k)fluoranthene	207-08-9	0.0038			mg/kg	0.002	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Calcium	7440-70-2	5740		J	mg/kg	5.6	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Calcium	7440-70-2	4550		J	mg/kg	5.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Calcium	7440-70-2	5930		J	mg/kg	7	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Calcium	7440-70-2	1350		J	mg/kg	5.8	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Calcium	7440-70-2	2300		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Calcium	7440-70-2	2830		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Chromium	7440-47-3	14.8		J	mg/kg	0.06	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Chromium	7440-47-3	14.2		J	mg/kg	0.06	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Chromium	7440-47-3	12.1		J	mg/kg	0.08	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Chromium	7440-47-3	8.4		J	mg/kg	0.06	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Chromium	7440-47-3	8.1		J	mg/kg	0.07	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Chromium	7440-47-3	6.3		J	mg/kg	0.07	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Chrysene	218-01-9	0.01			mg/kg	0.0057	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Chrysene	218-01-9	0.009			mg/kg	0.0054	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Chrysene	218-01-9	0.012			mg/kg	0.0062	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Chrysene	218-01-9	0.0032	J	J	mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Chrysene	218-01-9	0.0062			mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Chrysene	218-01-9	0.0063			mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Cobalt	7440-48-4	7.1		J	mg/kg	0.09	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Cobalt	7440-48-4	4.3		J	mg/kg	0.08	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Cobalt	7440-48-4	4.8		J	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Cobalt	7440-48-4	2.5		J	mg/kg	0.09	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Cobalt	7440-48-4	2.5		J	mg/kg	0.09	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Cobalt	7440-48-4	2.3		J	mg/kg	0.09	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Copper	7440-50-8	14.2			mg/kg	0.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Copper	7440-50-8	12.4			mg/kg	0.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Copper	7440-50-8	10.9			mg/kg	0.13	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Copper	7440-50-8	4.7		B	mg/kg	0.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Copper	7440-50-8	5.5		B	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Copper	7440-50-8	8.4		B	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.023	U	U	mg/kg	0.023	SEMIVOLATILES	SO	N	N	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.022	U	U	mg/kg	0.022	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.025	U	U	mg/kg	0.025	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.02	U	U	mg/kg	0.02	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.02	U	U	mg/kg	0.02	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Dibenz(a,h)anthracene	53-70-3	0.02	U	U	mg/kg	0.02	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Fluoranthene	206-44-0	0.023			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Fluoranthene	206-44-0	0.021			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Fluoranthene	206-44-0	0.032			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Fluoranthene	206-44-0	0.0085			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Fluoranthene	206-44-0	0.016			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Fluoranthene	206-44-0	0.017			mg/kg	0.0042	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Fluorene	86-73-7	0.011	U	U	mg/kg	0.011	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Fluorene	86-73-7	0.011	U	U	mg/kg	0.011	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Fluorene	86-73-7	0.012	U	U	mg/kg	0.012	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Fluorene	86-73-7	0.01	U	U	mg/kg	0.01	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Fluorene	86-73-7	0.01	U	U	mg/kg	0.01	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Fluorene	86-73-7	0.01	U	U	mg/kg	0.01	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0084			mg/kg	0.0057	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0058			mg/kg	0.0054	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.028			mg/kg	0.0062	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0022	J	J	mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0074			mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Indeno(1,2,3-cd)pyrene	193-39-5	0.0048	J	J	mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Iron	7439-89-6	26200		J	mg/kg	1.8	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Iron	7439-89-6	14700		J	mg/kg	1.7	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Iron	7439-89-6	17900		J	mg/kg	2.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Iron	7439-89-6	10600		J	mg/kg	1.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Iron	7439-89-6	9890		J	mg/kg	1.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Iron	7439-89-6	8230		J	mg/kg	1.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Lead	7439-92-1	12.8		J	mg/kg	0.2	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Lead	7439-92-1	11.6		J	mg/kg	0.19	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Lead	7439-92-1	12.8		J	mg/kg	0.25	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Lead	7439-92-1	7		J	mg/kg	0.21	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Lead	7439-92-1	10.4		J	mg/kg	0.21	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Lead	7439-92-1	8.3		J	mg/kg	0.21	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Magnesium	7439-95-4	2320		J	mg/kg	5.7	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Magnesium	7439-95-4	2180		J	mg/kg	5.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Magnesium	7439-95-4	1540		J	mg/kg	7.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Magnesium	7439-95-4	949		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Magnesium	7439-95-4	904		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Magnesium	7439-95-4	832		J	mg/kg	5.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Manganese	7439-96-5	465		J	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Manganese	7439-96-5	152		J	mg/kg	0.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Manganese	7439-96-5	605		J	mg/kg	0.14	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Manganese	7439-96-5	242		J	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Manganese	7439-96-5	216		J	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Manganese	7439-96-5	277		J	mg/kg	0.11	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Naphthalene	91-20-3	0.057	U	U	mg/kg	0.057	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Naphthalene	91-20-3	0.054	U	U	mg/kg	0.054	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Naphthalene	91-20-3	0.062	U	U	mg/kg	0.062	SEMIVOLATILES	SO	N	N	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Naphthalene	91-20-3	0.05	U	U	mg/kg	0.05	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Naphthalene	91-20-3	0.05	U	U	mg/kg	0.05	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Naphthalene	91-20-3	0.05	U	U	mg/kg	0.05	SEMIVOLATILES	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Nickel	7440-02-0	17.4		J	mg/kg	0.13	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Nickel	7440-02-0	14.8		J	mg/kg	0.12	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Nickel	7440-02-0	13.1		J	mg/kg	0.16	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Nickel	7440-02-0	7.5		J	mg/kg	0.13	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Nickel	7440-02-0	6.8		J	mg/kg	0.13	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Nickel	7440-02-0	5.8		J	mg/kg	0.13	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Phenanthrene	85-01-8	0.0098			mg/kg	0.0045	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Phenanthrene	85-01-8	0.01			mg/kg	0.0043	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Phenanthrene	85-01-8	0.017			mg/kg	0.005	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Phenanthrene	85-01-8	0.056			mg/kg	0.004	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Phenanthrene	85-01-8	0.068			mg/kg	0.004	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Phenanthrene	85-01-8	0.13	D		mg/kg	0.02	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Phosphorous	7723-14-0	6.3	U	U	mg/kg	6.3	GEN CHEMISTRY	SO	N	N	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Phosphorous	7723-14-0	10.7			mg/kg	6.2	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Phosphorous	7723-14-0	141			mg/kg	12.3	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Phosphorous	7723-14-0	9.1			mg/kg	5.2	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Phosphorous	7723-14-0	29.5			mg/kg	5.8	GEN CHEMISTRY	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Phosphorous	7723-14-0	6.1	U	U	mg/kg	6.1	GEN CHEMISTRY	SO	N	N	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Potassium	2023695	1010		J	mg/kg	7.2	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Potassium	2023695	1250		J	mg/kg	6.7	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Potassium	2023695	683		J	mg/kg	8.9	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Potassium	2023695	430		B	mg/kg	7.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Potassium	2023695	384		J	mg/kg	7.4	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Potassium	2023695	381		B	mg/kg	7.4	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Pyrene	129-00-0	0.017			mg/kg	0.011	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Pyrene	129-00-0	0.016			mg/kg	0.011	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Pyrene	129-00-0	0.025			mg/kg	0.012	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Pyrene	129-00-0	0.0058	J	J	mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Pyrene	129-00-0	0.012			mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Pyrene	129-00-0	0.012			mg/kg	0.01	SEMIVOLATILES	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Sodium	7440-23-5	774			mg/kg	21.5	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Sodium	7440-23-5	732			mg/kg	20.1	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Sodium	7440-23-5	686			mg/kg	26.6	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Sodium	7440-23-5	548			mg/kg	22	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Sodium	7440-23-5	469			mg/kg	22.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Sodium	7440-23-5	436			mg/kg	22.3	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Vanadium	7440-62-2	28.9		J	mg/kg	0.16	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Vanadium	7440-62-2	21.7		J	mg/kg	0.15	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Vanadium	7440-62-2	22.1		J	mg/kg	0.2	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Vanadium	7440-62-2	18.3		J	mg/kg	0.17	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Vanadium	7440-62-2	17.5		J	mg/kg	0.17	METALS	SO	N	Y	9A09G602
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Vanadium	7440-62-2	12.5		J	mg/kg	0.17	METALS	SO	N	Y	9A09G602
BCG	BCG-SO001	AE0001	12-Sep-00	0	1	Zinc	7440-66-6	46.8		J	mg/kg	0.05	METALS	SO	N	Y	9A09G602
BCG	BCG-SO002	AE0002	12-Sep-00	0	1	Zinc	7440-66-6	38.2		J	mg/kg	0.04	METALS	SO	N	Y	9A09G602
BCG	BCG-SO003	AE0003	12-Sep-00	0	1	Zinc	7440-66-6	32.1		J	mg/kg	0.06	METALS	SO	N	Y	9A09G602
BCG	BCG-SO004	AE0004	12-Sep-00	0	1	Zinc	7440-66-6	97.9		J	mg/kg	0.05	METALS	SO	N	Y	9A09G602
BCG	BCG-SO005	AE0005	12-Sep-00	0	1	Zinc	7440-66-6	34.4		J	mg/kg	0.05	METALS	SO	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SO006	AE0006	12-Sep-00	0	1	Zinc	7440-66-6	33.4		J	mg/kg	0.05	METALS	SO	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Aluminum	7429-90-5	270			ug/L	72.7	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Aluminum	7429-90-5	435			ug/L	72.7	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Aluminum	7429-90-5	72.7	U	U	ug/L	72.7	METALS	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Aluminum	7429-90-5	478			ug/L	72.7	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Aluminum	7429-90-5	361			ug/L	72.7	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Aluminum	7429-90-5	182			ug/L	72.7	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Antimony	7440-36-0	5.5	U	U	ug/L	5.5	METALS	SW	N	N	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Arsenic	7440-38-2	4.4	U	U	ug/L	4.4	METALS	SW	N	N	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Barium	7440-39-3	77.2			ug/L	0.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Barium	7440-39-3	37.4			ug/L	0.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Barium	7440-39-3	32.7			ug/L	0.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Barium	7440-39-3	49.9			ug/L	0.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Barium	7440-39-3	50.8			ug/L	0.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Barium	7440-39-3	52			ug/L	0.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Calcium	7440-70-2	105000			ug/L	71.9	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Calcium	7440-70-2	109000			ug/L	71.9	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Calcium	7440-70-2	113000			ug/L	71.9	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Calcium	7440-70-2	85000			ug/L	71.9	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Calcium	7440-70-2	87700			ug/L	71.9	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Calcium	7440-70-2	90400			ug/L	71.9	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Chromium	7440-47-3	0.9		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Chromium	7440-47-3	1.1		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Chromium	7440-47-3	1.1		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Chromium	7440-47-3	1.6		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Chromium	7440-47-3	0.8		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Chromium	7440-47-3	1		B	ug/L	0.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Cobalt	7440-48-4	1.1			ug/L	1.1	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Cobalt	7440-48-4	1.1	U	U	ug/L	1.1	METALS	SW	N	N	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Copper	7440-50-8	2.3			ug/L	1.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Copper	7440-50-8	2.2			ug/L	1.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Copper	7440-50-8	1.7			ug/L	1.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Copper	7440-50-8	3.2			ug/L	1.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Copper	7440-50-8	2.6			ug/L	1.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Copper	7440-50-8	6.7			ug/L	1.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Iron	7439-89-6	717			ug/L	23.3	METALS	SW	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _GROUP
BCG	BCG-SW002	AE2002	15-Sep-00			Iron	7439-89-6	1070			ug/L	23.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Iron	7439-89-6	618			ug/L	23.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Iron	7439-89-6	457			ug/L	23.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Iron	7439-89-6	362			ug/L	23.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Iron	7439-89-6	201			ug/L	23.3	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Lead	7439-92-1	2.6	U	U	ug/L	2.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Magnesium	7439-95-4	24800			ug/L	72.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Magnesium	7439-95-4	22700			ug/L	72.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Magnesium	7439-95-4	23100			ug/L	72.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Magnesium	7439-95-4	18200			ug/L	72.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Magnesium	7439-95-4	18800			ug/L	72.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Magnesium	7439-95-4	19300			ug/L	72.8	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Manganese	7439-96-5	109			ug/L	1.4	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Manganese	7439-96-5	357			ug/L	1.4	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Manganese	7439-96-5	332			ug/L	1.4	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Manganese	7439-96-5	19.9			ug/L	1.4	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Manganese	7439-96-5	19.3			ug/L	1.4	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Manganese	7439-96-5	20.4			ug/L	1.4	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Nickel	7440-02-0	1.6			ug/L	1.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Nickel	7440-02-0	1.6	U	U	ug/L	1.6	METALS	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Nickel	7440-02-0	4.4			ug/L	1.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Nickel	7440-02-0	4.3			ug/L	1.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Nickel	7440-02-0	4.4			ug/L	1.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Phosphorous	7723-14-0	0.11			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Phosphorous	7723-14-0	0.084			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Phosphorous	7723-14-0	0.05	U	U	mg/L	0.05	GEN CHEMISTRY	SW	N	N	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Phosphorous	7723-14-0	0.074			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Phosphorous	7723-14-0	0.073			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Phosphorous	7723-14-0	0.085			mg/L	0.05	GEN CHEMISTRY	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Potassium	2023695	2050			ug/L	91.2	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Potassium	2023695	3050			ug/L	91.2	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Potassium	2023695	2990			ug/L	91.2	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Potassium	2023695	4890			ug/L	91.2	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Potassium	2023695	5030			ug/L	91.2	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Potassium	2023695	5070			ug/L	91.2	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Sodium	7440-23-5	9660			ug/L	274	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Sodium	7440-23-5	24600			ug/L	274	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Sodium	7440-23-5	21200			ug/L	274	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Sodium	7440-23-5	28000			ug/L	274	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Sodium	7440-23-5	28200			ug/L	274	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Sodium	7440-23-5	29000			ug/L	274	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Vanadium	7440-62-2	4.5		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Vanadium	7440-62-2	4.7		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Vanadium	7440-62-2	5.2		B	ug/L	2.1	METALS	SW	N	Y	9A09G602

GROUP_ NAME	LOCATION_ CODE	SAMPLE_ NO	SAMPLE_ DATE	START_ DEPTH	END_ DEPTH	PARAMETER	CASNO	RESULT	LAB_ QUAL	VAL_ QUAL	UNITS	DETECT_ LIMIT	USER_TEST_ GROUP	SAMPLE_ TYPE	FILTERED	DETECT	SAMPLE_ DELIVERY _ GROUP
BCG	BCG-SW004	AE2004	15-Sep-00			Vanadium	7440-62-2	4.7		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Vanadium	7440-62-2	4.9		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Vanadium	7440-62-2	3.9		B	ug/L	2.1	METALS	SW	N	Y	9A09G602
BCG	BCG-SW001	AE2001	15-Sep-00			Zinc	7440-66-6	45.9			ug/L	0.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW002	AE2002	15-Sep-00			Zinc	7440-66-6	11			ug/L	0.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW003	AE2003	15-Sep-00			Zinc	7440-66-6	4.4		B	ug/L	0.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW004	AE2004	15-Sep-00			Zinc	7440-66-6	8			ug/L	0.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW005	AE2005	15-Sep-00			Zinc	7440-66-6	6.1			ug/L	0.6	METALS	SW	N	Y	9A09G602
BCG	BCG-SW006	AE2006	15-Sep-00			Zinc	7440-66-6	6.1			ug/L	0.6	METALS	SW	N	Y	9A09G602

Red Water Ponds Ecological Risk Assessment
Validation Addendum

Changes were made in the validation qualifiers in fish and worm tissue samples. An evaluation of qualifiers associated with blank contamination showed that the lab used clam tissue as a preparation blank for the metals analyses. DataChek used the clam tissue data to qualify fish and worm tissue. Since clam tissue is not an appropriate preparation blank for non-clam samples, the validation qualifiers do not apply. The qualifiers that were present because of clam tissue contamination were removed. The qualifiers resulting from blank contamination present in calibration and reagent blanks were used. Additionally, the worm pretest samples (bioaccumulation control samples) were used as field blanks. Samples associated with the pretest worms were qualified according to the contamination in the pretest worms.

IT Corporation performed additional validation for blank contamination in tissue samples only.

Explosives: No qualification due to blank contamination.

Metals: Five worm tissue samples in SDG 200144 were qualified for contamination in the associated pretest worm. Analytes qualified "B" in samples AD4016, AD4017, AD4018, AD4019, and AD4020 include arsenic, barium, cadmium, calcium, chromium, copper, iron, magnesium, manganese, potassium, sodium, vanadium, and zinc. Antimony, cobalt, and lead were detected in the reagent blank associated with samples in SDG 001227. Antimony and lead were qualified "B" in samples AC4001, AC4002, AC4003, AD4001, AD4002, AD4003, and AD4004. Cobalt was qualified "B" in AC4002.

PAHs: Acenaphthene, acenaphthalene, chrysene, fluorene, indeno(1,2,3-cd)pyrene, and phenanthrene were detected in the pretest worm associated with SDG 200145. Samples AD4011, AD4012, AD4013, AD4014, and AD4015 were qualified "B" for those compounds.

Phosphorous: Phosphorous was qualified "B" in worm tissue samples in SDG 200144. Samples AD4016, AD4017, AD4018, AD4019, and AD4020 were qualified because of contamination in the associated pretest worm.

Datacheck
318 Caswell Beach Rd.
Oak Island, NC 28465

March 4, 2001

Maureen McMyler
IT Corporation
312 Directors Drive
Knoxville, TN 37923

Re: PBOW: Red Water Ponds

Dear Maureen:

Enclosed are the validated Form Is for the tissue samples associated with the Red Water Ponds, with qualifiers and codes added as required. In addition to the Form Is we have included: 1) the data validation summary report that highlights the data usability and reasons for qualifying the results; 2) the sample summary report that has the total number of samples validated for the site; and 3) the invoices to be sent to the Knoxville accounts payable department.

One technical note, all the values for metals that fall below the reporting limit and are qualified as "B" by the laboratory were given "J" qualifiers by the reviewer to match the organic compounds that are qualified as "J" if they are below reporting limits. Also, we have discussed the variation in samples numbers on the Form Is and as per your direction I have not changed any of the numbers.

The original invoice for the accounts payable department is also enclosed. I have used the PO number I already have for the Red Water Ponds. If you would check off the invoice and take it to the right people in accounts payable, I would appreciate it. Thanks for your help.

If you should have any questions please don't hesitate to call (910-278-4653) or e-mail (kitch@bcinet.net).

Sincerely,

Tom

Tom Kitchings

Phone: (910) 278-4653 Fax: (910) 278-7604 e-mail: kitch@bcinet.net

DATA VALIDATION SUMMARY REPORT
PLUMBROOK ORDNANCE WORKS: RED WATER PONDS
March, 2001

Tissue data collected and analyzed in December 2000 to support the Red Water Pond risk assessment, were validated 100% at Level III. Validation was conducted according to the EPA National Functional Guidelines for Organic and Inorganic Data Review. Region III guidelines were used for validation of data affected by blank contamination. The samples collected and analyzed during the investigation of the Red Water Pond sites included six for metals, thirteen for explosives, six for PAH, and six for total phosphate. Overall data was of acceptable results as qualified.

PAH: All sample results were qualified as "UJ/J" due to low surrogate recoveries and low recoveries in the LCS analysis. Also, a high CCAL %D resulted in a "UJ" qualifier added to dibenzo(ah)anthracene.

Metals: Contamination in the preparation blank and continuing calibration blanks resulted in "UB" qualifiers for Ca, Cr, Mg, Mn, Na, K, V, and Zn in all six samples; Co and Ni in five; Al in three; and As in two. Cu was qualified as "J" in all six samples as a result of a high RPD in the duplicate analysis. A low recovery for the CRDL resulted in "J" qualifiers added to the Pb results in five of the six samples in SDG 200144

Explosives: High %Ds for the CCALs associated with both SDGs resulted in "UJ" qualifiers for 4-amino-2,dnt, 2-amino-4,dnt and HMX in all thirteen samples. Also, 2-nitrotoluene and 4-nitrotoluene were qualified as "UJ" in the six samples in SDG 200144 due to high CCAL %Ds.

Total Phosphate: No qualifiers required. Results acceptable as reported.

DATACHEK
318 CASWELL BEACH RD.
OAK ISLAND, NC 28465

December 5, 2000

Maureen McMyler
IT Corporation
312 Directors Drive
Knoxville, TN 37923

Re: PBOW: Sites TNTA, TNTC and Red Water Ponds

Dear Maureen:

Enclosed are the validated Form Is for the Plumbrook, TNTA, TNTC and Red Water Ponds, with qualifiers and codes added as required. This, along with the two previous shipments, completes all the data we received. In addition to the Form Is we have included: 1) the data validation summary report that highlights the data usability and reasons for qualifying the results; 2) the sample summary report that has the total number of samples validated for the site; and 3) the invoices to be sent to the Knoxville accounts payable department.

One technical note, all the values for metals that fall below the reporting limit and are qualified as "B" by the laboratory were given "J" qualifiers by the reviewer to match the organic compounds that are qualified as "J" if they are below reporting limits.

The original invoice for the accounts payable department is also enclosed. If you would add the P.O. numbers when they are issued, check off the invoice and take it to the right people in accounts payable, I would appreciate it. Thanks for your help.

If you should have any questions please don't hesitate to call (910-278-4653) or e-mail (kitch@bcinet.net).

Sincerely,

Tom

Tom Kitchings

PHONE: (910) 278-4653 FAX: (910) 278-7604 E-MAIL: KITCH@BCINET.NET

DATA VALIDATION SUMMARY REPORT
PLUMBROOK ORDNANCE WORKS
December, 2000

Data collected and analyzed from September, October and November, 2000, were validated 100% at Level III. Validation was conducted according to the EPA National Functional Guidelines for Organic and Inorganic Data Review. Region III guidelines were used for validation of data affected by blank contamination. Data were from sites at the Plumbrook Ordnance Works and were grouped into three sections:

I. Site TNTA
II. Site TNTC
III. Red Water Ponds

Data validation results are discussed below for each of the sections. The analyte groups and number of samples for each is also identified. Overall data was of acceptable results.

I. Site TNTA

This site was composed of 80 samples that were analyzed for volatile organic compounds, 79 for semi-volatiles, 83 for metals, 79 for explosives compounds, and 79 for PCBs. Overall, 59 soil samples and 24 water samples were distributed across eleven SDGs.

Volatile Organics: Methylene chloride was present in the associated method blanks and was qualified as "B" in 54 of the 80 samples. Contamination in the trip blanks resulted in "B" qualifiers being added to methylene chloride in fourteen samples. High and/or low surrogate recoveries resulted in "UJ/J" qualifiers for the six samples in SDGs 10121, 9180 and 9164. High percent differences (%D) in the continuing calibrations (CCALS) resulted in "J" qualifiers for acetone and methylene chloride in five soil samples in SDG 9154, and for acetone in one sample from SDG 9164. In SDG 10121, a single sample was qualified as "UJ/J" since the holding times were exceeded. Low RRFs in the ICAL and CCAL resulted in acetone being rejected, "R", in 16 water samples and "J" in two water and nine soil samples. Likewise, 2-butanone was rejected (R) in 22 water samples. Also, 2-hexanone was qualified as "R" in the five water samples in SDG 10063.

Semivolatiles: Method blank contamination resulted in "B" qualifiers being added to di-n-butylphthalate in four samples from SDG 10063. Hexachlorocyclopentadiene had high %Ds in the CCALs associated with five samples in two of the SDGs and was qualified as "UJ". In addition, 4-nitroaniline was qualified as "UJ" in three samples, 2-methylphenol in two, and 3,3'-dichlorobenzidine in two samples. Low surrogate recoveries for two samples in SDG 10063 resulted in "UJ/J" qualifiers for all the compounds. Finally, the single water sample from SDG 9169 had 2,4-dinitrotoluene qualified as "J" due to a low LCS recovery.

PCBs: A high percent difference (%D) between the results from the primary column and those from the confirmation column resulted in "J" qualifiers added to the Aroclor 1260

results in thirty samples across all SDGs. A low surrogate recovery for one sample in SDG 9164 and a high recovery for one in 9188 resulted in "UJ" and "J" qualifiers, respectively. Also, a high %D in the CCAL in SDG 9126 resulted in the Aroclor 1260 being qualified as "J".

Metals: Contamination in the preparation, ICAL and CCAL blanks resulted in fourteen elements being qualified as "B" with sodium the most often in 32 samples, with cadmium and antimony in seven each, and the others in lesser numbers. High and low recoveries in the matrix spike required "UJ/J" qualifiers for seventeen elements in samples across all the SDGs. Antimony in 51 samples, aluminum in 34 and lead in 30 were the most often qualified.. High %Ds in the duplicate analysis associated with six SDGs resulted in "J" qualifiers for nine elements, with lead in 32 samples, arsenic in 20, and copper and manganese in 17 each. Finally, "J" qualifiers were needed for chromium in seven samples from SDGs 10057 and 9141 based on %Ds in the serial dilution analysis that exceeded the 25% QC limit.

Explosives: The 79samples analyzed for explosives were acceptable as reported with one sample (AA3010) having 2,4-dinitrotoluene exceeding the instrument calibration limit. A dilution was analyzed.

II. Site TNTC:

This site was composed of 84 samples that were analyzed for volatile organic compounds, 79 for semi-volatiles, 58 for metals, 82 for explosives compounds, and 84 for PCBs. Overall, 59 soil samples and 24 water samples were distributed across eleven SDGs.

Volatile Organics: Methylene chloride was present in the associated method blanks and was qualified as "B" in 58 of the 84 samples. Contamination in the trip blanks resulted in "B" qualifiers being added to methylene chloride in two samples. Acetone also was qualified as "B" in six samples. High and/or low surrogate recoveries resulted in "UJ/J" qualifiers for the nine samples in SDGs 10052, 9180, 10063 and 9188. High percent differences (%D) in the continuing calibrations (CCALS) resulted in "J" qualifiers for acetone in two soil samples in SDG 9169. Low RRFs in the ICAL and CCAL resulted in acetone being rejected, "R", in fourteen water samples and seven soils, and "J" in three water and fifteen soil samples. Likewise, 2-butanone was rejected (R) in twenty water samples.

Semivolatiles: Method blank contamination resulted in "B" qualifiers being added to diethylphthalate in six samples from SDG 10063. Hexachlorocyclopentadiene had high %Ds in the CCALs associated with twelve samples in two of the SDGs and was qualified as "UJ". In addition, 4-nitroaniline was qualified as "UJ" in nine samples, 2,4-dinitrophenol in five, 4-nitroaniline in nine, and 3,3'-dichlorobenzidine in nine samples. Low surrogate recoveries for one sample in SDG 9126 resulted in "UJ/J" qualifiers for all the compounds.

PCBs: A high percent difference (%D) between the results from the primary column and those from the confirmation column resulted in "J" qualifiers added to the Aroclor 1260 results in eighteen samples across all SDGs. A high surrogate recovery for three samples in SDG 10052 resulted in "J" qualifiers. Also, a high %D in the CCAL in SDG 9126 and 9122 resulted in the Aroclor 1260 being qualified as "J" in seventeen samples.

Metals: Contamination in the preparation, ICAL and CCAL blanks resulted in twelve elements being qualified as "B" with sodium the most often in 24 samples, copper in twelve, and the others in lesser numbers. High and low recoveries in the matrix spike required "UJ/J" qualifiers for nine elements in samples across all the SDGs. Antimony in 48 samples, aluminum in 37 and potassium in 31 were the most often qualified. High %Ds in the duplicate analysis associated with all SDGs resulted in "J" qualifiers for eight elements, with Ca in 46 samples and Zn in 50 being the most commonly qualified. Finally, "J" qualifiers were needed for chromium in seven samples from SDGs 10057 based on %Ds in the serial dilution analysis that exceeded the 25% QC limit.

Explosives: A low surrogate recovery for one water sample in SDG 9126 had all compounds qualified as "UJ".

III. Red Water Ponds:

The samples collected and analyzed during the investigation of the Red Water Pond sites included five for semivolatiles, forty-five for metals, seventeen for explosives, eleven for PAH, and forty-five for phosphorous.

Semivolatiles: None of the five samples in SDG 9A09G601 required qualifications.

PAH: All sample results were acceptable as reported with no qualifiers required.

Metals: Contamination in the method blank resulted in copper, chromium, potassium and venadium being qualified as "B" in three, eleven, fourteen and thirty-three samples, respectively. High and low recoveries in the matrix spike required "UJ/J" qualifiers for antimony in twenty-eight samples in both SDGs 9A09G601 and 9A09G602, and As, Ba, and Co in the twelve soil samples from 9A09G602. High %Ds in the duplicate analysis associated with both SDGs resulted in "J" qualifiers for As, Ba, Co, Fe, Mn, and K in the twelve soil samples from SDG 9A09G602 and for Sb, and Pb in the sixteen soil samples and for Zn in the six water samples from SDG 9A09G601. Finally, based on a high %D in the serial dilution analysis eleven elements in the soil samples from SDG 9A09G602 required "J" qualifiers. In SDG 9A09G601, Ni, K and Zn in the soils and Zn in the water samples required "J" qualifiers.

Explosives: All results were acceptable as reported with no qualifiers required.

Phosphorous: No qualifiers required. Results acceptable as reported.

APPENDIX D

BACKGROUND STATISTICS DETAILS

Mann-Whitney Rank Info for As CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	62.500	12.500
Onsite	17	190.500	11.206

Mann-Whitney U for Ca CONCEN
Grouping Variable: LOCATION

U	6.000
U Prime	14.000
Z-Value	-.980
P-Value	.3272
Tied Z-Value	-.980
Tied P-Value	.3272
# Ties	0

13 cases were omitted due to missing values.

Mann-Whitney Rank Info for Ca CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	21.000	4.200
Onsite	4	24.000	6.000

13 cases were omitted due to missing values.

lann-Whitney U for Cu CONCEN
Grouping Variable: LOCATION

U	16.000
U Prime	69.000
Z-Value	-2.076
P-Value	.0379
Tied Z-Value	-2.079
Tied P-Value	.0376
# Ties	5

Mann-Whitney Rank Info for Cu CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	84.000	16.800
Onsite	17	169.000	9.941

Mann-Whitney U for P CONCEN
Grouping Variable: LOCATION

U	1.000
U Prime	2.000
Z-Value	-.447
P-Value	.6547
Tied Z-Value	-.447
Tied P-Value	.6547
# Ties	0

18 cases were omitted due to missing values.

Mann-Whitney Rank Info for P CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	7.000	2.333
Onsite	1	3.000	3.000

18 cases were omitted due to missing values.

West Area . .iment Data

LOCATION	UNITS	SAMP_NO	SITE-ID	DETECT	Al CONCEN	SAMP_NO	SITE-ID	DETECT	Fe CONCEN
Background	mg/kg	AE1004	BCG-SD004	Y	4920	AE1004	BCG-SD004	Y	11400
Background	mg/kg	AE1005	BCG-SD005	Y	7680	AE1005	BCG-SD005	Y	14700
Background	mg/kg	AE1006	BCG-SD006	Y	6260	AE1006	BCG-SD006	Y	11700
Background	mg/kg	11100	WARP-SD01	Y	3170	11100	WARP-SD01	Y	14900
Background	mg/kg	11110	WARP-SD02	Y	2450	11110	WARP-SD02	Y	9900
Onsite	mg/kg	11130	WARP-SD04	Y	3230	11140	WARP-SD05	Y	16000
Onsite	mg/kg	11120	WARP-SD03	Y	4260	11120	WARP-SD03	Y	16500
Onsite	mg/kg	11140	WARP-SD05	Y	6880	11150	WARP-SD06	Y	18000
Onsite	mg/kg	11150	WARP-SD06	Y	9600	11130	WARP-SD04	Y	24300
Onsite	mg/kg								
Onsite	mg/kg								
Onsite	mg/kg								
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Onsite	mg/kg								

West Area Sediment Data

SAMP_NO	CHEM_NAME	DETECT	As CONCEN
AE1004	BCG-SD004	Y	3.9
AE1005	BCG-SD005	Y	5.2
AE1006	BCG-SD006	Y	3.5
11100	WARP-SD01	Y	5.4
11110	WARP-SD02	Y	3.5
PB-WA-SED1-1.7/2.5	PB-RWP-SED1	N	1.9
PB-WA-SED6-1.3/1.7	PB-RWP-SED6	N	1.9
PB-WA-SED3-0.2/1.0	PB-RWP-SED3	N	1.95
PB-WA-SED1-0.2/1.7	PB-RWP-SED1	N	2.05
PB-WA-SED4-0.2/0.5	PB-RWP-SED4	N	2.05
PB-WA-SED6-0.2/1.3	PB-RWP-SED6	N	2.05
PB-WA-SED2-0.2/1.0	PB-RWP-SED2	N	2.4
PB-WA-SED7-0.2/1.0	PB-RWP-SED7	N	2.4
PB-WA-SED4-0.5/1.5	PB-RWP-SED4	Y	4.00
PB-WA-SED5-0.2/0.5	PB-RWP-SED5	Y	4.20
11140	WARP-SD05	Y	4.60
PB-WA-SED3-1.0/2.0	PB-RWP-SED3	Y	5.20
PB-WA-SED5-0.5/1.5	PB-RWP-SED5	Y	7.20
11120	WARP-SD03	Y	7.30
11130	WARP-SD04	Y	8.60
11150	WARP-SD06	Y	8.70
PB-WA-SED2-1/2	PB-RWP-SED2	Y	11.30

SAMP_NO	CHEM_NAME	DETECT	Ca CONCEN
AE1004	BCG-SD004	Y	10900
AE1005	BCG-SD005	Y	9750
AE1006	BCG-SD006	Y	8190
11100	WARP-SD01	Y	10800
11110	WARP-SD02	Y	13900
11140	WARP-SD05	Y	6710
11120	WARP-SD03	Y	12300
11130	WARP-SD04	Y	16000
11150	WARP-SD06	Y	74700

West Area . ;iment Data

SAMP_NO	CHEM_NAME	DETECT	Cu CONCEN
AE1004	BCG-SD004	Y	12.1
AE1005	BCG-SD005	Y	13.6
AE1006	BCG-SD006	Y	11.6
11100	WARP-SD01	Y	13.7
11110	WARP-SD02	Y	8.8
PB-WA-SED3-1.0/2.0	PB-RWP-SED3	N	1.2
PB-WA-SED5-0.5/1.5	PB-RWP-SED5	N	1.2
PB-WA-SED6-1.3/1.7	PB-RWP-SED6	N	1.25
PB-WA-SED1-1.7/2.5	PB-RWP-SED1	N	1.3
PB-WA-SED3-0.2/1.0	PB-RWP-SED3	N	1.3
PB-WA-SED1-0.2/1.7	PB-RWP-SED1	N	1.35
PB-WA-SED6-0.2/1.3	PB-RWP-SED6	N	1.35
PB-WA-SED5-0.2/0.5	PB-RWP-SED5	N	1.4
PB-WA-SED2-0.2/1.0	PB-RWP-SED2	N	1.6
PB-WA-SED7-0.2/1.0	PB-RWP-SED7	N	1.6
PB-WA-SED2-1/2	PB-RWP-SED2	Y	3.2
PB-WA-SED4-0.2/0.5	PB-RWP-SED4	Y	3.9
PB-WA-SED4-0.5/1.5	PB-RWP-SED4	Y	3.9
11130	WARP-SD04	Y	9.8
11120	WARP-SD03	Y	15.0
11140	WARP-SD05	Y	15.2
11150	WARP-SD06	Y	24.5

SAMP_NO	CHEM_NAME	DETECT	P CONCEN
AE1004	BCG-SD004	N	2.6
AE1005	BCG-SD005	Y	12.3
AE1006	BCG-SD006	N	2.75
PB-WA-SED1-0.2/1.7	PB-RWP-SED1	Y	3.10

Mann-Whitney U for Al CONCEN
Grouping Variable: LOCATION

West Area Surface Water Results

U	7.500
U Prime	12.500
Z-Value	-.612
P-Value	.5403
Tied Z-Value	-.615
Tied P-Value	.5386
# Ties	1

5 cases were omitted due to missing values.

Mann-Whitney Rank Info for Al CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	22.500	4.500
Onsite	4	22.500	5.625

5 cases were omitted due to missing values.

Mann-Whitney U for Fe CONCEN
Grouping Variable: LOCATION

U	2.000
U Prime	18.000
Z-Value	-1.960
P-Value	.0500
Tied Z-Value	-1.960
Tied P-Value	.0500
# Ties	0

5 cases were omitted due to missing values.

Mann-Whitney Rank Info for Fe CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	17.000	3.400
Onsite	4	28.000	7.000

5 cases were omitted due to missing values.

Mann-Whitney U for Pb CONCEN
Grouping Variable: LOCATION

U	2.000
U Prime	43.000
Z-Value	-2.733
P-Value	.0063
Tied Z-Value	-2.808
Tied P-Value	.0050
# Ties	3

Mann-Whitney Rank Info for Pb CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	17.000	3.400
Onsite	9	88.000	9.778

Mann-Whitney U for Mg CONCEN
Grouping Variable: LOCATION

U	3.000
U Prime	17.000
Z-Value	-1.715
P-Value	.0864
Tied Z-Value	-1.715
Tied P-Value	.0864
# Ties	0

5 cases were omitted due to missing values.

Mann-Whitney Rank Info for Mg CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	18.000	3.600
Onsite	4	27.000	6.750

5 cases were omitted due to missing values.

Mann-Whitney U for Mn CONCEN
Grouping Variable: LOCATION

U	6.000
U Prime	39.000
Z-Value	-2.200
P-Value	.0278
Tied Z-Value	-2.202
Tied P-Value	.0276
# Ties	1

Mann-Whitney Rank Info for Mn CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	21.000	4.200
Onsite	9	84.000	9.333

Mann-Whitney U for V CONCEN
Grouping Variable: LOCATION

U	3.000
U Prime	17.000
Z-Value	-1.715
P-Value	.0864
Tied Z-Value	-1.917
Tied P-Value	.0552
# Ties	2

5 cases were omitted due to missing values.

Mann-Whitney Rank Info for V CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	18.000	3.600
Onsite	4	27.000	6.750

5 cases were omitted due to missing values.

West Area Surface Water Data

LOCATION	UNITS	SAMP_NO	SITE-ID	DETECT	Al CONCEN	SAMP_NO	SITE-ID	DETECT	Fe CONCEN
Background	ug/L	AE2004	BCG-SW004	Y	478	AE2004	BCG-SW004	Y	457
Background	ug/L	AE2005	BCG-SW005	Y	361	AE2005	BCG-SW005	Y	362
Background	ug/L	AE2006	BCG-SW006	Y	182	AE2006	BCG-SW006	Y	201
Background	ug/L	12100	WARP-SW01	Y	631	12100	WARP-SW01	Y	1300
Background	ug/L	12110	WARP-SW02	N	100	12110	WARP-SW02	Y	126
Onsite	ug/L	12130	WARP-SW04	N	100	12130	WARP-SW04	Y	646
Onsite	ug/L	12120	WARP-SW03	Y	300	12120	WARP-SW03	Y	747
Onsite	ug/L	12150	WARP-SW06	Y	12400	12150	WARP-SW06	Y	19000
Onsite	ug/L	12140	WARP-SW05	Y	13800	12140	WARP-SW05	Y	21100
Onsite	ug/L								
Onsite	ug/L								
Onsite	ug/L								
Onsite	ug/L								
Onsite	ug/L								

** fixed this value to be 1/2 of the DL because value was "B" qualified.

West Area Su..ce Water Data

SAMP_NO	SITE-ID	DETECT	Pb CONCEN
AE2004	BCG-SW004	N	1.3
AE2005	BCG-SW005	N	1.3
AE2006	BCG-SW006	N	1.3
12100	WARP-SW01	N	1.5
12110	WARP-SW02	N	1.5
12120	WARP-SW03	N	1.5
12130	WARP-SW04	N	1.5
PB-WA-SW1	PB-RWP-SW1	N	12.5
PB-WA-SW2	PB-RWP-SW2	N	12.5
PB-WA-SW4	PB-RWP-SW4	N	12.5
PB-WA-SW5	PB-RWP-SW5	N	12.5
12140	WARP-SW05	Y	25
12150	WARP-SW06	Y	32.9
PB-WA-SW3	PB-RWP-SW3	Y	77

SAMP_NO	SITE-ID	DETECT	Mg CONCEN
AE2004	BCG-SW004	Y	18200
AE2005	BCG-SW005	Y	18800
AE2006	BCG-SW006	Y	19300
12100	WARP-SW01	Y	26000
12110	WARP-SW02	Y	26500
12130	WARP-SW04	Y	25800
12120	WARP-SW03	Y	26200
12140	WARP-SW05	Y	46500
12150	WARP-SW06	Y	50700

West Area Surface Water Data

SAMP_NO	SITE-ID	DETECT	Mn CONCEN
AE2004	BCG-SW004	Y	19.9
AE2005	BCG-SW005	Y	19.3
AE2006	BCG-SW006	Y	20.4
12100	WARP-SW01	Y	890
12110	WARP-SW02	Y	30.6
12130	WARP-SW04	Y	126
PB-WA-SW1	PB-RWP-SW1	Y	190
PB-WA-SW3	PB-RWP-SW3	Y	230
PB-WA-SW2	PB-RWP-SW2	Y	260
PB-WA-SW4	PB-RWP-SW4	Y	260
12120	WARP-SW03	Y	261
12140	WARP-SW05	Y	1150
12150	WARP-SW06	Y	1550
PB-WA-SW5	PB-RWP-SW5	Y	1600

SAMP_NO	SITE-ID	DETECT	V CONCEN
AE2004	BCG-SW004	N	1.05 **
AE2005	BCG-SW005	N	1.05 **
AE2006	BCG-SW006	N	1.05 **
12100	WARP-SW01	N	25.0
12110	WARP-SW02	N	25.0
12120	WARP-SW03	N	25.0
12130	WARP-SW04	N	25.0
12140	WARP-SW05	N	25.0
12150	WARP-SW06	Y	52.2

Mann-Whitney U for Anthracene CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.750
Tied P-Value	.0060
# Ties	6

Mann-Whitney Rank Info for Anthracene CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for B(a)A CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.746
Tied P-Value	.0060
# Ties	5

Mann-Whitney Rank Info for B(a)A CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for B(a)P CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.747
Tied P-Value	.0060
# Ties	6

Mann-Whitney Rank Info for B(a)P CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for B(b)F CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.746
Tied P-Value	.0060
# Ties	5

Mann-Whitney Rank Info for B(b)F CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for B(ghi)P CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.747
Tied P-Value	.0060
# Ties	6

Mann-Whitney Rank Info for B(ghi)P CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for B(k)F CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.746
Tied P-Value	.0060
# Ties	5

Mann-Whitney Rank Info for B(k)F CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for Chrysene CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.746
Tied P-Value	.0060
# Ties	5

Mann-Whitney Rank Info for Chrysene CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for I(123-cd)P CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.746
Tied P-Value	.0060
# Ties	5

Mann-Whitney Rank Info for I(123-cd)P CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

Mann-Whitney U for Phenanthrene CONCEN
Grouping Variable: LOCATION

U	0.000
U Prime	54.000
Z-Value	-2.714
P-Value	.0067
Tied Z-Value	-2.746
Tied P-Value	.0060
# Ties	5

Mann-Whitney Rank Info for Phenanthrene CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	3	6.000	2.000
Onsite	18	225.000	12.500

West Area Soil Background Data

LOCATION	UNITS	SAMP_NO	SITE-ID	DETECT	Anthracene CONCEN	SAMP_NO	CHEM_NAME	DETECT	B(a)A CONCEN
Onsite	mg/kg	8870	WARP-DP20	Y	0.12	8870	WARP-DP20	Y	0.17
Onsite	mg/kg	8300	WARP-DP06	N	0.185	8300	WARP-DP06	N	0.185
Onsite	mg/kg	8780	WARP-DP18	N	0.185	8780	WARP-DP18	N	0.185
Onsite	mg/kg	8820	WARP-DP19	N	0.185	8820	WARP-DP19	N	0.185
Onsite	mg/kg	8380	WARP-DP08	N	0.19	8380	WARP-DP08	N	0.19
Onsite	mg/kg	8460	WARP-DP10	N	0.19	8460	WARP-DP10	N	0.19
Onsite	mg/kg	8350	WARP-DP07	N	0.195	8350	WARP-DP07	N	0.195
Onsite	mg/kg	8430	WARP-DP09	N	0.195	8430	WARP-DP09	N	0.195
Onsite	mg/kg	8670	WARP-DP15	N	0.195	8670	WARP-DP15	N	0.195
Onsite	mg/kg	8180	WARP-DP03	N	0.195	8180	WARP-DP03	N	0.195
Onsite	mg/kg	8500	WARP-DP11	N	0.195	8500	WARP-DP11	N	0.195
Onsite	mg/kg	8270	WARP-DP05	N	0.2	8270	WARP-DP05	N	0.2
Onsite	mg/kg	8750	WARP-DP17	N	0.2	8750	WARP-DP17	N	0.2
Onsite	mg/kg	8140	WARP-DP02	N	0.2	8140	WARP-DP02	N	0.2
Onsite	mg/kg	8700	WARP-DP16	N	0.2	8700	WARP-DP16	N	0.2
Onsite	mg/kg	8110	WARP-DP01	N	0.205	8110	WARP-DP01	N	0.205
Onsite	mg/kg	8550	WARP-DP12	N	0.205	8550	WARP-DP12	N	0.205
Onsite	mg/kg	8580	WARP-DP13	Y	0.23	8580	WARP-DP13	Y	0.40
Background	mg/kg	AE0004	BCG-SO004	N	0.001	AE0004	BCG-SO004	N	0.0025
Background	mg/kg	AE0005	BCG-SO005	N	0.001	AE0005	BCG-SO005	Y	0.0049
Background	mg/kg	AE0006	BCG-SO006	N	0.001	AE0006	BCG-SO006	Y	0.0048

SAMP_NO	CHEM_NAME	DETECT	B(a)P CONCEN
8870	WARP-DP20	Y	0.14
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8580	WARP-DP13	Y	0.39
AE0004	BCG-SO004	Y	0.0038
AE0005	BCG-SO005	Y	0.0078
AE0006	BCG-SO006	Y	0.0078

SAMP_NO	CHEM_NAME	DETECT	B(b)F CONCEN
8870	WARP-DP20	Y	0.14
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8580	WARP-DP13	Y	0.3
AE0004	BCG-SO004	Y	0.0036
AE0005	BCG-SO005	Y	0.0078
AE0006	BCG-SO006	Y	0.0074

SAMP_NO	CHEM_NAME	DETECT	B(ghi)P CONCEN
8870	WARP-DP20	Y	0.076
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8580	WARP-DP13	Y	0.22
AE0004	BCG-SO004	N	0.004
AE0005	BCG-SO005	N	0.00405
AE0006	BCG-SO006	N	0.00405

SAMP_NO	CHEM_NAME	DETECT	B(k)F CONCEN
8870	WARP-DP20	Y	0.11
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8580	WARP-DP13	Y	0.35
AE0004	BCG-SO004	Y	0.0018
AE0005	BCG-SO005	Y	0.0035
AE0006	BCG-SO006	Y	0.0038

SAMP_NO	CHEM_NAME	DETECT	Chrysene CONCEN
8870	WARP-DP20	Y	0.17
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8580	WARP-DP13	Y	0.42
AE0004	BCG-SO004	Y	0.0032
AE0005	BCG-SO005	Y	0.0062
AE0006	BCG-SO006	Y	0.0063

SAMP_NO	CHEM_NAME	DETECT	I(123-cd)P CONCEN
8870	WARP-DP20	Y	0.076
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8580	WARP-DP13	Y	0.23
AE0004	BCG-SO004	Y	0.0022
AE0005	BCG-SO005	Y	0.0074
AE0006	BCG-SO006	Y	0.0048

SAMP_NO	CHEM_NAME	DETECT	Phenanthrene CONCEN
8300	WARP-DP06	N	0.185
8780	WARP-DP18	N	0.185
8820	WARP-DP19	N	0.185
8380	WARP-DP08	N	0.19
8460	WARP-DP10	N	0.19
8350	WARP-DP07	N	0.195
8430	WARP-DP09	N	0.195
8670	WARP-DP15	N	0.195
8180	WARP-DP03	N	0.195
8500	WARP-DP11	N	0.195
8270	WARP-DP05	N	0.2
8750	WARP-DP17	N	0.2
8140	WARP-DP02	N	0.2
8700	WARP-DP16	N	0.2
8110	WARP-DP01	N	0.205
8550	WARP-DP12	N	0.205
8870	WARP-DP20	Y	0.25
8580	WARP-DP13	Y	0.36
AE0004	BCG-SO004	Y	0.056
AE0005	BCG-SO005	Y	0.068
AE0006	BCG-SO006	Y	0.13

Pentolite Road Sediment Results

Mann-Whitney U for Mg CONCEN
Grouping Variable: LOCATION

U	6.000
U Prime	29.000
Z-Value	-1.868
P-Value	.0618
Tied Z-Value	-1.868
Tied P-Value	.0618
# Ties	0

Mann-Whitney Rank Info for Mg CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	21.000	4.200
On-site	7	57.000	8.143

Mann-Whitney U for K CONCEN
Grouping Variable: LOCATION

U	9.000
U Prime	26.000
Z-Value	-1.380
P-Value	.1675
Tied Z-Value	-1.380
Tied P-Value	.1675
# Ties	0

ann-Whitney Rank Info for K CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	41.000	8.200
On-site	7	37.000	5.286

Mann-Whitney U for Carbazole CONCEN
Grouping Variable: LOCATION

U	2.000
U Prime	12.000
Z-Value	-1.464
P-Value	.1432
Tied Z-Value	-1.470
Tied P-Value	.1416
# Ties	1

3 cases were omitted due to missing values.

Mann-Whitney Rank Info for Carbazole CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	2	5.000	2.500
On-site	7	40.000	5.714

cases were omitted due to missing values.

Pentolite Road Sediment Data

SAMP_NO	SITE-ID	LOCATION	UNITS	*Magnesium*	*DETECT*	*Mg CONCEN*	*Potassium*	*DETECT*	*K CONCEN*
AE1001	BCG-SD001	Background	mg/kg	***Magnesium***	***Y***	***10300***	***Potassium***	***Y***	***1210***
AE1002	BCG-SD002	Background	mg/kg	***Magnesium***	***Y***	***7940***	***Potassium***	***Y***	***3240***
AE1003	BCG-SD003	Background	mg/kg	***Magnesium***	***Y***	***8480***	***Potassium***	***Y***	***2110***
11160	PRRP-SD01	Background	mg/kg	***Magnesium***	***Y***	***10700***	***Potassium***	***N***	***655***
11170	PRRP-SD02	On-site	mg/kg	***Magnesium***	***Y***	***19300***	***Potassium***	***N***	***315.5***
11180	PRRP-SD03	On-site	mg/kg	***Magnesium***	***Y***	***13500***	***Potassium***	***Y***	***1040***
11190	PRRP-SD04	Background	mg/kg	***Magnesium***	***Y***	***2710***	***Potassium***	***N***	***332***
AC1001	PRWP-SD001	On-site	mg/kg	***Magnesium***	***Y***	***11200***	***Potassium***	***N***	***8***
AC1002	PRWP-SD002	On-site	mg/kg	***Magnesium***	***Y***	***9140***	***Potassium***	***N***	***5.7***
AC1003	PRWP-SD003	On-site	mg/kg	***Magnesium***	***Y***	***15900***	***Potassium***	***Y***	***2480***
AC1004	PRWP-SD004	On-site	mg/kg	***Magnesium***	***Y***	***12400***	***Potassium***	***Y***	***1650***
AC1005	PRWP-SD005	On-site	mg/kg	***Magnesium***	***Y***	***6920***	***Potassium***	***N***	***5.95***

SAMP_NO	SITE-ID	LOCATION	UNITS	Carbazole	DETECT	Carbazole CONCEN
AE1001	BCG-SD001	Background	mg/kg	Carbazole		
AE1002	BCG-SD002	Background	mg/kg	Carbazole		
AE1003	BCG-SD003	Background	mg/kg	Carbazole		
11160	PRRP-SD01	Background	mg/kg	Carbazole	N	0.215
11170	PRRP-SD02	On-site	mg/kg	Carbazole	Y	0.18
11180	PRRP-SD03	On-site	mg/kg	Carbazole	N	0.285
11190	PRRP-SD04	Background	mg/kg	Carbazole	N	0.11
AC1001	PRWP-SD001	On-site	mg/kg	Carbazole	N	0.17
AC1002	PRWP-SD002	On-site	mg/kg	Carbazole	N	0.28
AC1003	PRWP-SD003	On-site	mg/kg	Carbazole	N	0.23
AC1004	PRWP-SD004	On-site	mg/kg	Carbazole	N	0.23
AC1005	PRWP-SD005	On-site	mg/kg	Carbazole	N	0.27

Mann-Whitney U for Al CONCEN
Grouping Variable: LOCATION

U	18.000
U Prime	22.000
Z-Value	-.293
P-Value	.7697
Tied Z-Value	-.294
Tied P-Value	.7685
# Ties	1

Mann-Whitney Rank Info for Al CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	33.000	6.600
On-site	8	58.000	7.250

Mann-Whitney U for Fe CONCEN
Grouping Variable: LOCATION

U	15.000
U Prime	25.000
Z-Value	-.732
P-Value	.4642
Tied Z-Value	-.732
Tied P-Value	.4642
# Ties	0

Mann-Whitney Rank Info for Fe CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	40.000	8.000
On-site	8	51.000	6.375

Mann-Whitney U for Mn CONCEN
Grouping Variable: LOCATION

U	17.000
U Prime	23.000
Z-Value	-.439
P-Value	.6605
Tied Z-Value	-.439
Tied P-Value	.6605
# Ties	0

Mann-Whitney Rank Info for Mn CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	38.000	7.600
On-site	8	53.000	6.625

Pentolite Road Surface Water Background Data

SAMP_NO	SITE-ID	LOCATION	UNITS	*Aluminum*	*DETECT*	*Al CONCEN*	*Iron*	*DETECT*	*Fe CONCEN*
AE2001	BCG-SW001	Background	ug/L	***Aluminum***	***Y***	***270***	***Iron***	***Y***	***717***
AE2002	BCG-SW002	Background	ug/L	***Aluminum***	***Y***	***435***	***Iron***	***Y***	***1070***
AE2003	BCG-SW003	Background	ug/L	***Aluminum***	***N***	***36.35***	***Iron***	***Y***	***618***
12160	PRRP-SW01	Background	ug/L	***Aluminum***	***Y***	***778***	***Iron***	***Y***	***1420***
12170	PRRP-SW02	On-site	ug/L	***Aluminum***	***Y***	***530***	***Iron***	***Y***	***972***
12180	PRRP-SW03	On-site	ug/L	***Aluminum***	***Y***	***3040***	***Iron***	***Y***	***5790***
12190	PRRP-SW04	Background	ug/L	***Aluminum***	***N***	***100***	***Iron***	***Y***	***948***
AC2004	PRWP-SW004	On-site	ug/L	***Aluminum***	***Y***	***712***	***Iron***	***Y***	***1220***
AC2006	PRWP-SW006	On-site	ug/L	***Aluminum***	***N***	***36.35***	***Iron***	***Y***	***388***
AC2007	PRWP-SW007	On-site	ug/L	***Aluminum***	***Y***	***137***	***Iron***	***Y***	***364***
AC2008	PRWP-SW008	On-site	ug/L	***Aluminum***	***Y***	***237***	***Iron***	***Y***	***608***
AC2009	PRWP-SW009	On-site	ug/L	***Aluminum***	***N***	***36.35***	***Iron***	***Y***	***314***
AC2010	PRWP-SW010	On-site	ug/L	***Aluminum***	***Y***	***494***	***Iron***	***Y***	***1010***

Pentolite Road Surface Water Background Data

SAMP_NO	SITE-ID	LOCATION	UNITS	Manganese	DETECT	Mn CONCEN
AE2001	BCG-SW001	Background	ug/L	Manganese	Y	109
AE2002	BCG-SW002	Background	ug/L	Manganese	Y	357
AE2003	BCG-SW003	Background	ug/L	Manganese	Y	332
12160	PRRP-SW01	Background	ug/L	Manganese	Y	245
12170	PRRP-SW02	On-site	ug/L	Manganese	Y	261
12180	PRRP-SW03	On-site	ug/L	Manganese	Y	404
12190	PRRP-SW04	Background	ug/L	Manganese	Y	67.1
AC2004	PRWP-SW004	On-site	ug/L	Manganese	Y	149
AC2006	PRWP-SW006	On-site	ug/L	Manganese	Y	104
AC2007	PRWP-SW007	On-site	ug/L	Manganese	Y	106
AC2008	PRWP-SW008	On-site	ug/L	Manganese	Y	148
AC2009	PRWP-SW009	On-site	ug/L	Manganese	Y	101
AC2010	PRWP-SW010	On-site	ug/L	Manganese	Y	147

Pentolite Road Surfac ater Background Data

SAMP_NO	SITE-ID	LOCATION	UNITS	Lead	DETECT	Pb CONCEN
AE2001	BCG-SW001	Background	ug/L	Lead	N	1.3
AE2002	BCG-SW002	Background	ug/L	Lead	N	1.3
AE2003	BCG-SW003	Background	ug/L	Lead	N	1.3
12160	PRRP-SW01	Background	ug/L	Lead	N	1.5
12170	PRRP-SW02	On-site	ug/L	Lead	N	1.5
12180	PRRP-SW03	On-site	ug/L	Lead	Y	8.7
12190	PRRP-SW04	Background	ug/L	Lead	N	1.5
AC2004	PRWP-SW004	On-site	ug/L	Lead	N	1.3
AC2006	PRWP-SW006	On-site	ug/L	Lead	N	1.3
AC2007	PRWP-SW007	On-site	ug/L	Lead	N	1.3
AC2008	PRWP-SW008	On-site	ug/L	Lead	N	1.3
AC2009	PRWP-SW009	On-site	ug/L	Lead	N	1.3
AC2010	PRWP-SW010	On-site	ug/L	Lead	N	1.3

Mann-Whitney U for Pb CONCEN
Grouping Variable: LOCATION

Pentolite Road Surface Water

U	18.000
U Prime	22.000
Z-Value	-.293
P-Value	.7697
Tied Z-Value	-.361
Tied P-Value	.7184
# Ties	2

Mann-Whitney Rank Info for Pb CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	5	37.000	7.400
On-site	8	54.000	6.750

Mann-Whitney U for Sb CONCEN
Grouping Variable: LOCATION

Pentolite Road Soil Results

U	371.000
U Prime	2239.000
Z-Value	-5.781
P-Value	<.0001
Tied Z-Value	-5.785
Tied P-Value	<.0001
# Ties	29

Mann-Whitney Rank Info for Sb CONCEN
Grouping Variable: LOCATION

	Count	Sum Ranks	Mean Rank
Background	29	2674.000	92.207
Onsite	90	4466.000	49.622

Pentolite Road Soil Background Data

SAMP_NO	SITE-ID	LOCATION	UNITS	Antimony	DETECT	Sb CONCEN
6990	BCG-SB01	Background	mg/kg	Antimony	N	74
7000	BCG-SB01	Background	mg/kg	Antimony	N	6.8
7010	BCG-SB02	Background	mg/kg	Antimony	N	7.4
7020	BCG-SB02	Background	mg/kg	Antimony	Y	7.8
7030	BCG-SB03	Background	mg/kg	Antimony	N	7.4
7040	BCG-SB03	Background	mg/kg	Antimony	Y	7.9
7050	BCG-SB04	Background	mg/kg	Antimony	Y	9.3
7060	BCG-SB04	Background	mg/kg	Antimony	N	8
7070	BCG-SB05	Background	mg/kg	Antimony	N	7.2
7080	BCG-SB05	Background	mg/kg	Antimony	N	7.4
7090	BCG-SB06	Background	mg/kg	Antimony	N	7
7100	BCG-SB06	Background	mg/kg	Antimony	N	6.8
BG-S1	0.5-3.0	Background	mg/kg	Antimony	N	5.4
BG-S1	3.0-5.0	Background	mg/kg	Antimony	N	5.7
BG-S2	0.5-3.0	Background	mg/kg	Antimony	Y	6.3
BG-S2	3.0-5.0	Background	mg/kg	Antimony	N	5.8
BG-S3	0.5-3.0	Background	mg/kg	Antimony	N	5.4
BG-S3	3.0-4.0	Background	mg/kg	Antimony	N	5.5
BG-S4	0.5-3.0	Background	mg/kg	Antimony	Y	7.6
BG-S5	0.5-3.0	Background	mg/kg	Antimony	Y	6.7
BG-S5	3.0-5.0	Background	mg/kg	Antimony	Y	5.9
BG-S6	0.5-3.0	Background	mg/kg	Antimony	Y	6.4
BG-S6	3.0-4.5	Background	mg/kg	Antimony	N	5.7
BG-S7	0.5-3.0	Background	mg/kg	Antimony	Y	7.5
BG-S9	0.5-3.0	Background	mg/kg	Antimony	N	5.6
BG-S9	3.0-5.0	Background	mg/kg	Antimony	N	6.1
PB-PR-S8-0.0/2.0	PB-RWP-PR-S8	Onsite	mg/kg	Antimony	N	2.6
PB-PR-S8-2.0/5.0	PB-RWP-PR-S8	Onsite	mg/kg	Antimony	N	2.6
PB-PR-S1-0.0/2.0	PB-RWP-9PR-S1	Onsite	mg/kg	Antimony	N	2.65
PB-PR-S3-0.0/2.0	PB-RWP-PR-S3	Onsite	mg/kg	Antimony	N	2.65
PB-PR-S14-0.0/3.0	PB-RWP-PR-S14	Onsite	mg/kg	Antimony	N	2.65
PB-PR-S30-0.0/0.5	PB-RWP-PR-S30	Onsite	mg/kg	Antimony	N	2.65
PB-PR-S16-0.0/3.0	PB-RWP-PR-S16	Onsite	mg/kg	Antimony	N	2.7
PB-PR-S19-0.0/3.0	PB-RWP-PR-S19	Onsite	mg/kg	Antimony	N	2.7
PB-PR-S21-0.0/0.5	PB-RWP-PR-S21	Onsite	mg/kg	Antimony	N	2.7
PB-PR-S17-0.0/2.0	PB-RWP-PR-S17	Onsite	mg/kg	Antimony	N	2.75
PB-PR-S20-0.0/2.0	PB-RWP-PR-S20	Onsite	mg/kg	Antimony	N	2.75
PB-PR-S11-0.0/3.0	PB-RWP-PR-S11	Onsite	mg/kg	Antimony	N	2.75
PB-PR-S15-0.0/3.0	PB-RWP-PR-S15	Onsite	mg/kg	Antimony	N	2.75
PB-PR-S15-3.0/5.0	PB-RWP-PR-S15	Onsite	mg/kg	Antimony	N	2.75
PB-PR-S18-0.0/2.0	PB-RWP-PR-S18	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S2-0.0/3.0	PB-RWP-PR-S2	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S5-0.0/3.0	PB-RWP-PR-S5	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S6-0.0/3.0	PB-RWP-PR-S6	Onsite	mg/kg	Antimony	N	2.8
PR-PR-S9-0.0/3.0	PB-RWP-PR-S9	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S22-0.0/0.5	PB-RWP-PR-S22	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S24-0.0/0.5	PB-RWP-PR-S24	Onsite	mg/kg	Antimony	N	2.8

Pentolite Road Soil Background Data

SAMP_NO	SITE-ID	LOCATION	UNITS	Antimony	DETECT	Sb CONCEN
PB-PR-S13-3.0/5.0	PB-RWP-PR-S13	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S14-3.0/5.0	PB-RWP-PR-S14	Onsite	mg/kg	Antimony	N	2.8
PB-PR-S13-0.0/3.0	PB-RWP-PR-S13	Onsite	mg/kg	Antimony	N	2.85
PB-PR-S7-0.0/3.0	PB-RWP-PR-S7	Onsite	mg/kg	Antimony	N	2.85
PB-PR-S23-0.0/0.5	PB-RWP-PR-S23	Onsite	mg/kg	Antimony	N	2.85
PB-PR-S1-2.0/5.0	PB-RWP-PR-S1	Onsite	mg/kg	Antimony	N	2.85
PB-PR-S4-0.0/3.0	PB-RWP-PR-S4	Onsite	mg/kg	Antimony	N	2.9
PB-PR-S8-0.0/0.5	PB-RWP-PR-S8	Onsite	mg/kg	Antimony	N	2.9
PB-PR-S10-0.0/3.0	PB-RWP-PR-S10	Onsite	mg/kg	Antimony	N	2.95
PB-PR-S12-0.0/3.0	PB-RWP-PR-S12	Onsite	mg/kg	Antimony	N	3
PB-PR-S14-0.0/0.5	PB-RWP-PR-S14	Onsite	mg/kg	Antimony	N	3
PB-PR-S10-3.0/5.0	PB-RWP-PR-S10	Onsite	mg/kg	Antimony	N	3
PB-PR-S18-2.0/5.0	PB-RWP-PR-S18	Onsite	mg/kg	Antimony	N	3
PB-PR-S3-2.0/5.0	PB-RWP-PR-S3	Onsite	mg/kg	Antimony	N	3
PB-PR-S12-3.0/5.0	PB-RWP-PR-S12	Onsite	mg/kg	Antimony	N	3.05
PB-PR-S6-3.0/5.0	PB-RWP-PR-S6	Onsite	mg/kg	Antimony	N	3.05
PB-PR-S17-0.0/0.5	PB-RWP-PR-S17	Onsite	mg/kg	Antimony	N	3.1
PB-PR-S4-3.0/5.0	PB-RWP-PR-S4	Onsite	mg/kg	Antimony	N	3.1
PB-PR-S5-3.0/5.0	PB-RWP-PR-S5	Onsite	mg/kg	Antimony	N	3.1
PB-PR-S7-3.0/5.0	PB-RWP-PR-S7	Onsite	mg/kg	Antimony	N	3.1
PB-PR-S9-3.0/5.0	PB-RWP-PR-S9	Onsite	mg/kg	Antimony	N	3.1
PB-PR-S13-0.0/0.5	PB-RWP-PR-S13	Onsite	mg/kg	Antimony	N	3.15
PB-PR-S19-0.0/0.5	PB-RWP-PR-S19	Onsite	mg/kg	Antimony	N	3.15
7440	PRRP-DP07	Onsite	mg/kg	Antimony	N	3.2
7280	PRRP-DP03	Onsite	mg/kg	Antimony	N	3.3
7840	PRRP-DP17	Onsite	mg/kg	Antimony	N	3.3
7920	PRRP-DP19	Onsite	mg/kg	Antimony	N	3.3
7810	PRRP-DP16	Onsite	mg/kg	Antimony	N	3.3
7560	PRRP-DP10	Onsite	mg/kg	Antimony	N	3.35
7680	PRRP-DP13	Onsite	mg/kg	Antimony	N	3.35
7360R	PRRP-DP05	Onsite	mg/kg	Antimony	N	3.4
7520R	PRRP-DP09	Onsite	mg/kg	Antimony	N	3.4
7640	PRRP-DP12	Onsite	mg/kg	Antimony	N	3.4
7240R	PRRP-DP02	Onsite	mg/kg	Antimony	N	3.45
7480	PRRP-DP08	Onsite	mg/kg	Antimony	N	3.45
7600	PRRP-DP11	Onsite	mg/kg	Antimony	N	3.45
7760	PRRP-DP15	Onsite	mg/kg	Antimony	N	3.45
7880	PRRP-DP18	Onsite	mg/kg	Antimony	N	3.45
7960	PRRP-DP20	Onsite	mg/kg	Antimony	N	3.45
7400	PRRP-DP06	Onsite	mg/kg	Antimony	N	3.55
7320	PRRP-DP04	Onsite	mg/kg	Antimony	N	3.6
7610	PRRP-DP11	Onsite	mg/kg	Antimony	N	3.6
7690	PRRP-DP13	Onsite	mg/kg	Antimony	N	3.6
7930	PRRP-DP19	Onsite	mg/kg	Antimony	N	3.6
7850	PRRP-DP17	Onsite	mg/kg	Antimony	Y	3.6
7730	PRRP-DP14	Onsite	mg/kg	Antimony	N	3.65
7970	PRRP-DP20	Onsite	mg/kg	Antimony	N	3.65

Pentolite Road Soil Background Data

SAMP_NO	SITE-ID	LOCATION	UNITS	Antimony	DETECT	Sb CONCEN
7200	PRRP-DP01	Onsite	mg/kg	Antimony	N	3.7
7720	PRRP-DP14	Onsite	mg/kg	Antimony	N	3.7
7800	PRRP-DP16	Onsite	mg/kg	Antimony	N	3.7
7250	PRRP-DP02	Onsite	mg/kg	Antimony	N	3.7
7410	PRRP-DP06	Onsite	mg/kg	Antimony	N	3.7
7450	PRRP-DP07	Onsite	mg/kg	Antimony	N	3.7
7490	PRRP-DP08	Onsite	mg/kg	Antimony	N	3.7
7770	PRRP-DP15	Onsite	mg/kg	Antimony	N	3.7
7530R	PRRP-DP09	Onsite	mg/kg	Antimony	N	3.75
7650	PRRP-DP12	Onsite	mg/kg	Antimony	Y	3.75
7290	PRRP-DP03	Onsite	mg/kg	Antimony	N	3.8
7330	PRRP-DP04	Onsite	mg/kg	Antimony	N	3.8
7570	PRRP-DP10	Onsite	mg/kg	Antimony	N	3.85
7890	PRRP-DP18	Onsite	mg/kg	Antimony	Y	3.85
PB-PR-S16-3.0/5.0	PB-RWP-PR-S16	Onsite	mg/kg	Antimony	Y	5.6
PB-PR-S20-2.0/5.0	PB-RWP-PR-S20	Onsite	mg/kg	Antimony	Y	5.7
PB-PR-S19-3.0/5.0	PB-RWP-PR-S19	Onsite	mg/kg	Antimony	Y	6
PB-PR-S17-2.0/5.0	PB-RWP-PR-S17	Onsite	mg/kg	Antimony	Y	6.1
PB-PR-S2-3.0/5.0	PB-RWP-PR-S2	Onsite	mg/kg	Antimony	Y	6.8
PB-PR-S11-3.0/5.0	PB-RWP-PR-S11	Onsite	mg/kg	Antimony	Y	7.3
7210	PRRP-DP01	Onsite	mg/kg	Antimony	Y	7.9
7370	PRRP-DP05	Onsite	mg/kg	Antimony	Y	9.3
AE0001	BGC-SO001	Background	mg/kg	Antimony	N	0.215
AE0002	BGC-SO002	Background	mg/kg	Antimony	N	0.2
AE0003	BGC-SO003	Background	mg/kg	Antimony	N	0.265

APPENDIX E

RESULTS OF TOXICITY TESTING ON SURFACE WATER, SOIL, AND SEDIMENTS FROM PLUM BROOK ORDNANCE WORKS, EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC. JANUARY 2001

RESULTS OF TOXICITY TESTING ON SURFACE WATERS, SOILS, AND SEDIMENTS FROM PLUM BROOK ORDNANCE WORKS

Prepared for:

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January 2001

EA Project 70003.10

Report Number 3535

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1. INTRODUCTION

At the request of IT Corporation, EA Engineering, Science, and Technology performed toxicity testing on surface water, soil, and sediment samples collected from Plum Brook Ordnance Works, Red Water Ponds Area (Sandusky, Ohio). The samples were evaluated for toxicity using selected freshwater invertebrate and vertebrate test species. Chronic toxicity tests with *Ceriodaphnia dubia* (water flea) and *Pimephales promelas* (fathead minnow) were conducted on undiluted surface water samples. The freshwater amphipod *Hyalella azteca* was exposed to whole sediments in 10-day toxicity tests. Bioaccumulation testing was performed on soil and sediment samples using the terrestrial red worm *Eisenia foetida* and the aquatic oligochaete *Lumbriculus variegatus*. The objective of the toxicity testing was to assess the toxicity of the water and sediment samples to the test organisms by determining the effects upon specific endpoints (e.g., survival, reproduction, and growth) of the organisms exposed to the samples, as compared to the organisms exposed to a laboratory control water or sediment. The testing with *Eisenia foetida* and *Lumbriculus variegatus* evaluated the bioaccumulation characteristics of the soil and sediment samples.

2. METHODS AND MATERIALS

2.1 SAMPLE DESCRIPTIONS

Surface waters, soils, and sediments were collected from two sites, identified as West Area and Pentolite Road, within the Red Water Ponds Area of Plum Brook Ordnance Works (Sandusky, Ohio). A total of five surface waters and five soils were collected from each site. For the sediments, ten samples were collected from West Area and five samples were collected from Pentolite Road.

The samples were collected by IT Corporation on 13, 14, and 15 September 2000. The samples were packed on wet ice and shipped by overnight courier to EA's Ecotoxicology Laboratory in Sparks, Maryland. Upon receipt at EA, the samples were logged in and assigned laboratory accession numbers. Table 1 summarizes the collection, receipt, and sample identification data for the water, soil, and sediment samples. Temperature, pH, alkalinity, hardness, and conductivity were measured on the water samples, and the results of these analyses are presented in Table 2. All samples were stored in the dark at 4°C when not in use. Prior to use in toxicity testing, the surface water samples were screened through 250 μm Nitex mesh to remove debris.

Due to an error by the courier service, the Pentolite Road surface water samples did not arrive at EA in time to initiate toxicity testing within 36 hours of sample collection. All surface waters were used for toxicity testing within 56 hours of sample collection. The sediments for the *H. azteca* toxicity testing were used within 10 days of sample collection. The soil and sediment samples for bioaccumulation testing were tested within 60 days of collection.

2.2 TEST ORGANISMS

The *Ceriodaphnia dubia* (water fleas) were obtained from EA's Culture Facility in Sparks, Maryland. The *C. dubia* were cultured in moderately hard synthetic fresh water, and the

cultures were kept in an environmentally controlled room at 25°C with a 16-hour light/8-hour dark photoperiod. Organisms were fed daily a suspension of yeast/cereal leaves/trout chow supplemented with the algae *Selenastrum capricornutum* as described in US EPA (1989). Adults were maintained in individual 30-ml plastic cups (one brood female per culture cup) with a 15-ml volume. Gravid adults were reisolated the evening before the initiation of toxicity testing to ensure that neonates (young) produced were less than 24 hours old for test initiation. For use in the chronic toxicity testing, the less than 24-hour old neonates were released from broods of eight or more within an 8-hour period from the time of reisolation.

The *Pimephales promelas* (fathead minnows) were obtained from EA's culture facility in Sparks, Maryland. Brood organisms were maintained in recirculating dechlorinated tap water at 25°C in 20-gallon aquaria. Eggs produced from the brood system were removed from the brood aquaria and placed into culture water at 25°C for the incubation period. Newly hatched larvae, less than 24 hours old, were used in the chronic toxicity testing.

The *Hyalella azteca* (freshwater amphipods) were also obtained from EA's culture facility (Sparks, Maryland). The amphipods were cultured at 20°C in 10-gallon glass aquaria with a substrate of hardwood leaves and overlying water of dechlorinated municipal tap water. Prior to introduction into the aquaria, the leaves were pre-soaked or boiled to remove tannins. The cultures were fed Tetramin-B flake food weekly in addition to the hardwood leaves. For use in testing, 7-14 day old organisms were collected from the cultures and gradually acclimated to the test temperature (23°C).

The adult *Eisenia foetida* (red worm) were acquired from Smith Worms, Inc. (Boston, Georgia). Upon receipt at EA on 31 October 2000, the worms were held at 20°C in the supplied bedding material until used the same day in the bioaccumulation tests. The approximate wet weight of the adult worms was 317 mg/worm.

The adult *Lumbriculus variegatus* were received at EA on 2 November 2000 from Aquatic Biosystems (Ft. Collins, Colorado). The organisms were acclimated to test temperature (23°C) prior to use in testing the same day.

2.3 CONTROL WATERS, SOIL, AND SEDIMENT

Each toxicity test utilized a control water, soil, or sediment for use in statistical comparisons with the test samples. The surface water testing included two control waters: a laboratory control water of moderately hard synthetic fresh water (80-100 mg/L $CaCO_3$ hardness), and a hardness control water of synthetic fresh water adjusted to match the hardness of the test waters (260 mg/L $CaCO_3$ hardness for the West Area Red Water Pond samples and 340 mg/L $CaCO_3$ hardness for the Pentolite Road Red Water Pond samples). Both control waters were prepared based on US EPA's synthetic freshwater recipe (1989) using reagent grade chemicals and deionized water. Batches of synthetic water were prepared at least 24 hours prior to use and kept under gentle aeration.

The *H. azteca* toxicity testing and the *L. variegatus* bioaccumulation testing included a control sediment collected from the Magothy River, Maryland. Sediment collected from this location has historically been non-toxic and is routinely utilized as a control sediment in EA's toxicity tests. The overlying water in the *H. azteca* and *L. variegatus* tests was synthetic laboratory freshwater (US EPA 1989) adjusted to match the hardness of the site water (410 mg/L $CaCO_3$ hardness).

For the red worm toxicity testing, an artificial soil was prepared by combining 10 percent sphagnum moss, 20 percent kaolinite clay, and 70 percent silica sand on a dry weight basis (Harris, et. al. 1990). The pH of the artificial soil was adjusted to pH 6-7 with the addition of calcium carbonate prior to use in testing. The artificial soil was hydrated to 39 percent moisture with the addition of deionized water.

2.4 TOXICITY TEST OPERATIONS AND PERFORMANCE

Toxicity testing was conducted in accordance with US EPA (1989 and 2000), ASTM (1997), and Linder et al. (1992) guidance. Test methodologies followed EA's standard toxicity testing protocols (EA 1996) which are included in Attachment I. Copies of the original data sheets and statistical analyses are provided in Attachment II for the *C. dubia* testing, Attachment III for the *P. promelas* testing, Attachment IV for the *H. azteca* testing, Attachment V for the *E. foetida* bioaccumulation testing, and Attachment VI for the *L. variegatus* bioaccumulation testing. Copies of the chain-of-custody records are included as Attachment VII, and the Report Quality Assurance Record is included as Attachment VIII.

Prior to use in testing, the surface waters, soils, and sediments were warmed to the appropriate test temperature. The samples were evaluated as 100 percent treatments (whole, undiluted samples). A single sample was used for initiation and subsequent renewals in all surface water testing.

2.4.1 *Ceriodaphnia dubia* Chronic Toxicity Testing

Chronic toxicity tests with *C. dubia* were conducted on five West Area surface waters (AD2006, AD2007, AD2008, AD2009, and AD2010) and five Pentolite Road surface water samples (AC2006, AC2007, AC2008, AC2009, and AC2010). Testing with the West Area surface water samples was initiated on 14 September 2000, and testing with the Pentolite Road samples was initiated on 16 September 2000.

The *C. dubia* chronic toxicity tests were conducted in 30-ml plastic cups with 15 ml of test solution per cup. Each test concentration had ten replicate cups with one organism per cup. To initiate the chronic toxicity test, one brood of eight of more *C. dubia* neonates was used per test row according to US EPA (1989) known parentage blocking technique. The organisms were fed daily during testing with 0.2 ml suspension of yeast/cereal leaves/trout chow supplemented with algae (*Selenastrum capricornutum*). The tests were maintained at

25±1°C with a 16-hour light/8-hour dark photoperiod.

Daily renewals of test solution were performed by carefully transferring the test organism from each test cup into a new cup containing freshly prepared test solution. During the daily transfer process, observations of mortality were recorded along with the number of neonates produced per organism. Temperature, pH, dissolved oxygen, and conductivity measurements were recorded on each concentration at test initiation and termination, and daily on the test solutions before and after renewal. A summary of the water quality measurements is presented in Table 3. The chronic toxicity tests were terminated when at least 60 percent of the surviving control organisms had produced three broods, with a mean of at least 15 neonates per control organism.

The results of the *C. dubia* chronic toxicity tests were statistically analyzed according to US EPA (1989) guidance to determine if any surface water sample was significantly different ($p=0.05$) from the hardness adjusted control water with respect to survival or reproduction. If the data from each individual comparison were normally distributed, then an ANOVA followed by a homoscedastic or heteroscedastic (depending on equality of variances) t-Test were performed to detect statistically significant differences between one sediment and another. If the data from a comparison were not normally distributed, then a Wilcoxon's Rank Sum Test was used to compare the group means. The Shapiro Wilk's Test and the F-Test were used to test the normality assumption and the homogeneity of variance assumption, respectively. Tables 5 and 6 present the results of the *C. dubia* chronic toxicity testing.

2.4.2 *Pimephales promelas* Chronic Toxicity Testing

Chronic toxicity tests with *P. promelas* were conducted on five West Area surface waters (AD2006, AD2007, AD2008, AD2009, and AD2010) and five Pentolite Road surface water samples (AC2006, AC2007, AC2008, AC2009, and AC2010). Testing with the West Area surface water samples was initiated on 14 September 2000, and testing with the Pentolite Road samples was initiated on 16 September 2000.

The *P. promelas* chronic toxicity tests were conducted in 1-L polypropylene beakers with each beaker containing 250 ml test solution. Each test water had five replicates of ten organisms, for a total of 50 organisms exposed per test water and control. The *P. promelas* larvae were fed 0.15 to 0.25 ml (ration increased with age) of a 0.05 g/ml suspension of newly hatched brine shrimp nauplii (*Artemia* sp., less than 24 hours old) three times daily. The test solution in each beaker was renewed (replaced) daily. The daily solution renewals were performed by siphoning 80 percent of the old test solution from each test chamber taking care to remove debris from the bottom of the chamber, and then slowly siphoning new test solution into the chamber.

The tests were performed at 25±1°C with a 16-hour light/8-hour dark photoperiod. Observations of mortality were recorded daily. Temperature, pH, dissolved oxygen, and conductivity measurements were recorded on one replicate of each concentration at test initiation and termination, and daily on the test solutions before and after solution renewal. Table 6 summarizes the water quality measurements from the *P. promelas* testing.

At the end of the 7-day exposure period, the surviving larvae were placed in pre-weighed, oven-dried aluminum pans (one pan per replicate) and dried at 100°C for a minimum of six hours. The total organism dry weight per replicate was divided by the number of surviving organisms to obtain a mean dry weight for each replicate.

Following US EPA (1989) guidance, the survival and dry weight data were statistically analyzed by a t-Test or Wilcoxon's Rank Sum Test to determine if any test sediment was significantly different ($p=0.05$) from the control sediment. Tables 7 and 8 present the results of the *P. promelas* chronic toxicity testing.

2.4.3 *Hyalella azteca* Toxicity Testing

Five sediment samples from the West Area, identified as AD1006, AD1007, AD1008, AD1009, and AD1010, were evaluated in 10-day *H. azteca* toxicity tests. The *H. azteca* toxicity tests were initiated on 22 September 2000.

The *H. azteca* sediment toxicity tests were conducted in 300-ml lipless glass beakers each containing 100 ml of sediment and 175 ml of overlying water. The tests were performed with eight replicates per sediment sample. The sediment and overlying water were added to the chambers 24 hours prior to introduction of the test organisms. The beakers were left undisturbed overnight so as to allow any suspended sediment particles in the water column to settle. Ten organisms were randomly introduced into each replicate beaker. The introduction of the test organisms to the test chambers marked the initiation of the toxicity tests. The test chambers were placed in a water bath and maintained at 23±1°C with a 16-hour light/8-hour dark photoperiod. The *H. azteca* were fed 1 ml/replicate of YCT (a suspension of yeast, ground cereal leaves, and trout chow) daily.

The overlying water in the exposure chambers was renewed twice daily using a water delivery system (Zumwalt et al. 1994). Fresh overlying water was slowly added to each replicate, displacing the water already in the beaker through a notch cut into the top of the beaker. The notch was sealed with fine mesh screen to prevent any organisms from being flushed out of the test chamber. Temperature, pH, dissolved oxygen, and conductivity measurements were recorded daily on the overlying water in one replicate of each sediment. The ammonia of the overlying water of each sample was measured at test initiation (Day 0) and test completion (Day 10). These water quality measurements are summarized in Table 9.

At the end of the 10-day exposure period, the surviving organisms from each replicate were retrieved by screening through a 250 μm sieve. The number of surviving *H. azteca* from each replicate was recorded, and the organisms of each replicate were placed in a dried, pre-weighed tin and placed in a drying oven at 100°C for at least six hours. The tins were then removed from the oven, placed in a desiccator to cool, and each pan was weighed to the nearest 0.01 mg to determine a mean dry weight per replicate.

The survival and dry weight data were statistically analyzed by a t-Test or Wilcoxon's Rank Sum Test to determine if any test sediment was significantly different ($p=0.05$) from the control sediment. The results of the *H. azteca* toxicity testing are presented in Table 10.

2.4.4 *Eisenia foetida* Bioaccumulation Testing

Six soil samples were evaluated in *Eisenia foetida* bioaccumulation testing. These six samples included one soil, AC0001, from the Pentolite Road site and five soils (AD0001, AD0002, AD0003, AD0004, and AD0005) from the West Area site. The soils were loaded into the test chambers the day before the worms were introduced to allow the temperature of the soils to equilibrate to the testing temperature. The bioaccumulation testing with *E. foetida* was initiated on 31 October 2000.

The *E. foetida* bioaccumulation tests were performed in 2-L wide-mouth glass jars equipped with screw-top lids with a screened hole for air exchange. Each jar contained 1,500 g of soil and 60 organisms. There were five replicate jars per concentration. The test chambers were placed in an environmentally controlled chamber and maintained at 23±1°C for the 28-day exposure period. Because earthworms burrow into the soil to avoid light, the photoperiod for these tests was continuous illumination in order to maximize organism contact with the soil. Daily observations were made on all test chambers, and any organisms not in contact with the sample were gently placed back onto the surface of the soil. The worms were not fed during the testing period. Temperature in the chamber was recorded daily on a surrogate vessel containing soil. In addition, pH and percent moisture was measured on each soil at test initiation. The temperature, pH, and percent moisture measurements are summarized in Table 11.

The number of surviving worms was recorded on Day 28. Death was defined by a lack of response to a gentle prod with a glass rod. Since earthworms decompose rapidly in soil, those organisms not found were presumed and recorded as dead. The surviving worms were then placed onto moist paper to depurate for six hours. After the depuration period, the worms were collected for chemical analyses. Table 12 presents the survival data from the *E. foetida* bioaccumulation testing.

2.4.5 *Lumbriculus variegatus* Bioaccumulation Testing

Bioaccumulation testing with *L. variegatus* was conducted on five West Area sediment samples (AD1001, AD1002, AD1003, AD1004, and AD1005). The *L. variegatus* testing was conducted in 2-L beakers containing 1.1 L sediment and 1 L overlying water (such that the ratio of total organic carbon in sediment to organism dry weight was at least 50:1). The sediment and overlying water were added to the test chambers 24 hours before the introduction of the test organisms to allow the suspended sediments to settle out. Five grams of organisms were added to each replicate on 2 November 2000 marking the initiation of the bioaccumulation testing. The *L. variegatus* were not fed during the 28-day exposure period.

The test chambers were kept at 23±1°C with a 16-hour light/8-hour dark photoperiod. The overlying water in each test chamber was renewed twice daily. Water quality (temperature, pH, dissolved oxygen, and conductivity) was monitored daily on the overlying water in one replicate of each sediment. Alkalinity and hardness were measured on the overlying water of each sample at test initiation (Day 0), test completion (Day 28), and weekly on Days 7, 14, and 21. Table 13 summarizes these water quality measurements. Due to low dissolved oxygen levels (<2.5 mg/L) in the overlying water, each test chamber was aerated through a glass pipet submerged beneath the surface of the overlying water. The aeration pipet was positioned in the water column well above the sediment surface so as not to re-suspend the sediment.

After 28 days of exposure, the surviving organisms from each replicate were retrieved and placed into clean laboratory water to depurate for six hours. At the end of the depuration period, the organisms were collected for chemical analyses.

2.5 REFERENCE TOXICANT TESTS

In conformance with EA's quality assurance/quality control program, reference toxicant tests were performed on the in-house cultured organisms (*C. dubia*, *P. promelas*, and *H. azteca*)

and on the acquired organism stocks (*E. foetida* and *L. variegatus*). The results of each reference toxicant test were compared to EA's established control chart limits. The reference toxicants used were sodium chloride (NaCl) for *C. dubia*, cadmium chloride ($CdCl_2$) for *P. promelas*, copper sulfate ($CuSO_4$) for *H. azteca*, 2-chloroacetamide for *E. foetida*, and copper chloride ($CuCl_2$) for *L. variegatus*. The results of the reference toxicant testing are summarized in Table 14.

2.6 ARCHIVES

Original data sheets, records, memoranda, notes, and computer printouts are archived at EA's Baltimore Office in Sparks, Maryland. These data will be retained for a period of 5 years unless a longer period of time is requested by IT Corporation.

3. RESULTS AND DISCUSSION

3.1 *Ceriodaphnia dubia* CHRONIC TOXICITY TESTING

The results of the *C. dubia* chronic toxicity tests are presented in Tables 4 (West Area) and 5 (Pentolite Road). Two of the ten surface water samples, identified as sample numbers AD2008 and AD2009 from the West Area site, were chronically toxic to *C. dubia* based on a significant ($p=0.05$) decrease in young production as compared to the Hardness Control. The Hardness Control had a mean of 23.3 neonates/organism, while samples AD2008 and AD2009 had means of 17.3 and 19.6 neonates/organism, respectively.

For the remaining three surface waters from the West Area (AD2006, AD2007, and AD2010) and the five surface waters from the Pentolite Road (AC2006, AC2007, AC2008, AC2009, and AC2010), there was no signficant ($p=0.05$) difference in survival or reproduction as compared to the Hardness Control, indicating that these eight samples were not chronically toxic to *C. dubia*.

3.2 *Pimephales promelas* CHRONIC TOXICITY TESTING

The *P. promelas* chronic toxicity test results are summarized in Table 7 for the West Area samples and Table 8 for the Pentolite Road samples. The five surface water samples from the West Area (AD2006, AD2007, AD2008, AD2009, and AD2010) were not chronically toxic to *P. promelas*.

Two of the Pentolite Road surface water samples, AC2006 and AC2008, were chronically toxic to *P. promelas* based on significantly ($p=0.05$) lower survival than the Hardness Control. Sample AC2006 had 70 percent survival and sample AC2008 had 80 percent survival, compared to the Hardness Control which had 94 percent survival. It should be noted that the acceptable control performance criterion for this test method is ≥80 percent survival; thus, the decreased survival observed in the AC2008 sample could potentially be considered

not biologically significant. Sample AC2009 of the Pentolite Road site also had 80 percent survival; however, this sample was marginally not statistically less than the Hardness Control due to a higher coefficient of variation (CV) between these replicates than sample AC2008 (18.4% CV versus 8.2% CV). Samples AC2007, AC2009, and AC2010 of the Pentolite Road site were not chronically toxic to *P. promelas*.

3.3 *Hyalella azteca* TOXICITY TESTING

The results of the *H. azteca* toxicity testing are presented in Table 10. Two of the five West Area sediment samples, AD1006 and AD1008, had significantly (p=0.05) lower survival than the Hardness Control, indicating that these two sediment samples were toxic to *H. azteca*. Sample AD1006 had 78 percent survival and sample AD1008 had 83 percent survival, compared to the Hardness Control which had 94 percent survival. The remaining three sediments from the West Area site (AD1007, AD1009, and AD1010) were not toxic to *H. azteca*.

3.4 *Eisenia foetida* BIOACCUMULATION TESTING

The survival data from the *E. foetida* bioaccumulation testing are presented in Table 12. After 28 days of exposure, there was 99.7 percent survival in the control. Of the six test soils, the West Area sample AD0001 had the lowest survival (70 percent) and was significantly (p=0.05) different from the control survival. The remaining soils (West Area samples AD0002, AD0003, AD0004, and AD0005 and Pentolite Road sample AC0001) had survival ranging from 94 to 99 percent. As a result of the very high control survival, sample AD0005 with 98 percent survival and sample AC0001 with 94 percent survival had significantly (p=0.05) lower survival than the control. However, these survival rates (98 and 94 percent) are above the acceptable control criterion of 80 percent survival for this test method, and do not represent a biologically significant reduction in survival.

Following the depuration period, the *E. foetida* organism tissues were submitted to Severn Trent Laboratories (Baltimore, Maryland) for chemical analyses. The results of the chemical analyses will be submitted directly to IT Corporation, and therefore are not included in this report.

3.5 *Lumbriculus variegatus* BIOACCUMULATION TESTING

The *L. variegatus* organism tissues were submitted to Severn Trent Laboratories (Baltimore, Maryland) for chemical analyses following the depuration period. The results of the chemical analyses will be submitted directly to IT Corporation, and therefore are not included in this report.

4. REFERENCES

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TABLE 1 SUMMARY OF SAMPLE INFORMATION FOR WATER, SOIL, AND SEDIMENT SAMPLES FROM PLUM BROOK ORDNANCE WORKS

Sample Location	Sample Description	Sample Number	EA Accession Number	Collection Time and Date	Receipt Time and Date
Surface Waters:					
West Area Red Water Pond	PBOW-00-WRWP-SW006	AD2006	AT0-709	1115, 13 SEP 00	0955, 14 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SW007	AD2007	AT0-710	1100, 13 SEP 00	0955, 14 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SW008	AD2008	AT0-711	1145, 13 SEP 00	0955, 14 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SW009	AD2009	AT0-712	1220, 13 SEP 00	0955, 14 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SW010	AD2010	AT0-713	1240, 13 SEP 00	0955, 14 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW006	AC2006	AT0-728	1050, 14 SEP 00	1200, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW007	AC2007	AT0-724	1020, 14 SEP 00	1720, 15 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW008	AC2008	AT0-729	1000, 14 SEP 00	1200, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW009	AC2009	AT0-730	0940, 14 SEP 00	1200, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW010	AC2010	AT0-725	0918, 14 SEP 00	1720, 15 SEP 00
Soils:					
West Area Red Water Pond	PBOW-00-WRWP-SO001	AD0001	AT0-735	0955, 15 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SO002	AD0002	AT0-736	0845, 15 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SO003	AD0003	AT0-737	0900, 15 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SO004	AD0004	AT0-738	0915, 15 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SO005	AD0005	AT0-739	0930, 15 SEP 00	1115, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SO001	AC0001	AT0-758	1500, 15 SEP 00	1330, 19 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SO002	AC0002	AT0-759	1510, 15 SEP 00	1330, 19 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SO003	AC0003	AT0-760	1520, 15 SEP 00	1330, 19 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SO004	AC0004	AT0-761	1530, 15 SEP 00	1330, 19 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SO005	AC0005	AT0-762	1540, 15 SEP 00	1330, 19 SEP 00

TABLE 1 (continued)

Sample Location	Sample Description	Sample Number	EA Accession Number	Collection Time and Date	Receipt Time and Date
Sediments:					
West Area Red Water Pond	PBOW-00-WRWP-SD001	AD1001	AT0-745	1410, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD002	AD1002	AT0-746	1500, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD003	AD1003	AT0-747	1330, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD004	AD1004	AT0-748	1055, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD005	AD1005	AT0-749	1150, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD006	AD1006	AT0-740	1835, 13 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD007	AD1007	AT0-741	0940, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD008	AD1008	AT0-742	1240, 14 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD009	AD1009	AT0-743	1825, 13 SEP 00	1115, 16 SEP 00
West Area Red Water Pond	PBOW-00-WRWP-SD010	AD1010	AT0-744	1905, 13 SEP 00	1115, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SD001	AC1001	AT0-750	1000, 15 SEP 00	1115, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SD002	AC1002	AT0-751	1010, 15 SEP 00	1115, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SD003	AC1003	AT0-752	1130, 15 SEP 00	1115, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SD004	AC1004	AT0-753	1140, 15 SEP 00	1115, 16 SEP 00
Pentolite Road Red Water Pond	PBOW-00-PRWP-SD005	AC1005	AT0-754	1150, 15 SEP 00	1115, 16 SEP 00

TABLE 2 SUMMARY OF WATER QUALITY PARAMETERS MEASURED UPON RECEIPT ON SURFACE WATER SAMPLES FROM PLUM BROOK ORDNANCE WORKS

Sample Location	Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Conductivity (µS/cm)
West Area Red Water Pond	PBOW-00-WRWP-SW006	AD2006	AT0-709	2.5	9.4	250	188	543
West Area Red Water Pond	PBOW-00-WRWP-SW007	AD2007	AT0-710	3.9	8.3	306	232	631
West Area Red Water Pond	PBOW-00-WRWP-SW008	AD2008	AT0-711	1.8	8.0	256	184	533
West Area Red Water Pond	PBOW-00-WRWP-SW009	AD2009	AT0-712	4.3[a]	7.7	112	64	252
West Area Red Water Pond	PBOW-00-WRWP-SW010	AD2010	AT0-713	1.9	8.0	168	260	574
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW006	AC2006	AT0-728	2.7	7.7	290	420	658
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW007	AC2007	AT0-724	3.3	7.7	332	396	1,140
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW008	AC2008	AT0-729	2.2	7.8	326	412	681
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW009	AC2009	AT0-730	2.7	7.8	324	420	646
Pentolite Road Red Water Pond	PBOW-00-PRWP-SW010	AC2010	AT0-725	3.1	7.7	326	404	638

(a) Temp[illegible]re of sample upon receipt at EA was slightly above the recommended [illegible]ing temperature of 0-4°C. Sample was received at EA on ice.

TABLE 3 WATER QUALITY MEASUREMENTS[a] RECORDED DURING *Ceriodaphnia dubia* CHRONIC TOXICITY TESTING

Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)
Test Number: TN-00-618 (West Area Red Water Pond)						
PBOW-00-WRWP-SW006	AD2006	AT0-709	24.0-25.1 24.3 (±0.4)	8.4-9.0 8.8 (±0.2)	7.1-8.5 7.8 (±0.4)	467-591 519 (±34)
PBOW-00-WRWP-SW007	AD2007	AT0-710	24.1-24.9 24.3 (±0.3)	8.4-8.8 8.6 (±0.1)	7.2-8.3 7.8 (±0.4)	542-710 621 (±48)
PBOW-00-WRWP-SW008	AD2008	AT0-711	24.1-24.9 24.4 (±0.3)	8.2-9.2 8.7 (±0.3)	7.3-8.5 7.8 (±0.3)	502-598 540 (±32)
PBOW-00-WRWP-SW009	AD2009	AT0-712	24.1-25.4 24.5 (±0.4)	8.0-8.8 8.4 (±0.3)	7.3-8.2 7.7 (±0.3)	231-390 279 (±57)
PBOW-00-WRWP-SW010	AD2010	AT0-713	24.0-25.0 24.4 (±0.4)	8.1-8.6 8.3 (±0.2)	7.2-8.4 7.7 (±0.3)	517-611 561 (±32)
Hardness Control (260 mg/L)	--	--	24.1-25.0 24.4 (±0.3)	7.7-8.7 8.3 (±0.3)	7.0-8.3 7.8 (±0.4)	708-790 753 (±30)
Laboratory Control	--	--	24.1-25.9 24.7 (±0.6)	7.3-8.7 7.9 (±0.4)	7.0-8.3 7.6 (±0.4)	304-408 332 (±30)

(a) Range and mean (± standard deviation).

TABLE 3 (continued)

Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)
Test Number: TN-00-623 (Pentolite Road Red Water Pond)						
PBOW-00-PRWP-SW006	AC2006	AT0-728	24.0-25.3 24.6 (±0.4)	8.0-8.4 8.2 (±0.1)	7.6-8.6 7.9 (±0.3)	440-690 533 (±76)
PBOW-00-PRWP-SW007	AC2007	AT0-724	24.0-25.1 24.5 (±0.5)	7.9-8.3 8.1 (±0.1)	7.6-8.2 7.9 (±0.2)	446-646 537 (±64)
PBOW-00-PRWP-SW008	AC2008	AT0-729	24.0-25.5 24.6 (±0.5)	8.0-8.3 8.2 (±0.1)	7.5-8.4 7.9 (±0.3)	436-681 526 (±77)
PBOW-00-PRWP-SW009	AC2009	AT0-730	24.0-25.5 24.6 (±0.5)	7.8-8.4 8.2 (±0.2)	7.3-8.2 7.8 (±0.3)	449-720 540 (±88)
PBOW-00-PRWP-SW010	AC2010	AT0-725	24.0-25.2 24.5 (±0.5)	8.0-8.3 8.2 (±0.1)	7.7-8.5 8.0 (±0.2)	425-637 508 (±61)
Hardness Control (340 mg/L)	--	--	24.0-25.7 24.7 (±0.6)	8.1-8.5 8.3 (±0.1)	6.4-8.6 7.9 (±0.6)	981-1,157 1,063 (±51)
Laboratory Control	--	--	24.0-25.9 25.1 (±0.6)	7.6-8.6 8.1 (±0.3)	6.4-8.3 7.7 (±0.5)	285-347 315 (±20)

TABLE 4 RESULTS OF *Ceriodaphnia dubia* CHRONIC TOXICITY TESTING ON SURFACE WATERS FROM PLUM BROOK ORDNANCE WORKS

Test Species:	*Ceriodaphnia dubia* (water flea)
Sample Location:	West Area Red Water Pond
Sample Dates:	13 September 2000
EA Test Number:	TN-00-618
Test Initiation Time and Date:	1220, 14 September 2000
Test Termination Time and Date:	1215, 20 September 2000

Sample Description	Sample Number	EA Accession Number	6-Day Percent Survival	Mean Young Production as Neonates/Organism (±SD)
PBOW-00-WRWP-SW006	AD2006	AT0-709	100	24.2 (±2.3)
PBOW-00-WRWP-SW007	AD2007	AT0-710	100	28.9 (±2.6)
PBOW-00-WRWP-SW008	AD2008	AT0-711	100	17.3 (±3.4)[a]
PBOW-00-WRWP-SW009	AD2009	AT0-712	100	19.6 (±4.4)[a]
PBOW-00-WRWP-SW010	AD2010	AT0-713	90	23.1 (±8.8)
Hardness Control (260 mg/L)	--	--	100	23.3 (±3.8)
Laboratory Control	--	--	100	25.3 (±2.8)

(a) Sample was significantly different (p=0.05) from the Hardness Control based on mean young production.

TABLE 5 RESULTS OF *Ceriodaphnia dubia* CHRONIC TOXICITY TESTING ON SURFACE WATERS FROM PLUM BROOK ORDNANCE WORKS

Test Species:	*Ceriodaphnia dubia* (water flea)
Sample Location:	Pentolite Road Red Water Pond
Sample Dates:	14 September 2000
EA Test Number:	TN-00-623
Test Initiation Time and Date:	1540, 16 September 2000
Test Termination Time and Date:	1530, 22 September 2000

Sample Description	Sample Number	EA Accession Number	6-Day Percent Survival	Mean Young Production as Neonates/Organism (±SD)
PBOW-00-PRWP-SW006	AC2006	AT0-728	90	18.9 (±9.0)
PBOW-00-PRWP-SW007	AC2007	AT0-724	90	20.5 (±4.8)
PBOW-00-PRWP-SW008	AC2008	AT0-729	100	20.6 (±5.2)
PBOW-00-PRWP-SW009	AC2009	AT0-730	100	21.5 (±3.1)
PBOW-00-PRWP-SW010	AC2010	AT0-725	100	21.4 (±3.0)
Hardness Control (340 mg/L)	--	--	100	16.8 (±6.8)
Laboratory Control	--	--	100	18.6 (±5.2)

TABLE 6 WATER QUALITY MEASUREMENTS[a] RECORDED DURING *Pimephales promelas* CHRONIC TOXICITY TESTING

Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)
Test Number: TN-00-619 (West Area Red Water Pond)						
PBOW-00-WRWP-SW006	AD2006	AT0-709	24.0-25.9 24.7 (±0.5)	8.0-9.0 8.7 (±0.3)	6.4-8.5 7.4 (±0.6)	467-556 500 (±25)
PBOW-00-WRWP-SW007	AD2007	AT0-710	24.1-25.2 24.5 (±0.4)	8.3-8.7 8.5 (±0.1)	6.0-8.3 7.3 (±0.7)	542-643 601 (±28)
PBOW-00-WRWP-SW008	AD2008	AT0-711	24.1-25.3 24.6 (±0.4)	8.3-9.2 8.7 (±0.3)	6.4-8.5 7.4 (±0.7)	486-547 521 (±18)
PBOW-00-WRWP-SW009	AD2009	AT0-712	24.1-25.3 24.6 (±0.4)	7.8-8.8 8.2 (±0.3)	6.2-8.2 7.2 (±0.7)	231-279 247 (±12)
PBOW-00-WRWP-SW010	AD2010	AT0-713	24.0-25.3 24.6 (±0.5)	8.0-8.4 8.2 (±0.1)	6.6-8.4 7.4 (±0.7)	481-596 550 (±31)
Hardness Control (260 mg/L)	--	--	24.0-25.9 24.6 (±0.5)	7.5-8.7 8.3 (±0.3)	6.5-8.6 7.6 (±0.7)	735-825 776 (±25)
Laboratory Control	--	--	24.0-25.8 24.7 (±0.5)	7.0-8.7 7.9 (±0.4)	6.5-8.1 7.3 (±0.5)	290-347 317 (±18)

(a) Range and mean (± standard deviation).

TABLE 6 (continued)

Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)
Test Number: TN-00-622 (Pentolite Road Red Water Pond)						
PBOW-00-PRWP-SW006	AC2006	AT0-728	24.0-25.6 24.7 (±0.5)	8.0-8.4 8.2 (±0.1)	5.8-8.6 7.3 (±0.9)	458-690 541 (±66)
PBOW-00-PRWP-SW007	AC2007	AT0-724	24.0-25.7 24.8 (±0.5)	8.0-8.3 8.2 (±0.1)	6.4-8.1 7.3 (±0.6)	449-646 531 (±53)
PBOW-00-PRWP-SW008	AC2008	AT0-729	24.0-25.9 24.7 (±0.6)	8.0-8.4 8.2 (±0.1)	6.5-8.4 7.5 (±0.6)	452-681 536 (±62)
PBOW-00-PRWP-SW009	AC2009	AT0-730	24.0-25.8 24.7 (±0.6)	7.8-8.4 8.1 (±0.2)	6.2-8.2 7.4 (±0.6)	450-720 548 (±75)
PBOW-00-PRWP-SW010	AC2010	AT0-725	24.0-25.9 24.8 (±0.7)	8.0-8.3 8.1 (±0.1)	6.8-8.5 7.5 (±0.5)	440-637 518 (±48)
Hardness Control (340 mg/L)	--	--	24.0-25.6 24.7 (±0.5)	8.1-8.8 8.4 (±0.2)	6.4-8.6 7.5 (±0.8)	992-1,249 1,084 (±71)
Laboratory Control	--	--	24.0-25.9 25.1 (±0.7)	7.7-8.6 8.0 (±0.2)	6.5-7.9 7.2 (±0.4)	272-374 314 (±27)

TABLE 7 RESULTS OF *Pimephales promelas* CHRONIC TOXICITY TESTING ON SURFACE WATERS FROM PLUM BROOK ORDNANCE WORKS

Test Species:	*Pimephales promelas* (fathead minnow)
Sample Location:	West Area Red Water Pond
Sample Dates:	13 September 2000
EA Test Number:	TN-00-619
Test Initiation Time and Date:	1550, 14 September 2000
Test Termination Time and Date:	1515, 21 September 2000

Sample Description	Sample Number	EA Accession Number	7-Day Percent Survival	Mean Dry Weight as mg/Surviving Organism (±SD)
PBOW-00-WRWP-SW006	AD2006	AT0-709	100	0.490 (±0.039)
PBOW-00-WRWP-SW007	AD2007	AT0-710	100	0.521 (±0.033)
PBOW-00-WRWP-SW008	AD2008	AT0-711	100	0.508 (±0.033)
PBOW-00-WRWP-SW009	AD2009	AT0-712	98	0.528 (±0.047)
PBOW-00-WRWP-SW010	AD2010	AT0-713	88	0.477 (±0.086)
Hardness Control (260 mg/L)	--	--	96	0.496 (±0.042)
Laboratory Control	--	--	98	0.464 (±0.033)

TABLE 8 RESULTS OF *Pimephales promelas* CHRONIC TOXICITY TESTING ON SURFACE WATERS FROM PLUM BROOK ORDNANCE WORKS

Test Species:	*Pimephales promelas* (fathead minnow)
Sample Location:	Pentolite Road Red Water Pond
Sample Dates:	14 September 2000
EA Test Number:	TN-00-622
Test Initiation Time and Date:	1625, 16 September 2000
Test Termination Time and Date:	1600, 23 September 2000

Sample Description	Sample Number	EA Accession Number	7-Day Percent Survival	Mean Dry Weight as mg/Surviving Organism (±SD)
PBOW-00-PRWP-SW006	AC2006	AT0-728	70[(a)]	0.359 (±0.016)[(b)]
PBOW-00-PRWP-SW007	AC2007	AT0-724	82	0.463 (±0.108)
PBOW-00-PRWP-SW008	AC2008	AT0-729	80[(a)]	0.420 (±0.046)[(b)]
PBOW-00-PRWP-SW009	AC2009	AT0-730	80	0.400 (±0.024)
PBOW-00-PRWP-SW010	AC2010	AT0-725	82	0.412 (±0.077)
Hardness Control (340 mg/L)	--	--	94	0.413 (±0.029)
Laboratory Control	--	--	86	0.405 (±0.031)

(a) Sample was significantly different (p=0.05) from the Hardness Control based on percent survival.
(b) A sample which has significantly lower survival than the Hardness Control is not included in statistical analyses for mean dry weight (US EPA 1989).

TABLE 9 WATER QUALITY MEASUREMENTS[a] RECORDED DURING *Hyalella azteca* SEDIMENT TOXICITY TESTING

Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Ammonia (mg/L NH_3-N) Day 0	Ammonia (mg/L NH_3-N) Day 10
Test Number: TN-00-644 (West Area Red Water Pond)								
PBOW-00-WRWP-SD006	AD1006	AT0-740	22.2-23.7 22.8 (±0.5)	7.9-8.6 8.2 (±0.2)	4.1-7.8 5.3 (±1.2)	961-1,280 1,134 (±102)	6.93	0.17
PBOW-00-WRWP-SD007	AD1007	AT0-741	22.3-23.8 22.8 (±0.5)	7.9-8.6 8.2 (±0.2)	3.7-7.8 5.5 (±1.2)	978-1,267 1,115 (±88)	6.48	0.43
PBOW-00-WRWP-SD008	AD1008	AT0-742	22.4-23.8 22.8 (±0.5)	7.9-8.6 8.1 (±0.2)	3.3-7.9 5.3 (±1.4)	973-1,291 1,127 (±101)	11.20	0.57
PBOW-00-WRWP-SD009	AD1009	AT0-743	22.0-23.4 22.7 (±0.4)	8.1-8.6 8.3 (±0.2)	3.7-8.0 5.5 (±1.3)	966-1,224 1,104 (±81)	1.69	0.26
PBOW-00-WRWP-SD010	AD1010	AT0-744	22.2-23.5 22.9 (±0.4)	8.0-8.6 8.2 (±0.2)	3.5-7.9 5.2 (±1.3)	964-1,237 1,107 (±86)	3.03	0.29
Control	--	--	22.1-23.5 22.8 (±0.4)	8.0-8.5 8.2 (±0.2)	4.4-8.0 5.9 (±1.0)	1,079-1,849 1,423 (±285)	--	0.49

(a) Range and mean (± standard deviation).

TABLE 10 RESULTS OF *Hyalella azteca* TOXICITY TESTING ON SEDIMENTS FROM PLUM BROOK ORDNANCE WORKS

Test Species:	*Hyalella azteca* (amphipod)
Sample Location:	West Area Red Water Pond
Sample Dates:	13-14 September 2000
EA Test Number:	TN-00-644
Test Initiation Time and Date:	1700, 22 September 2000
Test Termination Time and Date:	1500, 2 October 2000

Sample Description	Sample Number	EA Accession Number	10-Day Percent Survival	Mean Dry Weight as mg/Surviving Organism (±SD)
PBOW-00-WRWP-SD006	AD1006	AT0-740	78[a]	0.240 (±0.044)[b]
PBOW-00-WRWP-SD007	AD1007	AT0-741	85	0.223 (±0.047)
PBOW-00-WRWP-SD008	AD1008	AT0-742	83[a]	0.214 (±0.022)[b]
PBOW-00-WRWP-SD009	AD1009	AT0-743	88	0.248 (±0.033)
PBOW-00-WRWP-SD010	AD1010	AT0-744	89	0.192 (±0.028)
Control	--	--	94	0.216 (±0.036)

(a) Sample was significantly different (p=0.05) from the control based on percent survival.
(b) A sample which has significantly lower survival than the control is not included in statistical analyses for mean dry weight (US EPA 1989).

TABLE 11 ENVIRONMENTAL MEASUREMENTS RECORDED DURING *Eisenia foetida* BIOACCUMULATION TESTING

Sample Description	Sample Number	EA Accession Number	Soil pH	Soil Moisture Content (%)	Temperature (°C)[a]
Test Number: TN-00-742					
PBOW-00-WRWP-SO001	AD0001	AT0-735	7.8	23.44	Range: 22.0-24.0 Mean (±SD): 23.0 (±0.4)
PBOW-00-WRWP-SO002	AD0002	AT0-736	6.5	26.72	
PBOW-00-WRWP-SO003	AD0003	AT0-737	6.7	25.31	
PBOW-00-WRWP-SO004	AD0004	AT0-738	6.2	26.63	
PBOW-00-WRWP-SO005	AD0005	AT0-739	7.2	30.02	
PBOW-00-PRWP-SO001	AC0001	AT0-758	7.9	21.44	
Control	--	--	--	39.02	

(a) Temperature was measured daily on a surrogate soil chamber.

TABLE 12 SURVIVAL RESULTS FROM *Eisenia foetida* BIOACCUMULATION TESTING ON SEDIMENTS FROM PLUM BROOK ORDNANCE WORKS

Test Species:	*Eisenia foetida* (red worm)
Sample Location:	West Area and Pentolite Road Red Water Pond
Sample Date:	15 September 2000
EA Test Number:	TN-00-742
Test Initiation Time and Date:	1500, 31 October 2000
Test Termination Time and Date:	1200, 28 November 2000

Sample Description	Sample Number	EA Accession Number	28-Day Percent Survival
PBOW-00-WRWP-SO001	AD0001	AT0-735	70[(a)]
PBOW-00-WRWP-SO002	AD0002	AT0-736	97
PBOW-00-WRWP-SO003	AD0003	AT0-737	96
PBOW-00-WRWP-SO004	AD0004	AT0-738	99
PBOW-00-WRWP-SO005	AD0005	AT0-739	98[(a)(b)]
PBOW-00-PRWP-SO001	AC0001	AT0-758	94[(a)(b)]
Control	--	--	99.7

(a) Soil had significantly lower survival than the control (p=0.05).
(b) Survival was above the acceptable control criterion (see text, page 13).

TABLE 13 WATER QUALITY PARAMETERS MEASURED DURING *Lumbriculus variegatus* BIOACCUMULATION TESTING

Sample Description	Sample Number	EA Accession Number	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Alkalinity (mg/L $CaCO_3$)	Hardness (mg/L $CaCO_3$)
Test Number: TN-00-745 (West Area Red Water Pond)								
PBOW-00-WRWP-SD001	AD1001	AT0-745	21.2-23.6[a] 22.5 (±0.6)	7.5-8.5 8.2 (±0.2)	6.9-8.2 7.6 (±0.4)	911-1,301 1,181 (±82)	186-254 201 (±30)	340-404 354 (±28)
PBOW-00-WRWP-SD002	AD1002	AT0-746	21.4-23.4[a] 22.5 (±0.5)	8.0-8.5 8.2 (±0.2)	4.9-8.5 7.8 (±0.7)	917-1,294 1,172 (±84)	186-246 207 (±24)	328-528 385 (±82)
PBOW-00-WRWP-SD003	AD1003	AT0-747	21.8-24.0[a] 22.7 (±0.5)	8.1-8.5 8.3 (±0.1)	6.7-8.5 7.9 (±0.4)	915-1,301 1,163 (±83)	178-266 210 (±34)	328-484 369 (±66)
PBOW-00-WRWP-SD004	AD1004	AT0-748	21.5-23.7[a] 22.5 (±0.5)	7.9-8.4 8.2 (±0.1)	6.5-8.5 7.7 (±0.4)	904-1,294 1,165 (±84)	178-252 195 (±32)	324-568 402 (±104)
PBOW-00-WRWP-SD005	AD1005	AT0-749	21.8-23.9[a] 22.7 (±0.5)	7.7-8.4 8.1 (±0.2)	6.5-8.3 7.6 (±0.5)	873-1,291 1,158 (±89)	164-306 208 (±56)	328-460 367 (±57)
Control	--	--	21.3-23.3[a] 22.5 (±0.5)	7.8-8.5 8.2 (±0.2)	6.1-8.2 7.8 (±0.4)	1,120-1,737 1,353 (±143)	186-250 204 (±26)	352-448 388 (±50)

(a) Temperatures of several replicates were below the target range of 23±1°C on Days 13, 18, 19, and 26; however, the daily mean temperatures were within 23±1°C.

TABLE 14 RESULTS OF REFERENCE TOXICANT TESTING FOR ALL TEST SPECIES

Test Species	Reference Toxicant	EA Test Number	Endpoint		Acceptable Control Chart Limits
Ceriodaphnia dubia	Sodium chloride (NaCl)	RT-00-111	NOEC:	600 mg/L NaCl	300-1,200 mg/L NaCl
Pimephales promelas	Cadmium chloride ($CdCl_2$)	RT-00-106	NOEC:	18 µg/L Cd	7.5-42 µg/L Cd
Hyalella azteca	Copper sulfate ($CuSO_4$)	RT-00-166	96-Hour LC50:	232 mg/L Cu	73-448 mg/L Cu
Eisenia foetida	2-chloroacetamide	RT-00-149	48-Hour LC50:	203 mg/L	11-396 mg/L
Lumbriculus variegatus	Copper chloride ($CuCl_2$)	RT-00-154	48-Hour LC50:	0.12 mg/L Cu	0-0.37 mg/L Cu

ATTACHMENT I

EA Toxicity Testing Protocols

SURVIVAL AND REPRODUCTION TEST WITH CLADOCERAN (*Ceriodaphnia dubia*)

1. TEST OBJECTIVE

To assess the toxicity of a test material to *Ceriodaphnia dubia* and determine the effects on reproductive potential and survival of test organisms compared to controls.

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test material is supplied by the client. Adequate chemical specifications with special reference to hazardous properties and storage conditions are also supplied by the client.

2.2 Methods of Synthesis

In most cases, the test article is an effluent sample. Information on the methods of synthesis, stability, and composition or other characteristics which define the test article are on file with the client.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

3.1.1 Species

The test species is the water flea, *Ceriodaphnia dubia*.

3.1.2 Source

C. dubia used for toxicity tests are obtained from stock cultures maintained at EA's Culture Facility.

3.1.3 Culturing and Holding Conditions

C. dubia cultures are maintained at 25±2°C and a 16-hour light, 8-hour dark photoperiod cycle

in an environmentally controlled laboratory. Test organisms are maintained in 18.9-L all glass aquaria (as backup cultures) or 1-L culture bowls, or individually in 30-ml plastic portion cups in brood boards and fed algae and a trout chow/yeast/cerophyll suspension (US EPA 1994). New cultures are initiated on a routine basis to ensure healthy, productive populations. Organisms from cultures producing ephippia are not used for toxicity tests. Certain regulatory or project specific objectives may require organism acclimation to the dilution water when it is different from the holding/culture water.

3.1.4 Age of Test Organisms at Test Initiation

Neonates of known age (i.e., less than 24 hours old) are obtained for testing from the individually cultured females in the brood board system. On the day before or the day of the test, neonates are segregated from the parent organisms. All organisms used for testing are released within one 8-hour period and are taken from broods of eight or more.

3.2 Dilution Water

Twenty percent dilute mineral water (US EPA 1994) is used for culturing and testing. Alternatively, moderately hard reconstituted water is prepared using MILLIPORE MILLI-Q^R or equivalent deionized water with addition of reagent grade chemicals. Receiving water can be used as dilution water if specified by the client.

3.3 Test Concentration Series

The test concentration series consists of a minimum of five dilutions (e.g., 6.25, 12.5, 25, 50, and 100 percent effluent plus a control) and may be determined from a prior screening of the test material. Rangefinding assays utilize more widely spaced test concentrations and a control. Ambient water or effluent samples may also be evaluated as single concentrations and compared to a control.

3.4 Test Concentration Preparation

Test concentrations are prepared in 250-ml graduated cylinders, and 15 ml of test solution are delivered to each individual test chamber.

3.5 Test Vessels and Test Volume

Test vessels are 30-ml portion cups or beakers; the final test volume is 15 ml.

3.6 Test Organism Number

Tests are conducted using ten replicates per concentration, with one organism per container. Neonates are randomly assigned to each replicate test container. More replicates can be added, if appropriate.

3.7 Test Environment

The test vessels are maintained in an environmentally controlled laboratory with a 16-hour light, 8-hour dark photoperiod. Temperature within the environmental room is monitored continuously using temperature recorders and test vessels are maintained at 25±1°C (unless a different project-specific temperature is required).

3.8 Analysis of Test Concentrations for Test Article

If required, test solutions may be analyzed for verification of chemical concentrations. The analytical method and number of analyses are determined after consultation with the client. When chemical analyses are necessary, both nominal and actual measured test concentrations are reported.

3.9 Test Observations

Each test day, test organisms are observed to record the number of surviving organisms and the number of neonates produced. Dead organisms are removed when observed. The study terminates after 60 percent of the control females have produced three broods with a minimum of 15 neonates per surviving female. However, test duration will not exceed 8 days of exposure to the test material.

Each effluent or receiving water sample received is analyzed for temperature, conductivity, alkalinity, hardness, and total residual chlorine. Aliquots of effluent and receiving water may be gently aerated (100 bubbles/min) prior to test initiation if dissolved oxygen is less than 4 mg/L or greater than 100 percent saturation. Water quality measurements recorded daily on old and new test solutions include dissolved oxygen, pH, temperature, and conductivity from a minimum of one replicate of every concentration. Analytical determinations are conducted according to APHA et al. (1995) and US EPA (1979).

3.10 Solution Renewal

The test solutions are renewed daily. New solutions are prepared on the day of renewal. After

the new solutions have reached test temperature, the test organisms are transferred from the old test vessels to the new test vessels using a pipet or glass tube. The offspring are counted and the number is recorded. Caution is given not to stress the test organisms during transfer. After neonates are counted and water quality measurements (temperature, pH, dissolved oxygen, and conductivity) are completed, the old solution is discarded.

3.11 Data Analysis

Statistical analyses are performed on percent survival and young production. Fisher's Exact Test is used to determine statistical significance of the survival data. Analysis of variance (ANOVA) and either Bonferroni's T-test or Dunnett's Mean Comparison test are used to analyze the young production data for significance of effects. Depending on the distributional characteristics of the data generated, it may be necessary to use Steele's Many-One Rank Test or the Wilcoxon Rank Sum Test instead (US EPA 1994). The Shapiro-Wilks test (for datasets with ≤ 50 datapoints) or the Chi-Square test is used to test for normality of the reproduction data. Bartlett's test is used to test for homogeneity of variance of the reproduction data. If requested before the initiation of the study, the young production data will be analyzed using EPA's ICp program to determine an IC50 and/or IC25. Although not standard practice, an LC50 may be calculated using the probit, moving average, and binomial methods as described by Stephan (1977). Depending on the nature of the data other methods may be used, including the probit approximation method of Litchfield and Wilcoxon (1949), SAS probit analysis (SAS Institute 1985) or graphical interpolation using the log concentration vs. percent lethality as described by APHA et al. (1995). The methods used are specified in the final report.

3.12 Test Acceptability

An individual test may be conditionally acceptable if temperature, dissolved oxygen, and other specified conditions fall outside specifications, depending on the degree of the departure and the objectives of the tests.

4. FINAL REPORT

The final report is prepared to contain, at a minimum, the following information:

- Objectives and procedures stated in the approved protocol, including any changes made to the original protocol

- Identity of the test article(s) by name or code number and their strength (i.e., quality/purity), and a description of any pretreatment

- Source of the dilution water, its chemical characteristics, and a description of any pretreatment
- Test concentration series used and duration of the assay
- Water quality characteristics (pH, dissolved oxygen, temperature, etc.) of dilution water and selected test concentrations during testing
- Any unforeseen circumstances that may have affected the quality or integrity of the study
- Signature of the project manager, senior technical reviewer, and quality control officer authorizing release of the report
- Location of all archived data and the original copy of the final report at EA

Items of data to be included in the report consist of experimental design and test performance, effects on general appearance of test organisms (if applicable), morbidity and mortality, presentation of water quality characteristics, survival and reproduction data.

5. QUALITY ASSURANCE

5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Protocol Amendment Form by EA after consultation with the client.

5.2 Standard Operating Procedures

Unless otherwise specified, all procedures given in the protocol are subject to detailed Standard Operating Procedures (SOPs) which are contained in the SOP manuals of the participating departments. These SOPs and protocols generally follow the types of requirements outlined in the U.S. EPA's Good Laboratory Practice Standards (GLPs) (US EPA 1989).

5.3 Reference Toxicant

A reference toxicant test, utilizing sodium dodecyl sulfate (SDS), cadmium chloride, NaCl, or another appropriate chemical is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted at least once monthly on organisms that are cultured in-house. The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA, to determine if the results are within acceptable limits. Limits are established using the control charts outlined in US EPA (1994).

5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is responsible for monitoring each study to assure the client that the facilities, equipment, personnel, methods, practices, records, and controls are in conformance with EA's QC program and, if applicable, EPA's GLPs.

5.5 Inspection by Regulatory Authorities

In the event of an inspection of EA by an outside authority during the course of the study, the client whose study is being inspected will be consulted before examiners are permitted access to any of the project records or the experimental areas.

5.6 Archives

Copies of project-specific records shall be transferred to the client promptly after the project is completed or as negotiated and budgeted. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, laboratory data sheets, records, memoranda, notes, photographs, microfilm, and computer printouts that are a result of the original observations and activities of the study and which are necessary for the reconstruction and evaluation of the study report.

5.7 Location

Studies are conducted at the Ecotoxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

6. SPECIFICATIONS OF THE *Ceriodaphnia dubia* SURVIVAL AND REPRODUCTIVE POTENTIAL TEST

6.1 Basic References

American Public Health Association (APHA) American Water Works Association, Water Environment Federation. 1995. Standard Methods for Examination of Water and Wastewater, 19th or most recent version. APHA, Washington, D.C.

EA. 1996. Quality Control and Standard Operating Procedures Manual for EA's Ecotoxicology Laboratory. Fifth Revision. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

Litchfield, J.T., and F. Wilcoxon. 1949. A simplified method of Evaluating Dose/Effect Experiments. J. Pharmacol. Exp. Ther. 96:99-113.

SAS Institute Inc. SAS Users Guide: Statistics, Version 5 Edition. Cary, NC:SAS Institute Inc., 1985.

Stephan, C.E. 1977. Methods of Calculating an LC50 in Aquatic Toxicology and Hazard Evaluation (F.L. Mayer and J.L. Hamlink, Eds.), pp. 65-84. ASTM STP 634, ASTM, Philadelphia, Pennsylvania.

US EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA/600/4-79/020. U.S. Environmental Protection Agency, Washington, D.C.

US EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. Fed. Regist. 54(158): 34034-34074.

US EPA. 1989. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Second Edition. EPA/600/4-89/001. U.S. Environmental Protection Agency, Cincinnati, Ohio.

US EPA. 1994. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Third Edition. EPA/600/4-91/002. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

6.2 Test Specifications

Test organism:	Water flea (*Ceriodaphnia dubia*)
Temperature:	Target: 25±1°C
Age:	<24 hours and all released within an 8-hour window
Aeration:	None
Light quality:	Wide-spectrum fluorescent light
Light intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Dilution water:	20 percent dilute mineral water, dechlorinated municipal tap water, reconstituted fresh water, or appropriate receiving water
Test containers:	30-ml plastic portion cups or beakers
Test volume:	15 ml per replicate
No. of concentrations:	Definitive assay - Minimum of five test concentrations and a control Screening assay - Single test concentration and a control
No. of replicates:	10
No. organisms per replicate:	1
Feeding regime:	200 μl of 5 g/L food solution (YCT and algae mixed) daily in each replicate (according to US EPA 1994)

Test type and duration:	Static renewal with daily replacement of test solutions. The test duration is determined when 60 percent of the control females have three broods; however, not exceeding 8 days.
Endpoints:	Survival of females used to initate test and number of young produced per female over the exposure period
Test acceptability:	80 percent or greater survival and an average of 15 or more young/surviving female in the control solution

LARVAL SURVIVAL AND GROWTH TEST WITH FATHEAD MINNOWS
(*Pimephales promelas*)

1. TEST OBJECTIVE

To assess the toxicity of a test material to *Pimephales promelas* and determine the effects on survival and growth (as determined by dry weight) of test animals compared to controls.

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test material is supplied by the client. Adequate chemical specifications with special reference to hazardous properties and storage conditions are also supplied by the client.

2.2 Methods of Synthesis

In most cases, the test article is an effluent sample. Information on the methods of synthesis, stability, and composition or other characteristics which define the test article are on file with the client.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

3.1.1 Species

The test species is the fathead minnow, *Pimephales promelas*.

3.1.2 Source

P. promelas used for toxicity tests are usually obtained from stock cultures maintained at EA's Culture Facility. However, organisms may be obtained from a scientific organism vendor, if necessary.

3.1.3 Culturing and Holding Conditions

P. promelas brood stock are maintained at 25±2°C and a 16-hour light, 8-hour dark photoperiod cycle in an environmentally controlled laboratory. Brood organisms are maintained in all glass aquaria in a recirculating system of dechlorinated municipal tap water. The eggs are held at 25±2°C throughout hatching. If eggs are obtained from a scientific vendor, the eggs, upon receipt, are transferred to static recirculating holding tanks of an appropriate size containing dechlorinated tap water at the temperature (±2°C) of the water in which the organisms were shipped. The eggs are slowly elevated to 25±2°C and examined regularly. Dead eggs, or those which appear unusually colored or malformed, are removed as observed, and recorded on appropriate log sheets. Certain regulatory or project specific objectives may require organism acclimation to the dilution water when it is different from the holding/culture water.

3.1.4 Age of Test Organisms at Test Initiation

Fathead minnow larvae (<24 hours old) are used for chronic toxicity testing. Under special circumstances (e.g., if eggs must be obtained from a scientific vendor), larvae used for chronic testing may be <48 hours old all hatched within a 24-hour window.

3.2 Dilution Water

The source of dechlorinated tap water is the City of Baltimore municipal water system. Upon entry to the laboratory, the water passes through a high-capacity, activated carbon filtration system to remove chlorine and other possible organic contaminants. This water source has proven safe for aquatic organism toxicity testing at EA, as evidenced by maintenance of multigeneration *Daphnia* sp. and fathead minnow cultures with no evident loss of fecundity. Reconstituted fresh water or other dilution water may be used depending on study requirements.

3.3 Test Concentration Series

The test concentration series consists of a minimum of five dilutions (e.g., 6.25, 12.5, 25, 50, and 100 percent effluent plus a control) and may be determined from a prior screening of the test material. Rangefinding assays utilize more widely spaced test concentrations and a control. Ambient water or effluent samples may also be evaluated as single concentrations and compared to a control.

3.4 Test Concentration Preparation

Test concentrations are prepared with Class A glassware.

3.5 Test Vessels and Test Volume

Test vessels are 1-L beakers; the final test volume is 250 ml. Other test vessels may be used depending on the study's requirements.

3.6 Test Organism Number

Tests are conducted using a minimum of three replicates, and as a standard practice four replicates, per concentration, with 10 organisms per container. Fish are randomly assigned to each replicate test container. More replicates can be added, if appropriate.

3.7 Test Environment

The test vessels are maintained in an environmentally controlled laboratory with a 16-hour light, 8-hour dark photoperiod. Temperature within the environmental room is monitored continuously using temperature recorders and is maintained at 25±1°C (unless a different project--specific temperature is required).

3.8 Analysis of Test Concentrations for Test Article

If required, test solutions may be analyzed for verification of chemical concentrations. The analytical method and number of analyses are determined after consultation with the client. When chemical analyses are necessary, both nominal and actual measured test concentrations are reported.

3.9 Test Observations

Each test day, test organisms are observed to record the number of surviving organisms. Dead organisms are removed when observed. The study terminates after 7 days. The study may be extended, however, at the request of the client.

Each effluent or receiving water sample received is analyzed for temperature, conductivity, alkalinity, hardness, and total residual chlorine. Aliquots of effluent and receiving water may be gently aerated (100 bubbles/min) prior to test initiation if dissolved oxygen is less than 4 mg/L or greater than 100 percent saturation. After test initiation, if the dissolved oxygen in

any test chamber is less than 4 mg/L, all test chambers are gently aerated or other corrective action is taken. Water quality measurements recorded daily on old and new test solutions include dissolved oxygen, pH, temperature, and conductivity from a minimum of one replicate of every concentration. Analytical determinations are conducted according to APHA et al. (1995) and US EPA (1979).

At the end of the test period, surviving fish are rinsed and placed in pre-weighed, oven dried aluminum pans (one replicate per pan). Fish are oven dried for a minimum of 6 hours at 100°C after which each pan is weighed to determine the mean dry weight of the fish. Mean dry weights are calculated based on the number of surviving organisms (per EPA guidance EPA/600/4-89/001), or based on the original number of exposed organisms (per EPA guidance EPA/600/4-91/002).

3.10 Solution Renewal (When Applicable)

The test solution is renewed daily. New solutions are prepared on the day of renewal. After the new solutions have reached test temperature and water quality measurements (temperature, pH, dissolved oxygen, and conductivity) are completed, the solution renewal may be performed by transferring the organisms from one test chamber to another or by replacing the test solution. If the test solution replacement method is used, caution must be given not to stress the test organisms while the test chamber is siphoned. Usually 75 percent of the old solution is removed and replaced; however, the amount is dependent on the size of the test organisms. The larvae in each test chamber are fed 0.1 ml (approximately 700 to 1,000) of a concentrated suspension of newly hatched (<24 hours old) brine shrimp nauplii (*Artemia sp.*) three times daily (morning, early afternoon, and the end of the work day). The nauplii are rinsed with dechlorinated tap water before feeding.

3.11 Data Analysis

Statistical analyses are performed on percent survival and mean dry weight data. Analysis of variance (ANOVA) and either Bonferroni's T-test or Dunnett's Mean Comparison test are used to analyze the survival and mean weight data for significance of effects. Depending on the distributional characteristics of the data generated, it may be necessary to use Steele's Many-One Rank Test or the Wilcoxon Rank Sum Test instead (US EPA 1994). The Shapiro-Wilks test (for datasets with ≤50 datapoints) or the Chi-Square test is used to test for normality of the reproduction data. Bartlett's test is used to test for homogeneity of variance of the reproduction data. If requested before the initiation of the study, growth data will be analyzed using EPA's ICp program to determine an IC50 and/or IC25. Although not standard practice, an LC50 may be calculated using the probit, moving average, and binomial methods as

described by Stephan (1977). Depending on the nature of the data, other methods may be used, including the probit approximation method of Litchfield and Wilcoxon (1949), SAS probit analysis (SAS Institute 1985) or graphical interpolation using the log concentration vs. percent lethality as described by APHA et al. (1995). The methods used are specified in the final report.

3.12 Test Acceptability

An individual test may be conditionally acceptable if temperature, dissolved oxygen, and other specified conditions fall outside specifications, depending on the degree of the departure and the objectives of the tests.

4. FINAL REPORT

The final report is prepared to contain, at a minimum, the following information:

- Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- Identity of the test article(s) by name or code number and their strength (i.e., quality/purity), and a description of any pretreatment
- Source of the dilution water, its chemical characteristics, and a description of any pretreatment
- Test concentration series used and duration of the assay
- Mean dry weights of test fish with the respective standard deviations
- Water quality characteristics (pH, dissolved oxygen, temperature, etc.) of dilution water and selected test concentrations during testing
- Any unforeseen circumstances that may have affected the quality or integrity of the study
- Signature of the project manager, senior technical reviewer, and quality control officer authorizing release of the report
- Location of all archived data and the original copy of the final report at EA

Items of data to be included in the report consist of experimental design and test performance, effects on general appearance of test organisms (if applicable), morbidity and mortality, presentation of water quality characteristics, survival and growth data.

5. QUALITY ASSURANCE

5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Protocol Amendment Form by EA after consultation with the client.

5.2 Standard Operating Procedures

Unless otherwise specified, all procedures given in the protocol are subject to detailed Standard Operating Procedures (SOPs) which are contained in the SOP manuals of the participating departments. These SOPs and protocols generally follow the types of requirements outlined in the U.S. EPA's Good Laboratory Practice Standards (GLPs) (US EPA 1989).

5.3 Reference Toxicant

A reference toxicant test, utilizing sodium dodecyl sulfate (SDS), cadmium chloride, or another appropriate chemical is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted at least once monthly on organisms which are cultured in-house, and on each population of organisms purchased for testing from an outside source if reference toxicant data are not available from the supplier on the acquired lot. The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA to determine if the results are within acceptable limits. Limits are established using the control charts outlined in US EPA (1994).

5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is responsible for monitoring each study to assure the client that the facilities, equipment, personnel, methods, practices, records, and controls are in conformance with EA's QC program and, if applicable, EPA's GLPs.

5.5 Inspection by Regulatory Authorities

In the event of an inspection of EA by an outside authority during the course of the study, the client whose study is being inspected will be consulted before examiners are permitted access to any of the project records or the experimental areas.

5.6 Archives

Copies of project-specific records shall be transferred to the client promptly after the project is completed or as negotiated and budgeted. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, laboratory data sheets, records, memoranda, notes, photographs, microfilm, and computer printouts that are a result of the original observations and activities of the study and which are necessary for the reconstruction and evaluation of the study report.

5.7 Location

Studies are conducted at the Ecotoxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

6. SPECIFICATIONS OF THE FATHEAD MINNOW SURVIVAL AND GROWTH TOXICITY TEST

6.1 Basic References

American Public Health Association (APHA), American Waterworks Association, Water Environment Federation. 1995. Standard Methods for Examination of Water and Wastewater, 19th or most recent version. APHA, Washington, D.C.

EA. 1996. Quality Control and Standard Operating Procedures Manual for EA's Ecotoxicology Laboratory. Fifth Revision. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

Litchfield, J.T., and F. Wilcoxon. 1949. A simplified method of Evaluating Dose/Effect Experiments. J. Pharmacol. Exp. Ther. 96:99-113.

SAS Institute Inc. SAS Users Guide: Statistics, Version 5 Edition. Cary, NC:SAS Institute Inc., 1985.

Stephan, C.E. 1977. Methods of Calculating an LC50 in Aquatic Toxicology and Hazard Evaluation (F.L. Mayer and J.L. Hamlink, Eds.), pp. 65-84. ASTM STP 634, ASTM, Philadelphia, Pennsylvania.

US EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA/600/4-79/020. U.S. Environmental Protection Agency, Washington, D.C.

US EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. Fed. Regist. 54(158): 34034-34074.

US EPA. 1989. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Second Edition. EPA/600/4-89/001. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1994. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Third Edition. EPA/600/4-91/002. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

6.2 Test Specifications

Test organism:	Fathead minnow (*Pimephales promelas*)
Temperature:	25±1°C
Organism age:	Preferably <24 hours old. If eggs are obtained from scientific vendor, larvae may be <48 hours old (24-hour window) at test initiation
Aeration:	None, unless dissolved oxygen falls below 4 mg/L
Light quality:	Wide-spectrum fluorescent light
Light intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark

Dilution water:	Dechlorinated municipal tap water, reconstituted fresh water, or appropriate receiving water
Test containers:	1-L beaker
Test volume:	250 ml per replicate
No. of concentrations:	Definitive assay - Minimum of five test concentrations and a control Screening assay - Single test concentration and a control
No. of replicates:	4 (minimum of 3)
No. organisms per replicate:	10
Feeding regime:	Feed 0.1 ml newly hatched (<24-hour old) brine shrimp nauplii three times daily (morning, afternoon, evening).
Test type and duration:	Static renewal, test duration 7 days
Endpoints:	Survival and growth
Test acceptability:	80 percent or greater survival in the control solution; average dry weight of surviving controls equals or exceeds 0.25 mg.

SEDIMENT TOXICITY TEST (DAILY RENEWAL) WITH *Hyalella azteca*

1. TEST OBJECTIVE

To assess the toxicity of a whole sediment sample to *Hyalella azteca* and determine the effects on survival (growth optional) of the test organisms compared to controls.

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test material is supplied by the client. Adequate chemical specifications with special reference to hazardous properties and storage conditions are also supplied by the client.

2.2 Methods of Synthesis

Test article is a whole sediment sample. Information on the methods of synthesis, stability, and composition or other characteristics which define the test article are on the file with the client.

2.3 Sample Preparation

Depending upon the project, the sediment may be screened through a suitably sized sieve to remove large particles and indigenous organisms, and homogenized before being placed in the test chambers. Sediment and overlying water should be added to test vessels one day prior to introduction of test organisms in order to allow suspended sediments to settle.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

3.1.1 Species

The test species is the amphipod, *Hyalella azteca*.

3.1.2 Source

H. azteca used for toxicity tests are obtained from EA cultures or from a scientific organism vendor as specified in the report.

3.1.3 Culturing and Holding Conditions

Stocks obtained from a scientific vendor are transferred into recirculating holding tanks containing hardwood leaves which have been presoaked or boiled to remove tannins. The organisms are gradually acclimated to testing conditions and to the overlying water used in testing. During the holding period, the *H. azteca* are fed Tetramin flake food weekly in addition to the hardwood leaves. Dead organisms or these displaying abnormal behavior, discoloration, or pronounced lethargy are removed as observed, and recorded on appropriate log sheets as part of the quality control program. Certain regulatory or project specific objectives may require organism acclimation to the dilution water when it is different from the holding/culture water.

3.1.4 Age of Test Organisms at Test Initiation

Juvenile organisms, 7 to 14 days old at test initiaion, are used for the toxicity testing. If growth is used as a test endpoint, then pre-test length or weight should be measured on a subset of at least 20 organisms of the same age as those used to start the test.

3.2 Test Concentration Series

H. azteca are exposed in replicate chambers to sediment samples and to a laboratory or reference sediment control. Screening assays may be conducted on whole sediment samples. Alternatively, a definitive (multi-concentration test) may be conducted on a sample using a laboratory or reference sediment to prepare the test concentrations.

3.3 Overlying Water

The overlying water is typically dechlorinated tap water. The source of dechlorinated tap water is the City of Baltimore municipal water system. Upon entry to the laboratory, the water passes through a high-capacity, activated-carbon filtration system to remove chlorine and other possible organic contaminants. This water source has proven safe for aquatic organism toxicity testing at EA, as evidenced by maintenance of the multigeneration *Daphnia* and *Pimephales promelas* cultures, with no evident loss of fecundity. Reconstituted fresh water or other dilution water (e.g. site water) may be used depending on study requirements.

3.4 Test Vessels and Test Volume

Test vessels are typically 300-ml high-form lipless beakers, each containing 100 ml volume of sediment and 175 ml volume of overlying water. The size of the test vessels, and the volume of sediment and overlying water may be changed depending upon the study requirements.

3.5 Test Organism Number

The number of replicate chambers per treatment depends on the test objective. Five to eight replicates are recommended for routine testing. Each replicate test chamber has 10 organisms. To introduce the test organisms into the test chambers, ten *H. azteca* are randomly assigned to 30-ml portion cups. One cup of 10 organisms is then randomly added to each replicate. Prior to organism transfer, the volume of each transfer portion cup is reduced.

3.6 Test Environment

The test vessels are maintained in an environmentally controlled laboratory with a 16-hour light, 8-hour dark photoperiod. Temperature within the environmental room is monitored continuously using temperature recorders and is maintained at 23±1°C (unless a different project-specific temperature is required). The instantaneous temperature must always be within ±3°C of the desired temperature, and the daily mean temperature must be within ±1°C of the desired temperature.

3.7 Test Observations

The overlying water is renewed daily, either continuously or intermittently, at a rate of at least 1-2 volume additions/day.

Test organisms are fed a suspension of yeast/cereal leaves/trout chow (YCT) during the exposure period. However, the amount of food added to the test chambers is kept to a minimum to avoid fungal or bacterial growth on the sediment surface. A typical feeding rate is 1.0 to 1.5 ml YCT daily per replicate. If the dissolved oxygen concentration drops below 40 percent of saturation in the overlying water of a replicate, then feeding should be suspended in all replicates until the dissolved oxygen concentration increases to ≥40 percent.

Samples of overlying water from the test sediment and control or reference sediment are analyzed for conductivity, alkalinity, hardness, pH, and ammonia at test initiation and termination. Water samples from the replicates of a treatment may be pooled for analysis. Measurements of water quality are taken daily thereafter for dissolved oxygen and temperature

from a minimum of one replicate of each sediment, reference, and control treatment. The overlying water may be gently aerated, if necessary, to maintain dissolved oxygen levels at or above 40 percent of saturation. Analytical determinations are conducted according to APHA et al. (1995) and US EPA (1979).

The study terminates after 10 days of exposure to the sediment sample. At test termination, test organisms are observed to record the number of surviving *H. azteca* in each replicate. If growth is used as an endpoint, surviving *H. azteca* at the end of the test period may be placed into pre-weighed, oven-dried aluminum pans (one replicate per pan). Organisms are oven dried for a minimum of six hours at 100°C after which each pan is weighed. Mean dry weight of the *H. azteca* (weight of pan and organisms minus weight of pan/number of organisms) is calculated.

3.8 Data Analysis

Statistical analyses are performed on percent survival and mean dry weight data. For screening tests, a t-test is conducted to determine if a single test sample is significantly different from the control. For definitive assays, an analysis of variance (ANOVA) and either Bonferroni's T-Test or Dunnett's Mean Comparison Test are used to analyze significance of effects. Depending on the distributional characteristics of the data generated, it may be necessary to use Steel's Many-One Rank Test or the Wilcoxon Rank Sum Test instead (US EPA 2000). An LC50 and/or EC50 may be calculated from a definitive test using the probit, moving average, and binomial methods as described by Stephan (1977). Depending on the nature of the data, other methods may be used including the Trimmed Spearman-Karber method, the probit approximation method of Litchfield and Wilcoxon (1949), SAS probit analysis (SAS Institute 1985), or graphical interpolation using the log concentration vs. percent mortality and/or percent affected as described by APHA et al. (1995). The statistical methods are specified in the final report.

4. FINAL REPORT

The final report is prepared to contain, at a minimum, the following information:

- Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- Identity of the test article(s) by name or code number and their strength (i.e., quality/purity), and a description of any pretreatment

- Source of the overlying water, its chemical characteristics, and a description of any pretreatment
- Test concentration series used and duration of the assay
- Mean dry weights of test organisms with the respective standard deviations
- Water quality characteristics (pH, dissolved oxygen, temperature, etc.) of overlying water from reference, control, and test sediment treatments
- Any unforeseen circumstances that may have affected the quality or integrity of the study
- Signature of the project manager, senior technical reviewer, and quality control officer authorizing release of the report
- Location of all archived data and the original copy of the final report at EA

Items of data to be included in the report consist of experimental design and test performance, effects on general appearance of test organisms (if applicable), morbidity and mortality, presentation of water quality characteristics, and survival and weight data.

5. QUALITY ASSURANCE

5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Protocol Amendment Form by EA after consultation with the client.

5.2 Standard Operating Procedures

Unless otherwise specified, all procedures given in the protocol are subject to detailed Standard Operating Procedures (SOPs) which are contained in the SOP manuals of the participating departments. These SOPs and protocols generally follow the type of requirements in the U.S. EPA's Good Laboratory Practice Standards (GLPs) (US EPA 1989).

5.3 Reference Toxicant

A reference toxicant test, utilizing potassium chloride (KCl), copper sulfate, or another appropriate chemical, is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted periodically (at least semiannually) on organisms which are cultured in-house, and on each population of organisms purchased for testing from an outside source (if reference toxicant data are not available from the organism supplier). The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA, to determine if the results are within acceptable limits. Limits are established using the control charts outlined in US EPA (1993).

5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is responsible for monitoring each study to assure the client that the facilities, equipment, personnel, methods, practices, records, and controls are in conformance with EA's QC program and, if applicable, EPA's GLPs.

5.5 Inspection by Regulatory Authorities

In the event of an inspection of EA by an outside authority during the course of the study, the client whose study is being inspected will be consulted before examiners are permitted access to any of the project records or the experimental areas.

5.6 Archives

Copies of project-specific records shall be transferred to the client promptly after the project is completed or as negotiated and budgeted. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, laboratory data sheets, records, memoranda, notes, photographs, microfilm, and computer printouts that are a result of the original observations and activities of the study and which are necessary for the reconstruction and evaluation of the study report.

5.7 Location

Studies are conducted at the Ecotoxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

6. SPECIFICATIONS OF THE *Hyalella azteca* SEDIMENT TOXICITY TEST

6.1 Basic References

American Public Health Association (APHA) American Water Works Association, Water Envrionment Federation. 1995. Standard Methods for Examination of Water and Wastewater, 19th or most recent version. APHA, Washington, D.C.

American Society for Testing and Materials (ASTM). 1991. Standard Practice for Conducting Acute Tests with Fishes, Macroinvertebrates, and Amphibians. ASTM Designation: E729-80, Philadelphia, Pennsylvania.

American Socity for Testing and Materials (ASTM). 1991. Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates. ASTM Designation: E1383-90, Philadelphia, Pennsylvania

American Society for Testing and Materials (ASTM). 1995. Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates. ASTM Designation: E1706-95, Philadelphia, Pennsylvania.

EA. 1996. Quality Control and Standard Operating Procedures Manual for EA's Ecotoxicology Laboratory. Fifth Revision. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

US EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA/600/4-79/020. U.S. Environmental Protection Agency, Washington, D.C.

US EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. Fed. Regist. 54(158): 34034-34074.

US EPA. 1993. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027F. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1994. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Third Edition. EPA/600/4-91/002. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064. U.S. Environmental Protection Agency, Office of Research and Development, Duluth, Minnesota.

6.2 Test Specifications

Test organism:	*Hyalella azteca*
Organism age:	Juvenile (7-14 days old at start of test)
Aeration:	None, unless dissolved oxygen falls below 40% saturation; gentle aeration should be provided through a 1-ml glass pipet, placed no closer than 2 cm above the sediment surface.
Temperature:	23±1°C
Light quality:	Wide-spectrum fluorescent light
Light intensity:	10-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Overlying water:	Dechlorinated municipal tap water, reconstituted fresh water, or appropriate receiving water
Test container:	300-ml beaker
Test volume:	100 ml sediment with 175 ml overlying water
No. of replicates:	5 to 8
No. organisms per replicate:	10

Feeding regime:	1.0 to 1.5 ml YCT daily per replicate
Test duration:	10 days
Endpoints:	Survival (growth optional)
Test acceptability:	≥80 percent survival in the control sediment

BIOACCUMULATION TEST FOR SOIL AND SEDIMENT USING *Eisenia* sp.

1. TEST OBJECTIVE

To assess the toxicity and bioaccumulative effects of a soil and/or sediment sample to *Eisenia foetida* (red worm) or other earthworm species.

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test material is supplied by the client. The test article is a soil and/or sediment sample. Adequate chemical and/or biological specifications with special reference to hazardous properties and storage conditions are also supplied by the client. When available, information on the stability, composition, or other characteristics which define the test article are on the file with the client.

2.2 Sample Preparation

Minimal manipulation of the samples is performed in order to evaluate the samples in as close to in situ conditions as possible. Samples can be sieved, if necessary, to remove stones and rocks and then homogenized. Percent moisture of each sample is evaluated using ASTM (D421) standard guide. The percent moisture of the samples may be adjusted as appropriate to meet study objectives (e.g., 35-45% moisture or 75% of water holding capacity). The pH of the samples is determined and may be adjusted (depending on project requirements) using calcium carbonate and dilute mineral acid (HCl) and base (NaOH) if outside the pH range of ≥ 4 but ≤ 10.

An artificial soil/sediment or appropriate project specific reference site soil/sediment is used to evaluate the effect of the test samples to the worms. An artificial soil can be used as the control soil (laboratory control) following the formulation presented in EPA Region IV Standard Operating Procedures for the Toxicity Testing Hazardous Waste Assessment (Harris, et al. 1990). The following constituents are mixed together on a dry weight basis to produce the artificial soil: 10 percent sphagnum peat moss; 20 percent kaolinite clay; and 70 percent grade 70 silica sand. Addition of calcium carbonate (approximately 0.4 percent) is added to adjust to the pH range of 6.5 ± 0.5.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

3.1.1 Species

The test species is the red worm *Eisenia foetida* or other earthworm species.

3.1.2 Source

E. foetida or other earthworm species used for toxicity tests are obtained from an organism vendor as specified in the report.

3.1.3 Culturing and Holding Conditions

E. foetida used in testing are purchased commercially. Organisms are gradually acclimated to testing temperature in an environmentally controlled laboratory at 20±2°C, with a 16-hour light, 8-hour dark photoperiod. If the organisms need to be held for several days, the cultures can be fed manure and/or baby food *ad libitum*.

3.1.4 Age of Test Organisms at Test Initiation

Adult worms used to initiate testing should be >300 mg (wet weight).

3.2 Test Concentration Series

E. foetida are exposed in replicate chambers to whole soil or sediment samples and to a laboratory control and/or reference sample.

3.3 Test Vessels and Test Volume

Test vessels are typically 10-gal glass aquaria containing approximately 1-gal of sample. The size of the test vessels and the volume of sediment may be changed depending on the study requirements.

3.4 Test Organism Number

The number of organisms exposed per sample should provide enough tissue at the end of the exposure period for the selected chemical analyses. Tests are typically conducted using a

minimum of three replicates per sample with 100 organisms randomly assigned per chamber. A standard loading ratio not to be exceeded is 100 worms per 2,000 g dry weight of sample. The number of replicates and the total number of organisms exposed per sample may be changed depending on the study requirements.

3.5 Test Environment

The test vessels are securely covered (e.g., with plexiglass covers) and are maintained in an environmentally controlled laboratory with continuous lighting. Temperature within the environmental room is monitored continuously using temperature recorders and is maintained at 20±1 °C for the 28-day exposure period (unless a different project-specific temperature is required).

3.6 Test Observations

The samples are loaded into the test chambers the day before the worms are introduced to allow the temperature of the samples to equilibrate to the testing temperature. The introduction of the organisms on the following day marks the initiation of the bioaccumulation test. The organisms are observed daily thereafter and observations of non-burial are recorded. Any organisms which have crawled up the side of the exposure chamber are gently placed back onto the surface of the sample. The organisms are not fed during testing.

The study terminates after 28 days of exposure. At test termination, the number of surviving test organisms in each replicate is recorded. Death is defined by a lack of response to a gentle prod to the anterior of the test animal. Worms decompose rapidly in soil, and those organisms not found are presumed dead. The surviving organisms per replicate are then processed accordingly for chemical analyses.

3.7 Data Analysis

Statistical analyses can be performed on percent survival and on chemical concentrations analyzed in each sample. An analysis of variance (ANOVA) and t-Test are used to analyze significance of effects between the control sediment and a single test sediment (US EPA 1994). Alternatively, Tukey's Test may be performed to check the difference between all pairs of treatments. Other appropriate statistical analyses may be performed. The statistical methods used are specified in the final report.

4. FINAL REPORT

The final report is prepared to contain, at a minimum, the following information:

- Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- Identity of the test article(s) by name or code number and a description of any pretreatment
- Duration of the assay
- Survival observations recorded during the test
- Any unforeseen circumstances that may have affected the quality or integrity of the study
- Signature of the project manager, senior technical reviewer, and quality control officer authorizing release of the report
- Location of all archived data and the original copy of the final report at EA

Items of data to be included in the report consist of experimental design and test performance, effects on general appearance of test organisms (if applicable), morbidity and mortality, survival data, and percent moisture and pH of test samples.

5. QUALITY ASSURANCE

5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Protocol Amendment Form by EA after consultation with the client.

5.2 Standard Operating Procedures

Unless otherwise specified, all procedures given in the protocol are subject to detailed Standard Operating Procedures (SOPs) which are contained in the SOP manuals of the participating departments. These SOPs and protocols generally follow the type of requirements in the U.S.

EPA's Good Laboratory Practice Standards (GLPs) (US EPA 1989).

5.3 Reference Toxicant

A reference toxicant test, utilizing 2-Chloroacetamide, or another appropriate chemical is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted on each population of organisms purchased for testing from an outside source if reference toxicant data are not available from the supplier on the acquired lot. The tests are performed as a 48-hour filter paper contact test. The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA, to determine if the results are within acceptable limits. Limits are established using the control charts outlined in US EPA (1993).

5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is responsible for monitoring each study to assure the client that the facilities, equipment, personnel, methods, practices, records, and controls are in conformance with EA's QC program and, if applicable, EPA's GLPs.

5.5 Inspection by Regulatory Authorities

In the event of an inspection of EA by an outside authority during the course of the study, the client whose study is being inspected will be consulted before examiners are permitted access to any of the project records or the experimental areas.

5.6 Archives

Copies of project-specific records shall be transferred to the client promptly after the project is completed or as negotiated and budgeted. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, laboratory data sheets, records, memoranda, notes, photographs, microfilm, and computer printouts that are a result of the original observations and activities of the study and which are necessary for the reconstruction and evaluation of the study report.

5.7 Location

Studies are conducted at the Ecotoxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

6. SPECIFICATIONS OF THE *Eisenia* sp. BIOACCUMULATION TEST

6.1 Basic References

American Public Health Association (APHA), American Water Works Association, Water Environment Federation. 1995. Standard Methods for Examination of Water and Wastewater, 19th or most recent version. APHA, Washington, D.C.

American Society for Testing and Materials (ASTM). 1995. Standard Guide for Conducting a Laboratory Soil Toxicity Test with Lumbricid Earthworm *Eisenia foetida*. ASTM Designation: E1670-95, Philadelphia, Pennsylvania.

Athey, L.A., J.M. Thomas, J.R. Skalski, and W.E. Miller. 1987. Role of Acute Toxicity Bioassays in The Remedial Action Process at Hazardous Waste Sites. U.S. Environmental Protection Agency, Corvallis, Oregon. EPA/600/8-87-044.

Callahan, C.A., L.K. Russell, and S.A. Peterson. 1985. Comparison of Three Earthworm Bioassay Procedures for The Assessment of Environmental Samples Containing Hazardous Wastes. U.S. Environmental Protection Agency, Corvallis, Oregon. EPA/600/J-85/447.

EA. 1996. Quality Control and Standard Operating Procedures Manual for EA's Ecotoxicology Laboratory. Fifth Revision. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

Green, J.C., C.L. Bartels, W.J. Warren-Hicks, B.R. Parkhurst, G.L. Linder, S.A. Peterson, and W.E. Miller. 1989. Protocols for the Short-Term Screening of Hazardous Waste Sites. EPA 600/3-88/029.

Harris, T., J. Glover, and J. Maudsley. 1990. Region IV Standard Operating Procedure for Toxicity Testing Hazardous Waste Assessments. U.S.EPA. Region IV, Athens, Georgia.

Litchfield, J.T., Jr. and F. Wilcoxon. 1949. A simplified method of evaluating dose-effect experiments. J. Pharm. Exp. Ther. 96:99-113.

Peltier, W.H., and C.I. Weber. 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. EPA/600/4-85/013. U.S. Environmental Protection Agency. Cincinnati, Ohio.

SAS Institute Inc. 1985. SAS® User's Guide: Basics, Version 5 Edition. Cary, NC: SAS Institute Inc. 1290 pp.

Stephan, C.E. 1977. Methods for calculating an LC50, in Aquatic Toxicology and Hazard Evaluation (F.L. Mayer and J.L. Hamelink, eds.), pp. 65-84. ASTM STP 634. American Society for Testing and Materials, Philadelphia, Pennsylvania.

US EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. Fed. Regist. 54(158): 34034-34074.

US EPA. 1989. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Second Edition. EPA/600/4-89/001.
U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1991. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1993. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027F. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1994. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Third Edition. EPA/600/4-91/002. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

6.2 Test Specifications

Test organism: *Eisenia foetida* or other earthworm

Organism age:	Adult (>300 mg wet weight)
Test Type:	Static
Temperature:	20±1°C
Light quality:	Wide-spectrum fluorescent light
Light intensity:	50-100 f.c.
Photoperiod:	24-hour light/0-hour dark
Test container:	10-gal glass aquaria
Sample volume:	approximately 1-gal per replicate
Test soil pH:	≥4 but ≤10 (s.u.)
Artificial soil laboratory control (% weight):	10% sphagnum peat, 20% colloidal clay, 70% silica sand
No. of replicates:	A minimum of 3 replicates
No. organisms per container:	100, not to exceed 100 worms per 2,000 g dry weight of sample
Feeding regime:	Organisms not fed during testing
Test duration:	28 days
Endpoints:	Survival and bioaccumulated concentration of selected chemical parameters
Test acceptability:	≥80 percent survival in control sample

SEDIMENT BIOACCUMULATION TEST WITH AN AQUATIC OLIGOCHAETE SPECIES

1. TEST OBJECTIVE

To assess the toxicity and bioaccumulative effects of a whole sediment sample to an aquatic oligochaete species.

2. TEST ARTICLE

2.1 Description/Identification

Unless otherwise specified, the test material is supplied by the client. The test article is a soil and/or sediment sample. Adequate chemical and/or biological specifications with special reference to hazardous properties and storage conditions are also supplied by the client. When available, information on the stability, composition, or other characteristics which define the test article are on the file with the client.

2.2 Methods of Synthesis

The test article is a whole sediment sample. Information on the methods of synthesis, stability, and composition or other characteristics which define the test article are on the file with the client.

2.3 Sample Preparation

Depending upon the project, the sediment may be screened through a suitably sized sieve to remove large particles and indigenous organisms, and homogenized before being placed in the test chambers. Sediment and overlying water should be added to test vessels 24 hours prior to introduction of test organisms in order to allow suspended sediments to settle.

3. EXPERIMENTAL DESIGN

3.1 Test Organisms

3.1.1 Species

The test species is an aquatic oligochaete species, as specified by the project study plan. A

commonly tested oligochaete species is *Lumbriculus variegatus*. Selection of test species is dependent on project-specific requirements.

3.1.2 Source

The oligochaete organisms used for toxicity tests are obtained from a biological supplier or from in-house laboratory cultures as specified in the final report.

3.1.3 Holding Conditions

Acquired organisms are transferred to holding tanks of fresh water upon receipt at EA's Culture Facility. Prior to use in testing, organisms are held in the laboratory a minimum of 24 hours and are gradually acclimated to testing conditions. During the holding period, dead or unhealthy organisms are removed as observed and recorded on appropriate log sheets as part of the quality control program. Certain regulatory or project specific objectives may require organism acclimation to the dilution water when it is different from the holding/culture water.

3.2 Test Concentration Series

The oligochaete species is exposed in replicate chambers to whole sediment samples. A reference and/or laboratory sediment may also be evaluated.

3.3 Overlying Water

Overlying water for sediment tests is either dechlorinated tap water, moderately hard synthetic fresh water, or an appropriate receiving water. Batches of synthetic fresh water are prepared using the formulation in US EPA (1993).

The source of the dechlorinated tap water is the City of Baltimore municipal water system. Upon entry to the laboratory, the water passes through a high-capacity, activated carbon filtration system to remove chlorine and possible organic contaminants. This water source has proven safe for aquatic organism toxicity testing at EA, as evidenced by maintenance of multigeneration *Daphnia* sp. and fathead minnow cultures with no evident loss of fecundity. The dechlorinated tap water or deionized tap water is mixed with commercially available synthetic sea salts to a salinity specified by the project study plan.

3.4 Test Vessels and Test Volume

Test chambers can range from 1-L beakers to 5-gallon aquaria, depending on the tissue requirement of each specific study, which contain enough sediment to provide an even layer of approximately 2-5 cm on the bottom of each chamber. Overlying water is added to each replicate to bring the total volume to at least ½ to ⅔ the total chamber volume.

3.5 Test Organism Size and Number

Test organisms should be approximately equal in size and should provide enough tissue per replicate for the selected chemical analyses after the test exposure period. The toxicity test is typically conducted with five replicates per test sediment and reference or laboratory sediment, with at least 5 grams of organism tissue per replicate.

3.6 Test Environment

The test vessels are maintained in an environmentally controlled laboratory with a 16-hour light, 8-hour dark photoperiod. Temperature within the environmental room is monitored continuously using temperature recorders and is maintained at 23±1°C (unless a different project-specific temperature is required).

3.7 Test Procedures and Observations

Test organisms are randomly distributed into the test chambers 24 hours after addition of the sediment and overlying water to the test vessels. The ratio of total organic carbon in sediment to dry weight of organisms at the start of the test should be no less than 50:1. Test organisms may be fed Tetramin flake food for the duration of the test; however, test chambers should be examined daily for the formation of fungus or the accumulation of excess food on the sediment surface. Gentle aeration should be initiated in all replicates if the dissolved oxygen level in any replicate drops below 60 percent saturation. Test chambers are examined daily for general organism appearance and behavior and obvious organism mortality.

Depending on project-specific requirements, the overlying water may be renewed during the test. Renewals are accomplished by siphoning the overlying water from each tank to a level approximately 2 cm above the sediment surface. Fresh overlying water is then slowly introduced to each tank so as not to disturb the sediment surface. Alternatively, the test may be conducted under a continuous flow-through system if required by the project.

Samples of overlying water from each test sediment and reference or laboratory sediment may be analyzed for conductivity, alkalinity, hardness, ammonia, and total residual chlorine. Measurements of water quality are taken at test initiation and daily thereafter for dissolved oxygen, pH, temperature, and conductivity from a minimum of one replicate of each test sediment and reference or laboratory sediment. Analytical determinations are conducted according to APHA et al. (1998) and US EPA (1979). Aliquots of overlying water may be gently aerated, if necessary, to maintain dissolved oxygen levels at or above 60 percent saturation.

The toxicity test terminates after the 28 day exposure period. The test duration may be extended at the request of the client. Test organisms are recovered from the test chambers, transferred to clean freshwater chambers (one chamber per replicate), and held at least 24 hours to purge the digestive tracts. The organisms are not fed during the purge period and any organisms that die during this time are recorded and removed if possible. Organisms are then removed from the holding tanks and processed accordingly for the chemical analyses.

3.8 Data Analysis

Statistical analyses can be performed on chemical concentrations analyzed in each sediment sample. An analysis of variance (ANOVA) and t-Test are used to analyze significance of effects between the control sediment and a single test sediment (US EPA 1994). Alternatively, Tukey's Test may be performed to check the difference between all pairs of treatments. Other appropriate statistical analyses may be performed. The statistical methods used are specified in the final report.

4. FINAL REPORT

The final report is prepared to contain, at a minimum, the following information:

- Objectives and procedures stated in the approved protocol, including any changes made to the original protocol
- Identity of the test article(s) by name or code number and their strength (i.e., quality/purity), and a description of any pretreatment
- Source of the overlying water, its chemical characteristics, and a description of any pretreatment
- Test treatments used and duration of the assay

- Organism tissue mass per replicate
- Water quality characteristics (pH, dissolved oxygen, temperature, etc.) of overlying water from reference, control, and test sediment treatments
- Any unforeseen circumstances that may have affected the quality or integrity of the study
- Signature of the project manager, senior technical reviewer, and quality control officer authorizing release of the report
- Location of all archived data and the original copy of the final report at EA

Items of data to be included in the report consist of experimental design and test performance, effects on general appearance of test organisms (if applicable), morbidity and mortality, and presentation of water quality characteristics.

5. QUALITY ASSURANCE

5.1 Amendments to Protocol

Amendments to the authorized protocol established by EA or by the client are made only after proper authorization. Such authorization is achieved by completion of the Protocol Amendment Form by EA after consultation with the client.

5.2 Standard Operating Procedures

Unless otherwise specified, all procedures given in the protocol are subject to detailed Standard Operating Procedures (SOPs) which are contained in the SOP manuals of the participating departments. These SOPs and protocols generally follow the type of requirements in the U.S. EPA's Good Laboratory Practice Standards (GLPs) (US EPA 1989).

5.3 Reference Toxicant

A reference toxicant test, utilizing sodium dodecyl sulfate (SDS), copper sulfate, or another appropriate chemical is used as an internal quality check of the sensitivity of the test organisms. Testing is conducted on each population of organisms purchased for testing from

an outside source if reference toxicant data are not available from the supplier on the acquired lot. The results of each test are compared with historical, species-specific toxicological information from reference toxicant tests performed at EA, to determine if the results are within acceptable limits. Limits are established using the control charts outlined in US EPA (1993).

5.4 Quality Assurance Evaluation

Studies conducted under this protocol may be subject to internal audit by EA's Quality Assurance Unit. A quality control officer is responsible for monitoring each study to assure the client that the facilities, equipment, personnel, methods, practices, records, and controls are in conformance with EA's QC program and, if applicable, EPA's GLPs.

5.5 Inspection by Regulatory Authorities

In the event of an inspection of EA by an outside authority during the course of the study, the client whose study is being inspected will be consulted before examiners are permitted access to any of the project records or the experimental areas.

5.6 Archives

Copies of project-specific records shall be transferred to the client promptly after the project is completed or as negotiated and budgeted. Original primary data are retained at EA for 5 years. Primary data include chain-of-custody records, laboratory data sheets, records, memoranda, notes, photographs, microfilm, and computer printouts that are a result of the original observations and activities of the study and which are necessary for the reconstruction and evaluation of the study report.

5.7 Location

Studies are conducted at the Ecotoxicology Laboratory of EA Engineering, Science, and Technology, Inc. at the Loveton Office in Sparks, Maryland.

6. SPECIFICATIONS OF THE SEDIMENT BIOACCUMULATION TEST WITH AN AQUATIC OLIGOCHAETE SPECIES

6.1 Basic References

American Public Health Association (APHA) American Water Works Association, Water Envrionment Federation. 1998. Standard Methods for Examination of Water and Wastewater, 20th or most recent version. APHA, Washington, D.C.

American Society for Testing and Materials (ASTM). 1991. Standard Practice for Conducting Acute Tests with Fishes, Macroinvertebrates, and Amphibians. ASTM Designation: E729-80, Philadelphia, Pennsylvania.

American Society for Testing and Materials (ASTM). 1995. Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates. ASTM Designation: E1383-94, Philadelphia, Pennsylvania.

EA. 1996. Quality Control and Standard Operating Procedures Manual for EA's Ecotoxicology Laboratory. Fifth Revision. EA Manual ATS-102. Internal document prepared by EA's Ecotoxicology Laboratory, EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

US EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA/600/4-79/020. U.S. Environmental Protection Agency, Washington, D.C.

US EPA. 1989. Toxic Substances Control Act (TSCA); Good Laboratory Practice Standards. Title 40 CFR Part 792. Fed. Regist. 54(158): 34034-34074.

US EPA. 1989. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Second Edition. EPA/600/4-89/001. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1991. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1993. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fourth Edition. EPA/600/4-90/027F. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

US EPA. 1994a. Methods for Measuring the Toxiciyt and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-94/024. U.S. Environmental Protection Agency, Office of Research and Development, Duluth, Minnesota.

US EPA. 1994b. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Third Edition. EPA/600/4-91/002. U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

6.2 Test Specifications

Test organism:	An aquatic oligochaete species, e.g., *Lumbriculus variegatus*, as specified by the project study plan
Temperature:	23±1°C
Light quality:	Wide-spectrum fluorescent light
Light intensity:	50-100 f.c.
Photoperiod:	16-hour light, 8-hour dark
Overlying water:	Laboratory fresh water or appropriate receiving water
Aeration:	Gentle aeration may be provided through a 1-ml glass pipet, placed no closer than 2 cm above the sediment surface
Test vessel:	Depends on project requirements
Test volume:	Approximate 2-5 cm layer of sediment with overlying water

No. of replicates:	5
No. organisms per replicate:	Approximately 5 grams of organism tissue
Feeding regime:	None, unless determined necessary
Test duration:	28 days
Endpoints:	Survival and bioaccumulated concentrations of selected chemical parameters
Test acceptability:	Sufficient biomass at end of the test to conduct analyses

ATTACHMENT II

Ceriodaphnia dubia Chronic Toxicity Testing
Data Sheets

C. dubia CHRONIC TOXICITY TEST DATA SHEET

Beginning Date: 9/14/00 Time: 1220

Project Number: 700003.10 Ending Date: 9/20/00 Time: 1215

Client: IT

QC Test Number: TN-00-618 Adults Isolated Date: 9/13/00 Time: 1224

Test Material: Surface waters Neonates Pulled Date: 9/13/00 Time: 1725

Accession Number: MD-709 to 713 Age of Neonates: <24 hrs Brood Size: 8+

Dilution Water: N/A Source: EA

Accession Number: ~~MD~~ — Culture Water Temperature: 25.1 °C

TEST SET-UP

TEST INITIATION				CONCENTRATION SERIES		
Date	Time	Initials	Activity	Test Concentration	Volume Test Material	Final Volume
9/14/00	1145	OR	Dilutions Made	Lab control	Ø	200ml
9/14/00	1145	OR	Test Vessels Filled			
9/14/00	1220	OR	Organisms Transferred	Hardness control	Ø	
9-14-00	1230	MW	Head Counts			

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION					FEEDING				
					Food: YCT + *Selenastrum capricornutum*				
Day	Date	Time	Initials	Sample / Diluent	Day	Date	Time	Initials	Amount
0	OR 9/14/00	1205	OR	LDO-393 (Lab) LDO-396 (Hard)	0	9/14/00	1230	AS	200ulo
1	NSL 9/15/00	0950	NSL	LDO ~~393~~ 396 (Hard) LDO-397 (Lab)	1	9/15/00	1115	NSL	200uls
2	WLM 9/16/00	0850	WLM	(HARD) LDO 396 (LAB) LDO-397	2	9/16/00	1047	AD	200uls
3	9/17/00	0830	CS	(Hard) LDO-396 (Lab) LDO-397	3	9/17/00	1345	CS	200uls
4	9/18/00	0830	CS	(Hard) LDO-396 (Lab) LDO-402	4	9/18/00	1600	D	200uls
5	9/19/00	1017	RD	(Lab) LDO-402 (Hard) LDO-396	5	9/19/00	1125	AD	200uls
6					6				

C. dubia CHRONIC TOXICITY TEST DATA SHEET

Project Number: 70000310
Client: IT OD
QC Test Number: IN-~~00~~ DMT-618
Test Material: Surface waters
Accession Number: ATO-709 to 713
Dilution Water: N/A
Accession Number: —

Beginning Date: ~~1220~~ 9/14/00 Time: 1220
Ending Date: 9/20/00 Time: 1215
Adults Isolated Date: 9/13/00 Time: 1224
Neonates Pulled Date: 9/13/00 Time: 1725
Age of Neonates: <24 hrs Brood Size: 8+
Source: EA
Culture Water Temperature: 25.1 °C

TEST SET-UP

TEST INITIATION				CONCENTRATION SERIES		
Date	Time	Initials	Activity	100% Test Concentration	Volume Test Material	Final Volume
9/14/00	1145	OV	Dilutions Made	ATO-709	200ml	200ml
9/14/00	1145	OV	Test Vessels Filled	ATO-710	↓	↓
9-14-00	~~1230~~ 1220	OV ~~AM~~	Organisms Transferred	ATO-711		
	1230	M	Head Counts	ATO-712		
				ATO-713		

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION

Day	Date	Time	Initials	Sample / Diluent
0	9/14/00	1205	OV	ATO-709→713
1	9/15/00	0950	RCL	ATO-709-713
2	9/16/00	0850	WLM	ATO 709-713
3	9/17/00	0830	LS	ATO-709-713
4	9/18/00	0830	LS	ATO-709-713
5	9/19/00	1031	AN	ATO-709-713
6				

FEEDING

Food: YCT + *Selenastrum capricornutum*

Day	Date	Time	Initials	Amount
0	9/14/00	1230	RS	200 mls
1	9/15/00	1115	RCL	200 mls
2	9/16/00	1031	AN	200 mls
3	9/17/00	1345	CS	100 mls
4	9/18/00	1600	CS	200 mls
5	9/19/00	1107	AN	200 mls
6				

Test Number: TN00-618

First column = # neonates ; Second column = 0 (female), 1 (dead female), 2 (male), 3 (dead male), 9 (lost replicate)

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1	0	0	0	0	0	0	0	0	0	0	1100 RCL
	2	0	0	0	0	0	0	0	0	0	0	1075/MN
Lab	3	40	50	30	50	40	30	30	40	30	20	1320
Control	4	60	120	90	60	90	60	80	80	80	90	520
	5	00	00	00	00	00	10	00	00	10	00	M/1121
10/10	6	15 0	14 0	16 0	14 0	11 0	11 0	13 0	15 0	12 0	13 0	1205 M
	7											
Total # Neonates:		25	31	28	25	24	21	24	27	24	24	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1	0	0	0	0	0	0	0	0	0	0	RCL
Hardness	2	0	0	0	0	0	0	0	0	0	0	MP
	3	30	40	50	50	30	30	30	50	40	50	
Control	4	60	60	80	70	90	80	80	90	90	70	JS
	5	00	00	00	00	00	00	00	00	00	00	MN
10/10	6	60	80	120	150	130	120	130	110	120	140	M
	7											
Total # Neonates:		15	18	25	27	25	23	24	25	25	26	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initial
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initia
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initi
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initi
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Neonate totals checked (date, initials): 1/11/01 MW

A
03/

Ceriodaphnia dubia CHRONIC TOXICITY TEST QC Test Number: TN-00-618

First column = # neonates ; Second column = 0 (female), 1 (dead female), 2 (male), 3 (dead male), 9 (lost replicate)

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO	1	0	0	0	0	0	0	0	0	0	0	1100 RCH
	2	0	0	0	0	0	0	0	0	0	0	1025 AC
709	3	3 0	3 0	4 0	5 0	6 0	5 0	3 0	4 0	2 0	4 0	85 1355
	4	10 0	8 0	7 0	6 0	9 0	8 0	8 0	7 0	11 0	7 0	1530
	5	2 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	MN 1155
10/10	6	9 0	11 0	11 0	15 0	14 0	13 0	11 0	14 0	10 0	12 0	1200
	7											
Total # Neonates:		24	22	22	26	29	26	22	25	23	23	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO	1	0	0	0	0	0	0	0	0	0	0	1100 RCH
	2	0	0	0	0	0	0	0	0	0	0	MN
710	3	3 0	4 0	5 0	4 0	5 0	4 0	6 0	5 0	4 0	5 0	AS
	4	11 0	11 0	13 0	10 0	10 0	9 0	10 0	11 0	11 0	10 0	D
	5	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	MN
10/10	6	13 0	13 0	14 0	13 0	17 0	11 0	14 0	12 0	15 0	16 0	AN
	7											
Total # Neonates:		27	28	32	27	32	24	30	28	30	31	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO	1	0	0	0	0	0	0	0	0	0	0	RCH
	2	0	0	0	0	0	0	0	0	0	0	MN
711	3	4 0	4 0	4 0	3 0	5 0	3 0	5 0	4 0	4 0	3 0	AS
	4	11 0	6 0	7 0	6 0	6 0	7 0	11 0	9 0	12 0	10 0	D
	5	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	MN
10/10	6	9 0	4 0	5 0	6 0	5 0	5 0	5 0	3 0	5 0	2 0	AN
	7											
Total # Neonates:		24	14	16	15	16	15	21	16	21	15	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO	1	0	0	0	0	0	0	0	0	0	0	RCH
	2	0	0	0	0	0	0	0	0	0	0	MN
712	3	4 0	4 0	3 0	3 0	2 0	3 0	3 0	3 0	3 0	3 0	AS
	4	8 0	9 0	13 0	8 0	10 0	10 0	8 0	8 0	10 0	8 0	D
	5	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	MN
10/10	6	2 0	12 0	8 0	6 0	12 0	6 0	10 0	5 0	10 0	2 0	AN
	7											
Total # Neonates:		14	25	24	17	24	19	21	16	23	13	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO	1	0	0	0	0	0	0	0	0	0	0	RCH
	2	0	0	0	0	0	MN	0	0	0	0	MN
713	3	3 0	3 0	4 0	3 0	3 0		4 0	4 0	5 0	4 0	AS
	4	8 0	10 0	11 0	9 0	10 0		9 0	10 0	11 0	11 0	D
	5	0 0	0 0	0 0	0 0	0 0		0 0	7 0	0 0	0 0	MN
9/10	6	16 0	11 0	14 0	11 0	9 0		12 0	0 0	13 0	16 0	AN
	7											
Total # Neonates:		27	24	29	23	22	0	25	21	29	31	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Neonate totals checked (date, initials): 1-11-01 MW

ATS-T4
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-1018

TEST ORGANISM
Common Name: Water flea
Scientific Name: C. dubia

Beginning Date: 9/14/00 Time: 1220
Ending Date: 9/20/00 Time: 1215

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
Lab Control		24.4	24.8	24.9	25.9	25.2	25.8		7.5	8.1	8.7	7.9	8.1	8.1		7.8	7.5	7.1	8.2	7.6	7.4		347	307	330	358	310	304	
Hardness Control		24.1	24.3	24.5	25.0	24.7	24.2		8.7	8.4	8.6	8.3	8.4	8.7		7.6	7.8	~~8.6~~ 7.5	8.2	8.1	~~8.7~~ 8.3		776	770	771	783	774	713	
Meter Number		10/106	92/106	73/101	10/103	57	12/103		10/106	92/106	73/101	10/103	73/103	12/103		57	57	57	57	57	57		12/921	12/921	14/921	73/921	73/914	12/921	
Time		1146	0935	0951	1110	1142	1155		1146	0935	0951	1110	1110	1156		1201	0940	1141	1145	1153	1158		1200	0947	0957	1145	1140	1200	
Initials		OV	MLL	MN	VAS	LS	JL		OV	MLL	MN	VAS	LS	JL		OV	MLL	MN	VAS	JL MN	JL		OV	MLL	MN	VAS	OV	JL	

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-618

TEST ORGANISM
Common Name: Waterflea
Scientific Name: C. dubia

Beginning Date: 9/14/00 Time: 1220
Ending Date: 9/20/00 Time: 1215

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
ATD-709		24.1	24.2	25.0	24.0	24.9	25.1		9.0	9.0	9.0	8.9	9.0	8.9		8.3	7.4	7.5	8.5	7.7	7.9		539	500	467	487	492	489	
ATD-710		24.1	24.2	24.9	24.2	24.7	24.9		8.5	8.5	8.7	8.4	8.5	8.6		8.3	7.6	7.5	8.3	7.6	8.0		643	612	542	590	596	593	
ATD-711		24.1	24.5	24.9	24.1	24.7	24.8		9.2	9.0	9.1	8.9	8.2	8.8		8.1	7.6	7.6	8.5	7.5	7.9		550	525	505	502	517	521	
ATD-712		24.1	24.5	24.9	24.4	24.7	24.8		8.3	8.4	8.8	8.0	8.2	8.3		8.2	7.4	7.4	8.2	7.6	7.9		274	244	248	237	231	232	
ATD-713		24.0	24.4	25.0	24.2	24.8	24.9		8.1	8.1	8.4	8.1	8.3	8.4		8.2	7.6	7.5	8.4	7.8	7.9		576	576	538	536	594	596	
Meter Number		10/106	92/100	72/114	10/103	72/104	72/116		10/106	92/106	72/114	10/103	73/105	72/116		57	57	57	57	57	57		12/921	12/921	10/921	72/921	73/910	11/920	
Time		1148	0935	0951	1110	1444	1016		1148	0935	0951	1110	1444	1016		1201	0940	1001	1145	1445	1005		1200	0945	0953	1145	1440	1000	
Initials		JW	MZ	MJ	MAS	LS	JN		JW	MZ	MJ	MAS	LS	JN		JW	MZ	MJ	MAS	LS	ND		JW	MZ	MJ	MAS	LS	JN	

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-618

TEST ORGANISM
Common Name: Water flea
Scientific Name: C. dubia

Beginning Date: 9/14/00 Time: 1220
Ending Date: 9/20/00 Time: 1215

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥ 4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
Lab Control		24.1	24.1	24.4	24.4	24.1	24.3		7.9	7.3	7.6	7.9	8.3	7.3		8.1	7.5	7.6	8.3	7.0	7.6		308	330	329	408	343	310	
Hardness Control		24.1	24.1	24.4	24.4	24.5	24.4		8.0	7.7	8.0	8.1	8.4	8.0		8.1	7.6	7.5	8.1	7.0	7.8		708	715	744	784	750	732	
Meter Number		42/106	11/106	6/103	14/104	12/103	11/104		42/106	11/106	6/103	14/104	12/103	11/104		57	57	57	57	57	57		11/420	10/421	12/421	13/421	11/420	13/421	
Time		1025	1040	1140	1205	1212	1150		1025	1040	1140	1205	1112	1150		1135	1055	1330	1555	1131	1248		1120	1052	1334	1602	1129	1226	
Initials		RH	NN	D	D	NN	DN		RH	NN	D	D	D	DN		RH	NN	RS	D	NN	DN		RH	NN	RS	D	NN	DN	

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-OD-618

TEST ORGANISM
Common Name: Waterflea
Scientific Name: C. dubia

Beginning Date: 9/14/00 Time: 1220
Ending Date: 9/20/00 Time: 1215

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
AFD 709		24.2	24.1	24.1	24.1	24.0	24.1		8.5	8.7	8.5	8.5 8.5	8.4 8.7	8.4		8.0	7.6	7.1	8.4	7.7	7.8		531	535	522	591	536	538	
~~AFD~~																7.1													
AFD 710		24.3	24.1	24.1	24.4	24.1	24.1		8.5	8.8	8.6	8.5	8.5 8.8	8.5		7.4	7.5	7.2	8.3	8.0	7.9		644	594	600	704	710	619	
AFD 711		24.4	24.3	24.3	24.4	24.1	24.2		8.5	8.8	8.5	8.5	8.5 8.8	8.5		7.5	7.5	7.3	8.0	7.9	7.7		574	540	542	590	598	530	
AFD 712		25.4	24.1	24.1	24.4	24.1	24.3		8.3	8.8	8.8	8.6	8.7	8.1		7.4	7.5	7.3	7.8	7.8	7.7		327	286	244	381	390	253	
AFD 713		24.3	24.1	24.1	24.3	24.0	24.3		8.2	8.6	8.3	8.5	8.5	8.2		7.4	7.5	7.2	7.8	7.7	7.6		542	531	580	600	611	517	
Meter Number		92 106	73/104	19/103	14/104	12/103	11/104		92 106	73/104	19/103	14/104	12/103	11/104		57	57	57	57	57	57		11 720	16/721	73 721	77/941	16/721	73 721	
Time		1025	1015	1340	1525	1050	1151		1025	1015	1340	1525	1050	1151		1135	1055	1416	1556	1133	1218		1120	1052	1410	1556	1100	1220	
Initials		RCJ	nn	RS	o	nn	M		RCJ	nn	RS	o	nn	M		RCJ	nn	RS	o	nn	M		RCJ	nn	RS	o	nn	M	

ATS-T14
03/01/00

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 7000310

Client: IT

QC Test Number: TN-00-618/619

Date/Time/Initials	Comments/Activity				
9/14/00 or	ATO- 709	4.7 ml	x 40	= 188 mg/L	Hardness
	-710	5.8 ml		= 232 mg/L	
	-711	4.6 ml		= 184 mg/L	
	-712	1.6 ml		= 64 mg/L	
	-713	6.5 ml		= 260 mg/L	
	LDO-396	6.5 ml	x 40	= 260 mg/L	

9/14/00 [3.9 L of Superhard H_2O (668 mg/L)] + [6.1 L DI]

or [10 L of 260 mg/L H_2O] — Hardness Control

~~9/16/00~~
~~ATO-~~

9/14/00 RD (HAM) Samples screened through Nitex to remove daphnids and duckweed prior to testing.

STATISTICS FOR WATER QUALITY
QC Test: TN-00-618 IT (LAB CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.4	24.1	7.5	7.9	7.8	8.1	347.0	308.0
2	24.8	24.1	8.1	7.3	7.5	7.5	307.0	330.0
3	24.9	24.4	8.7	7.6	7.1	7.6	330.0	319.0
4	25.9	24.4	7.9	7.9	8.2	8.3	358.0	408.0
5	25.2	24.1	8.1	8.3	7.6	7.0	320.0	343.0
6	25.8	24.3	8.1	7.3	7.4	7.6	304.0	310.0
7								
8								
9								
10								
11								
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48								
N	6	6	6	6	6	6	6.0	6.0
Min.	24.4	24.1	7.5	7.3	7.1	7.0	304.0	308.0
Max.	25.9	24.4	8.7	8.3	8.2	8.3	358.0	408.0
Mean	25.2	24.2	8.1	7.7	7.6	7.7	327.7	336.3
S.D.	0.59	0.15	0.39	0.39	0.37	0.46	21.7	37.5
N		12		12		12		12.0
Min.		24.1		7.3		7.0		304.0
Max.		25.9		8.7		8.3		408.0
Mean		24.7		7.9		7.6		332.0
S.D.		0.64		0.41		0.40		29.5

1-11-01
MW

10/16/2000 11:45 AM

STATISTICS FOR WATER QUALITY

QC Test: TN-00-618 IT (HARDNESS CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.1	8.7	8.0	7.6	8.1	776.0	708.0
2	24.3	24.1	8.4	7.7	7.8	7.6	790.0	715.0
3	24.5	24.7	8.6	8.0	7.5	7.5	771.0	744.0
4	25.0	24.4	8.3	8.1	8.2	8.1	783.0	784.0
5	24.7	24.5	8.4	8.4	8.1	7.0	774.0	750.0
6	24.2	24.4	8.7	8.0	8.3	7.8	713.0	732.0
7								
8								
9								
10								
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.1	24.1	8.3	7.7	7.5	7.0	713.0	708.0
Max.	25.0	24.7	8.7	8.4	8.3	8.1	790.0	784.0
Mean	24.5	24.4	8.5	8.0	7.9	7.7	767.8	738.8
S.D.	0.34	0.23	0.17	0.23	0.33	0.42	27.7	27.4
N		12		12		12		12.0
Min.		24.1		7.7		7.0		708.0
Max.		25.0		8.7		8.3		790.0
Mean		24.4		8.3		7.8		753.3
S.D.		0.28		0.32		0.38		30.3

10/16/2000 11:46 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-618 IT (AT0-709)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.2	9.0	8.5	8.3	8.0	539.0	531.0
2	24.2	24.1	9.0	8.7	7.4	7.6	500.0	535.0
3	25.0	24.1	9.0	8.5	7.5	7.1	467.0	522.0
4	24.0	24.1	8.9	8.5	8.5	8.4	487.0	591.0
5	24.9	24.0	9.0	8.7	7.7	7.7	492.0	536.0
6	25.1	24.1	8.9	8.4	7.9	7.8	489.0	538.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.9	8.4	7.4	7.1	467.0	522.0
Max.	25.1	24.2	9.0	8.7	8.5	8.4	539.0	591.0
Mean	24.6	24.1	9.0	8.6	7.9	7.8	495.7	542.2
S.D.	0.50	0.06	0.05	0.12	0.44	0.43	23.9	24.6
N		12		12		12		12.0
Min.		24.0		8.4		7.1		467.0
Max.		25.1		9.0		8.5		591.0
Mean		24.3		8.8		7.8		518.9
S.D.		0.41		0.24		0.42		33.5

VW
1-11-01

10/16/2000 11:48 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-618 IT (AT0-710)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.3	8.5	8.5	8.3	7.4	643.0	644.0
2	24.2	24.1	8.5	8.8	7.6	7.5	612.0	594.0
3	24.9	24.1	8.7	8.6	7.5	7.2	542.0	600.0
4	24.2	24.4	8.4	8.5	8.3	8.3	590.0	704.0
5	24.7	24.1	8.5	8.8	7.6	8.0	596.0	710.0
6	24.9	24.1	8.6	8.5	8.0	7.9	593.0	619.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.1	24.1	8.4	8.5	7.5	7.2	542.0	594.0
Max.	24.9	24.4	8.7	8.8	8.3	8.3	643.0	710.0
Mean	24.5	24.2	8.5	8.6	7.9	7.7	596.0	645.2
S.D.	0.37	0.13	0.10	0.15	0.37	0.42	32.9	51.0
N		12		12		12		12.0
Min.		24.1		8.4		7.2		542.0
Max.		24.9		8.8		8.3		710.0
Mean		24.3		8.6		7.8		620.6
S.D.		0.31		0.13		0.38		48.3

10-11-01
MW

10/16/2000 11:50 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-618 IT (AT0-711)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.4	9.2	8.5	8.1	7.5	530.0	574.0
2	24.5	24.3	9.0	8.8	7.6	7.5	525.0	540.0
3	24.9	24.3	9.1	8.5	7.6	7.3	505.0	542.0
4	24.1	24.4	8.9	8.5	8.5	8.0	502.0	590.0
5	24.7	24.1	8.2	8.8	7.5	7.9	517.0	598.0
6	24.8	24.2	8.8	8.5	7.9	7.7	521.0	530.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.1	24.1	8.2	8.5	7.5	7.3	502.0	530.0
Max.	24.9	24.4	9.2	8.8	8.5	8.0	530.0	598.0
Mean	24.5	24.3	8.9	8.6	7.9	7.7	516.7	562.3
S.D.	0.35	0.12	0.36	0.15	0.38	0.27	11.1	28.7
N		12		12		12		12.0
Min.		24.1		8.2		7.3		502.0
Max.		24.9		9.2		8.5		598.0
Mean		24.4		8.7		7.8		539.5
S.D.		0.28		0.30		0.33		31.6

1-11-01

STATISTICS FOR WATER QUALITY

QC Test: TN-00-618 IT (AT0-712)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	25.4	8.3	8.3	8.2	7.4	274.0	327.0
2	24.5	24.1	8.4	8.8	7.4	7.5	244.0	286.0
3	24.9	24.1	8.8	8.8	7.4	7.3	248.0	244.0
4	24.4	24.4	8.0	8.6	8.2	7.8	237.0	381.0
5	24.7	24.1	8.2	8.7	7.6	7.8	231.0	390.0
6	24.8	24.3	8.3	8.1	7.9	7.7	232.0	253.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.1	24.1	8.0	8.1	7.4	7.3	231.0	244.0
Max.	24.9	25.4	8.8	8.8	8.2	7.8	274.0	390.0
Mean	24.6	24.4	8.3	8.6	7.8	7.6	244.3	313.5
S.D.	0.29	0.51	0.27	0.29	0.37	0.21	16.0	63.0
N		12		12		12		12.0
Min.		24.1		8.0		7.3		231.0
Max.		25.4		8.8		8.2		390.0
Mean		24.5		8.4		7.7		278.9
S.D.		0.40		0.29		0.31		56.8

1-11-01
MW

10/16/2000 11:53 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-618 IT (AT0-713)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.0	24.3	8.1	8.2	8.2	7.4	576.0	542.0
2	24.4	24.1	8.1	8.6	7.6	7.5	556.0	531.0
3	25.0	24.1	8.4	8.3	7.5	7.2	538.0	536.0
4	24.2	24.3	8.1	8.5	8.4	7.8	536.0	600.0
5	24.8	24.0	8.3	8.5	7.8	7.7	594.0	611.0
6	24.9	24.3	8.4	8.2	7.9	7.6	596.0	517.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.1	8.2	7.5	7.2	536.0	517.0
Max.	25.0	24.3	8.4	8.6	8.4	7.8	596.0	611.0
Mean	24.6	24.2	8.2	8.4	7.9	7.5	566.0	556.2
S.D.	0.41	0.13	0.15	0.17	0.35	0.22	26.7	39.3
N		12		12		12		12.0
Min.		24.0		8.1		7.2		517.0
Max.		25.0		8.6		8.4		611.0
Mean		24.4		8.3		7.7		561.1
S.D.		0.35		0.17		0.34		32.4

1-11-01
MW

10/16/2000 11:54 AM

Ceriodaphnia Survival and Reproduction Test-6-Day Survival

Start Date:	Test ID: TN-00-618	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8	9	10
HARD. CONT.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-709	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-710	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-711	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-712	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-713	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
LAB CONT.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
HARD. CONT.	1.0000	1.0000	0	10	10	10		
AT0-709	1.0000	1.0000	0	10	10	10		
AT0-710	1.0000	1.0000	0	10	10	10		
AT0-711	1.0000	1.0000	0	10	10	10		
AT0-712	1.0000	1.0000	0	10	10	10		
AT0-713	0.9000	0.9000	1	9	10	10	0.5000	0.0500
LAB CONT.	1.0000	1.0000	0	10	10	10		

Hypothesis Test (1-tail, 0.05)

ToxCalc v5.0.23

Reviewed by: 1-11-01

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	Test ID: TN-00-618	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8	9	10	Std. Dev.
HARD. CONT.	15.000	18.000	25.000	27.000	25.000	23.000	24.000	25.000	25.000	26.000	3.80205
AT0-709	24.000	22.000	22.000	26.000	29.000	26.000	22.000	25.000	23.000	23.000	2.29976
AT0-710	27.000	28.000	32.000	27.000	32.000	24.000	30.000	28.000	30.000	31.000	2.55821
AT0-711	24.000	14.000	16.000	15.000	16.000	15.000	21.000	16.000	21.000	15.000	3.40098
AT0-712	14.000	25.000	24.000	17.000	24.000	19.000	21.000	16.000	23.000	13.000	4.42719
AT0-713	27.000	24.000	29.000	23.000	22.000	0.000	25.000	21.000	29.000	31.000	8.76166
LAB CONT.	25.000	31.000	28.000	25.000	24.000	21.000	24.000	27.000	24.000	24.000	2.75076

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	23.300	1.0000	23.300	15.000	27.000	16.318	10			
AT0-709	24.200	1.0386	24.200	22.000	29.000	9.503	10			
AT0-710	28.900	1.2403	28.900	24.000	32.000	8.852	10			
*AT0-711	17.300	0.7425	17.300	14.000	24.000	19.659	10	3.719	1.734	2.797
AT0-712	19.600	0.8412	19.600	13.000	25.000	22.588	10			
AT0-713	23.100	0.9914	23.100	0.000	31.000	37.929	10			
LAB CONT.	25.300	1.0858	25.300	21.000	31.000	10.873	10			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.96994	0.868	-0.4153	0.45942
F-Test indicates equal variances (p = 0.75)	1.24976	6.54109		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	2.79729	0.12006	180	13.0111	0.00157	1, 18

AT0-711 versus Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01 W

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	Test ID: TN-00-618	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8	9	10
H ARD. CONT.	15.000	18.000	25.000	27.000	25.000	23.000	24.000	25.000	25.000	26.000
AT0-709	24.000	22.000	22.000	26.000	29.000	26.000	22.000	25.000	23.000	23.000
AT0-710	27.000	28.000	32.000	27.000	32.000	24.000	30.000	28.000	30.000	31.000
AT0-711	24.000	14.000	16.000	15.000	16.000	15.000	21.000	16.000	21.000	15.000
AT0-712	14.000	25.000	24.000	17.000	24.000	19.000	21.000	16.000	23.000	13.000
AT0-713	27.000	24.000	29.000	23.000	22.000	0.000	25.000	21.000	29.000	31.000
LAB CONT.	25.000	31.000	28.000	25.000	24.000	21.000	24.000	27.000	24.000	24.000

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
H ARD. CONT.	23.300	1.0000	23.300	15.000	27.000	16.318	10			
AT0-709	24.200	1.0386	24.200	22.000	29.000	9.503	10			
AT0-710	28.900	1.2403	28.900	24.000	32.000	8.852	10			
AT0-711	17.300	0.7425	17.300	14.000	24.000	19.659	10			
*AT0-712	19.600	0.8412	19.600	13.000	25.000	22.588	10	2.005	1.734	3.200
AT0-713	23.100	0.9914	23.100	0.000	31.000	37.929	10			
LAB CONT.	25.300	1.0858	25.300	21.000	31.000	10.873	10			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91734	0.868	-0.7113	-0.5852
F-Test indicates equal variances (p = 0.66)	1.35588	6.54109		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	3.20007	0.13734	68.45	17.0278	0.06024	1, 18

AT0-712 versus Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	Test ID: TN-00-618	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8	9	10
HARD. CONT.	15.000	18.000	25.000	27.000	25.000	23.000	24.000	25.000	25.000	26.000
AT0-709	24.000	22.000	22.000	26.000	29.000	26.000	22.000	25.000	23.000	23.000
AT0-710	27.000	28.000	32.000	27.000	32.000	24.000	30.000	28.000	30.000	31.000
AT0-711	24.000	14.000	16.000	15.000	16.000	15.000	21.000	16.000	21.000	15.000
AT0-712	14.000	25.000	24.000	17.000	24.000	19.000	21.000	16.000	23.000	13.000
AT0-713	27.000	24.000	29.000	23.000	22.000	0.000	25.000	21.000	29.000	31.000
LAB CONT.	25.000	31.000	28.000	25.000	24.000	21.000	24.000	27.000	24.000	24.000

			Transform: Untransformed					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
HARD. CONT.	23.300	1.0000	23.300	15.000	27.000	16.318	10		
AT0-709	24.200	1.0386	24.200	22.000	29.000	9.503	10		
AT0-710	28.900	1.2403	28.900	24.000	32.000	8.852	10		
AT0-711	17.300	0.7425	17.300	14.000	24.000	19.659	10		
AT0-712	19.600	0.8412	19.600	13.000	25.000	22.588	10		
AT0-713	23.100	0.9914	23.100	0.000	31.000	37.929	10	110.50	82.00
LAB CONT.	25.300	1.0858	25.300	21.000	31.000	10.873	10		

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.75372	0.868	-2.4699	7.95677
F-Test indicates equal variances (p = 0.02)	5.31053	6.54109		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

AT0-713 versus Hardness control

ToxCalc v5.0.23

Reviewed by: 1-11-01

C. dubia CHRONIC TOXICITY TEST DATA SHEET

Beginning Date: 9/16/00 Time: 1540

Project Number: 70003.10 Ending Date: 9/22/00 Time: 1530

Client: IT

QC Test Number: IN-00-623 Adults Isolated Date: 9/15/00 Time: ~~1800~~ 1600 LMC

Test Material: Surface waters Neonates Pulled Date: 9/15/00 Time: 1900

Accession Number: ATD-724,725,728→730 Age of Neonates: < 24 hrs Brood Size: 8+

Dilution Water: N/A Source: EA

Accession Number: N/A Culture Water Temperature: _____ °C

TEST SET-UP

TEST INITIATION

Date	Time	Initials	Activity
9/16/00	1350	RD	Dilutions Made
	1351	RD	Test Vessels Filled
	1540	RD	Organisms Transferred
	1603	DB	Head Counts

CONCENTRATION SERIES

Test Concentration	Volume Test Material	Final Volume
Lab control	Ø	1500 mls
Hardness control	Ø	

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION

Day	Date	Time	Initials	Sample / Diluent
0	9/16/00	1350	RD	(Lab) LDO-397 (Hard) LDO-400
1	9/17/00	1305	OR	(Lab) LDO-398 (Hard) LDO-400
2	9/18/00	1501	OR	(Lab) LDO-402 (HW) LDO-400
3	9/19/00	1030	JZ	(Lab) LDO 402 (HW) LDO-400
4	9/20/00	1319	RD	(Lab) LDO-402 (HW) LDO-400
5	9/21/00	945	LS	LDO-404 (Lab) LDO-400 (HW)
6				

FEEDING

Food: YCT + *Selenastrum capricornutum*

Day	Date	Time	Initials	Amount
0	9/16/00	1605	DB	200 mls
1	9/17/00	1835	OR	200 mls
2	9/18/00	1520	OR	200 mls
3	9/19/00	1130	JZ	200 mls
4	9/20/00	1338	RD	200 mls
5	9/21/00	0955	LS	200 mls
6				

C. dubia CHRONIC TOXICITY TEST DATA SHEET

Beginning Date: 9/16/00 Time: 1540

Project Number: 70003.10 Ending Date: 9/22/00 Time: 1530

Client: IT

QC Test Number: IN-00-623 Adults Isolated Date: 9/15/00 Time: ~~1800~~ 1600 AM

Test Material: surface waters Neonates Pulled Date: 9/15/00 Time: 1900

Accession Number: ATO-724, 725, 728-730 Age of Neonates: <24 hrs Brood Size: 8+

Dilution Water: N/A Source: EA

Accession Number: N/A Culture Water Temperature: _____ °C

TEST SET-UP

TEST INITIATION				CONCENTRATION SERIES		
Date	Time	Initials	Activity	100% Test Concentration	Volume Test Material	Final Volume
9/16/00	1351	NP	Dilutions Made	ATO-724	1500ml	1500ml
	1351	NP	Test Vessels Filled	ATO-725		
	1540	NP	Organisms Transferred	ATO-728		
	1605	D	Head Counts	ATO-729		
				ATO-730		

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION					FEEDING (Food: YCT + *Selenastrum capricornutum*)				
Day	Date	Time	Initials	Sample / Diluent	Day	Date	Time	Initials	Amount
0	9/16/00	1351	NP	ATO-724, 725, 728, 729, 730	0	9/16/00	1605	D	200mls
1	9/17/00	1300	OV	ATO-724, 725, 728, 729, 730	1	9/17/00	1325	OV	200mls
2	9/18/00	1400	OV	ATO-724, 725, 728, 729, 730	2	9/18/00	1445	OV	200mls
3	9/19/00	1030	JZ	ATO-724, 725, 728, 729, 730 ~~[illegible]~~	3	9/19/00	1108	JZ	200mls
4	9/20/00	1319	NP	ATO-724, 725, 728, 729, 730	4	9/20/00	1425	NP	200mls
5	9/21/00	945	JS	ATO-724, 725, 728, 729, 730	5	9/21/00	0955	JS	200mls
6					6				

EA

Ceriodaphnia dubia CHRONIC TOXICITY TEST QC Test Number: TN-00-623

First column = # neonates ; Second column = 0 (female), 1 (dead female), 2 (male), 3 (dead male), 9 (lost replicate)

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
Lab Control	1	0	0	0	0	0	0	0	0	0	0	1335 JZ
	2	0	0	0	0	0	0	0	0	0	0	1507 OV
	3	0 0	5 0	6 0	4 0	5 0	3 0	2 0	0 0	2 0	4 0	1130 JZ
	4	0 0	7 0	2 0	0 0	7 0	0 0	4 0	7 0	0 0	5 0	1331 MN
	5	6 0	0 0	6 0	8 0	0 0	0 0	0 0	0 0	6 0	0 0	945 BS
	6	10 0	12 0	13 0	7 0	11 0	8 0	6 0	13 0	7 0	10 0	1535 JZ
10/10	7											
Total # Neonates:		16	24	27	19	23	11	12	20	15	19	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
Hardness Control	1	0	0	0	0	0	0	0	0	0	0	OV
	2	0	0	0	0	0	0	0	0	0	0	OV
	3	3 0	3 0	5 0	5 0	0 0	0 0	4 0	5 0	3 0	3 0	JZ
	4	7 0	8 0	8 0	6 0	4 0	0 0	5 0	5 0	4 0	8 0	MN
	5	0 0	0 0	0 0	0 0	0 0	7 0	0 0	0 0	0 0	0 0	BS
	6	14 0	11 0	12 0	0 0	0 0	12 0	9 0	0 0	7 0	10 0	JZ
10/10	7											
Total # Neonates:		24	22	25	11	4	19	18	10	14	21	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1											
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Neonate totals checked (date, initials): 1-11-01 MN

ATS-T4
03/01/00

EA

Ceriodaphnia dubia CHRONIC TOXICITY TEST

QC Test Number: TN00-623

First column = # neonates ; Second column = 0 (female), 1 (dead female), 2 (male), 3 (dead male), 9 (lost replicate)

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO-724	1	0	0	0	0	0	0	0	0	0	0	OR 1132
	2	0	0	0	0	0	0	0	0	0	0	[illegible]
	3	0 0	3 0	4 0	0 0	0 0	0 0	6 0	0 0	5 0	6 0	1055
	4	0 0	6 0	5 0	7 0	4 0	5 0	4 0	3 0	0 0	0 0	1411 RN
	5	4 0	0 0	0 0	0 0	5 0	0 0	0 0	5 0	10 0	9 0	1025 RS
9/10	6	12 0	15 0	11 0	11 0	12 0	12 0	4 1	12 0	15 0	10 0	1530 JZ
	7											
Total # Neonates:		16	24	20	18	21	17	14	20	30	25	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO-725	1	0	0	0	0	0	0	0	9	0	0	OR
	2	0	0	0	0	0	0	0		0	0	OR
	3	0 0	5 0	3 0	0 0	0 0	0 0	5 0		0 0	5 0	JZ
	4	4 0	8 0	2 0	4 0	2 0	6 0	7 0		6 0	5 0	RN
	5	6 0	0 0	8 0	0 0	8 0	0 0	0 0		0 0	0 0	RS
9/9	6	9 0	11 0	13 0	14 0	14 0	13 0	10 0		12 0	13 0	JZ
	7											
Total # Neonates:		19	24	26	18	24	19	22	MR	18	23	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO-728	1	0	0	0	0	0	0	0	0	0	0	OR
	2	0	0	1 0	0	0	0	0	0	0	0	OR
	3	0 0	4 0		6 0	0 0	0 0	5 0	0 0	4 0	3 0	JZ
	4	2 0	4 0		8 0	3 0	3 0	8 0	2 0	4 0	5 0	RN
	5	6 0	0 0		0 0	0 0	8 0	0 0	6 0	0 0	1 0	RS
9/10	6	0 0	12 0		15 0	16 0	14 0	14 0	9 0	10 0	11 0	JZ
	7											
Total # Neonates:		8	20	0	29	25	25	27	17	18	20	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO-729	1	0	0	0	0	0	0	0	0	0	0	OR
	2	0	0	0	0	0	0	0	0	0	0	OR
	3	0 0	5 0	4 0	4 0	4 0	0 0	0 0	4 0	0 0	4 0	JZ
	4	5 0	7 0	3 0	5 0	6 0	2 0	4 0	8 0	4 0	6 0	RN
	5	4 0	0 0	0 0	0 0	0 0	9 0	0 0	0 0	8 0	0 0	RS
10/10	6	0 0	15 0	13 0	11 0	11 0	13 0	13 0	15 0	9 0	10 0	JZ
	7	DS	DS	DS	DS							
Total # Neonates:		9	27	20	20	21	24	17	27	21	20	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
ATO-730	1	0	0	0	0	0	0	0	0	0	0	OR
	2	0	0	0	0	0	0	0	0	0	0	OR
	3	0 0	2 0	5 0	5 0	0 0	0 0	3 0	0 0	5 0	5 0	JZ
	4	0 0	5 0	7 0	5 0	2 0	3 0	6 0	3 0	8 0	5 0	RN
	5	6 0	0 0	2 0	0 0	4 0	6 0	0 0	4 0	0 0	0 0	RS
10/10	6	13 0	12 0	13 0	10 0	13 0	11 0	14 0	12 0	13 0	13 0	JZ
	7											
Total # Neonates:		19	19	27	20	19	20	23	19	26	23	

Concentration	Day	1	2	3	4	5	6	7	8	9	10	Time/Initials
	1					0	0	0	0	0	0	OR
	2											
	3											
	4											
	5											
	6											
	7											
Total # Neonates:												

Neonate totals checked (date, initials): 1-11-01 MW

AT
03/0

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: JN-00-623

TEST ORGANISM
Common Name: Water flea
Scientific Name: C. dubia

Beginning Date: 9/16/00 Time: 1540
Ending Date: 9/22/00 Time: 1530

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
Lab Control		25.4	25.2	25.1	25.8	~~25.8~~	25.9		8.3	8.3	8.2	8.1	~~8.6~~ 8.5 ~~8.9~~	8.6		7.3	8.3	7.6	7.4	~~7.9~~ 7.5 7.4	7.9		343	347	320	364	~~297~~ 296	291	
Hard Control		24.0	25.1	24.9	24.8	24.0	25.3		8.5	8.4	8.4	8.4	8.3	8.5		7.2	8.3	8.3	8.6	~~8.3~~ 8.5 8.5	8.3		1050	1091	1119	1044	~~1157~~ 1054	1157	
Meter Number		12/103	10/103	73/103	12/103	~~11/101~~ ~~55~~	55		12/103	10/103	73/103	12/103	10/103	10/103		57	57	57	57	~~57~~ 55	55		11/920	73/921	11/920	10/921	~~73~~ 920	12/920	
Time		1512	1120	1429	1155	~~945~~ 920	920		1512	1120	1429	1155	935	920		1515	1040	1419	1200	~~945~~ 1020	0920		1513	1135	1420	1200	~~940~~ 1025	940	
Initials		nn	MAS	AL	[illegible]	~~RS~~ 920	RS		nn	MAS	AL	[illegible]	RS	RS		nn	MAS	AL	[illegible]	RS	RS		nn	MAS	AL	[illegible]	RS	RS	

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00623

TEST ORGANISM
Common Name: Water flea
Scientific Name: C. dubia

Beginning Date: 9/16/00 Time: 1540
Ending Date: 9/22/00 Time: 1530

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
ATD-724		25.1	24.0	25.1	24.0	26.0	25.1		8.1	8.2	8.1	8.1	8.1	8.3		8.0	7.7	7.6	7.7	7.6	8.1		646	~~654~~ 640 VMS	564	584	543	559	
ATD-725		25.1	24.0	25.2	24.0	26.0	24.3		8.1	8.1	8.1	8.1	8.1	8.3		7.8	8.5	7.7	7.8	7.7	8.1		637	535	547	553	520	554	
ATD-728		25.0	24.0	25.2	24.1	24.4	24.5		8.1	8.3	8.2	8.3	8.2	8.4		7.7	8.6	7.7	7.8	8.0	8.1		690	632	578	582	553	536	
ATD-729		25.1	24.2	25.4	24.0	24.3	24.2		8.2	8.3	8.1	8.2	8.2	8.3		7.6	8.4	7.7	7.9	8.0	8.2		681	620	567	573	533	547	
ATD-730		24.4	24.2	25.4	24.0	24.1	24.6		7.8	7.9	8.1	8.3	8.2	8.4		8.1	7.3	7.7	7.8	7.7	8.2		720	665	574	571	546	586	
Meter Number		57	19/103	73/103	73/104	19/103	55		73/103	19/103	73/103	73/104	19/103	19/103		57	57	57	57	57/55	55		11/920	73/921	11/920	11/920	73/921	19/920	
Time		1315	1120	1429	1030	1035	920		1317	1120	1429	1030	1035	920		1315	1040	1419	0952	1020	920		1323	1135	1424	1020	1025	925	
Initials		nn	VMS	OL	ND	LS	LS		nn	VMS	OL	ND	LS	LS		nn	VMS	OL	ND	LS	LS		nn	VMS	OL	ND	LS	LS	

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-623

TEST ORGANISM
Common Name: Waterflea
Scientific Name: C. dubia

Beginning Date: 9/16/00 Time: 1540
Ending Date: 9/22/00 Time: 1530

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	~~Conductivity (µS/cm)~~ ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
Lab Control		25.4	25.2	24.0	24.3	26.0	24.3		8.2	8.1	8.2	7.6	8.2	~~10.9~~ 7.9 unit		7.7	7.6	8.2	6.4	8.1	7.9		322	336	313	310	266	310	
Hard Control		25.4	25.1	24.0	24.3	26.7	24.3		8.3	8.2	8.3	8.1	8.2	8.4		7.5	7.6	8.0	6.4	7.0	7.7		1012	1055	1090	1027	981	~~1190~~ 1110	82
Meter Number		12/104	12/104	73/104	16/103	19/103	10/103		12/104	12/104	73/104	16/15	19/103	10/103		57	57	57	57	55			73/921	11/920	11/920	12/920	12/920	73/921	
Time		1331	1430	1120	1325	930	1508		1330	1430	1120	1325	930	1508		1341	1518	1130	1340	1555			1337	1511	1130	1344	955	1550	
Initials		OV	OV	[illegible]	[illegible]	RS	[illegible]		OV	OV	[illegible]	[illegible]	RS	[illegible]		OV	OV	[illegible]	[illegible]	[illegible]			OV	OV	[illegible]	[illegible]	RS	[illegible]	

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-1023

TEST ORGANISM
Common Name: Waterflea
Scientific Name: C. dubia

Beginning Date: 9/16/00 Time: 1540
Ending Date: 9/22/00 Time: 1530

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	~~Conductivity (µS/cm)~~ ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
ATD-724		24.5	24.4	24.0	24.0	24.2	24.3		7.9	8.1	8.2	8.1	8.3	8.2		8.1	8.1	8.2	7.9	8.0	8.0		499	446	506	503	483	467	
ATD-725		24.5	24.7	24.0	24.1	24.1	24.3		8.0	8.2	8.3	8.2	8.3	8.2		8.1	8.2	8.1	7.8	7.9	7.9		475	425	486	477	460	430	
ATD-728		24.6	24.8	24.0	24.4	24.3	24.3		8.0	8.2	8.3	8.2	8.3	8.2		8.1	8.2	7.9	7.7	7.6	7.7		485	459	496	476	472	440	
ATD-729		24.7	24.9	24.0	24.4	24.5	24.3		8.0	8.1	8.2	8.2	8.3	8.2		8.1	8.2	7.9	7.8	7.5	7.7		472	448	483	463	465	436	
ATD-730		24.5	24.7	24.0	24.6	24.5	24.3		8.0	8.2	8.3	8.2	8.3	8.2		8.1	8.1	8.0	7.8	7.4	7.6		495	449	480	468	468	453	
Meter Number		12/104	12/104	12/103	14/103	10/103	10/103		12/104	12/104	12/103	14/103	10/103	10/103		57	57	57	57	55	55		73/921	11/920	12/921	12/920	12/920	73/921	
Time		1307	1424	1045	1356	935	1508		1307	1424	1045	1356	935	1508		1311	1418	1112	1431	1040	1555		1337	1514	1110	1420	1035	1550	
Initials		on	on	[illegible]	nn	RS	[illegible]		on	on	[illegible]	nn	RS	[illegible]		on	on	[illegible]	nn	RS	[illegible]		on	on	[illegible]	nn	RS	[illegible]	

ATS-T14
03/01/00

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-623

Date/Time/Initials	Comments/Activity	Hardness (mg/L)
9/16/00	ATO-724	~~36~~ 396
WM	-725	404
(LAH)	-728	420
	-729	412
	-730	420

5.66 L of SuperHard H_2O (668 mg/L) + 3.34 L DI ⇒ 9 L of Hardness Cont (420 mg/L)

LDO-400 = 340 mg/L Hardness
(no SuperHard water remained to "bump up" hardness)

STATISTICS FOR WATER QUALITY

QC Test: TN-00-623 IT (LAB CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.4	25.4	8.3	8.2	7.3	7.7	343.0	322.0
2	25.2	25.2	8.3	8.1	8.3	7.6	347.0	336.0
3	25.1	24.0	8.2	8.2	7.6	8.2	320.0	313.0
4	25.8	24.3	8.1	7.6	7.4	6.4	304.0	310.0
5	25.8	25.0	7.9	8.2	7.4	8.1	296.0	285.0
6	25.9	24.3	8.6	7.9	7.9	7.9	291.0	310.0
7								
8								
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46								
47								
48								
N	6	6	6	6	6	6	6.0	6.0
Min.	25.1	24.0	7.9	7.6	7.3	6.4	291.0	285.0
Max.	25.9	25.4	8.6	8.2	8.3	8.2	347.0	336.0
Mean	25.5	24.7	8.2	8.0	7.7	7.7	316.8	312.7
S.D.	0.34	0.57	0.23	0.24	0.38	0.65	24.0	16.8
N		12		12		12		12.0
Min.		24.0		7.6		6.4		285.0
Max.		25.9		8.6		8.3		347.0
Mean		25.1		8.1		7.7		314.8
S.D.		0.63		0.25		0.51		19.9

10-11-01
MW

10/16/2000 1:37 PM

STATISTICS FOR WATER QUALITY

QC Test: TN-00-623 IT (HARDNESS CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.0	25.4	8.5	8.3	7.2	7.5	1050.0	1012.0
2	25.1	25.1	8.4	8.2	8.3	7.6	1091.0	1055.0
3	24.9	24.0	8.4	8.3	8.3	8.0	1119.0	1090.0
4	24.8	24.3	8.4	8.1	8.6	6.4	1014.0	1027.0
5	24.0	25.7	8.3	8.2	8.5	7.8	1054.0	981.0
6	25.3	24.3	8.5	8.4	8.3	7.7	1157.0	1110.0
7								
8								
9								
10								
11								
12								
13								
14								
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42								
43								
44								
45								
46								
47								
48								
N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.3	8.1	7.2	6.4	1014.0	981.0
Max.	25.3	25.7	8.5	8.4	8.6	8.0	1157.0	1110.0
Mean	24.7	24.8	8.4	8.3	8.2	7.5	1080.8	1045.8
S.D.	0.56	0.69	0.08	0.10	0.51	0.57	52.0	48.7
N		12		12		12		12.0
Min.		24.0		8.1		6.4		981.0
Max.		25.7		8.5		8.6		1157.0
Mean		24.7		8.3		7.9		1063.3
S.D.		0.60		0.12		0.63		51.4

1-11-01
[illegible]

10/16/2000 1:39 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-623 IT (AT0-724)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.1	24.5	8.1	7.9	8.0	8.1	646.0	499.0
2	24.0	24.4	8.2	8.1	7.7	8.1	640.0	446.0
3	25.1	24.0	8.1	8.2	7.6	8.2	564.0	506.0
4	24.0	24.0	8.1	8.1	7.7	7.9	584.0	503.0
5	25.0	24.2	8.1	8.3	7.6	8.0	543.0	483.0
6	25.1	24.3	8.3	8.2	8.1	8.0	559.0	467.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.1	7.9	7.6	7.9	543.0	446.0
Max.	25.1	24.5	8.3	8.3	8.1	8.2	646.0	506.0
Mean	24.7	24.2	8.2	8.1	7.8	8.1	589.3	484.0
S.D.	0.56	0.21	0.08	0.14	0.21	0.10	43.6	23.7
N		12		12		12		12.0
Min.		24.0		7.9		7.6		446.0
Max.		25.1		8.3		8.2		646.0
Mean		24.5		8.1		7.9		536.7
S.D.		0.47		0.11		0.21		64.4

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10/16/2000 1:41 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-623 IT (AT0-725)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.1	24.5	8.1	8.0	7.8	8.1	637.0	475.0
2	24.0	24.7	8.1	8.2	8.5	8.2	535.0	425.0
3	25.2	24.0	8.1	8.3	7.7	8.1	547.0	486.0
4	24.0	24.1	8.1	8.2	7.8	7.8	553.0	477.0
5	25.0	24.9	8.1	8.3	7.7	7.9	520.0	460.0
6	24.3	24.3	8.3	8.2	8.1	7.9	554.0	430.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.1	8.0	7.7	7.8	520.0	425.0
Max.	25.2	24.9	8.3	8.3	8.5	8.2	637.0	486.0
Mean	24.6	24.4	8.1	8.2	7.9	8.0	557.7	458.8
S.D.	0.56	0.35	0.08	0.11	0.31	0.15	40.9	25.7
N		12		12		12		12.0
Min.		24.0		8.0		7.7		425.0
Max.		25.2		8.3		8.5		637.0
Mean		24.5		8.2		8.0		508.3
S.D.		0.46		0.10		0.24		61.0

1-11-01
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10/16/2000 1:43 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-623 IT (AT0-728)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.0	24.6	8.1	8.0	7.7	8.1	690.0	485.0
2	24.0	24.8	8.3	8.2	8.6	8.2	632.0	459.0
3	25.2	24.0	8.2	8.3	7.7	7.9	578.0	496.0
4	24.1	24.4	8.3	8.2	7.8	7.7	582.0	476.0
5	24.4	25.3	8.2	8.3	8.0	7.6	553.0	472.0
6	24.5	24.3	8.4	8.2	8.1	7.7	538.0	440.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.1	8.0	7.7	7.6	538.0	440.0
Max.	25.2	25.3	8.4	8.3	8.6	8.2	690.0	496.0
Mean	24.5	24.6	8.3	8.2	8.0	7.9	595.5	471.3
S.D.	0.48	0.45	0.10	0.11	0.34	0.24	56.3	19.8
N		12		12		12		12.0
Min.		24.0		8.0		7.6		440.0
Max.		25.3		8.4		8.6		690.0
Mean		24.6		8.2		7.9		533.4
S.D.		0.44		0.11		0.29		76.3

1-11-01
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10/16/2000 1:44 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-623 IT (AT0-729)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.1	24.7	8.2	8.0	7.6	8.1	681.0	472.0
2	24.2	24.9	8.3	8.1	8.4	8.2	620.0	448.0
3	25.4	24.0	8.1	8.2	7.7	7.9	567.0	483.0
4	24.0	24.4	8.2	8.2	7.9	7.8	573.0	463.0
5	24.3	25.5	8.2	8.3	8.0	7.5	533.0	465.0
6	24.2	24.3	8.3	8.2	8.2	7.7	567.0	436.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	8.1	8.0	7.6	7.5	533.0	436.0
Max.	25.4	25.5	8.3	8.3	8.4	8.2	681.0	483.0
Mean	24.5	24.6	8.2	8.2	8.0	7.9	590.2	461.2
S.D.	0.57	0.53	0.08	0.10	0.30	0.26	52.5	16.8
N		12		12		12		12.0
Min.		24.0		8.0		7.5		436.0
Max.		25.5		8.3		8.4		681.0
Mean		24.6		8.2		7.9		525.7
S.D.		0.53		0.09		0.27		76.9

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10/16/2000 1:46 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-623 IT (AT0-730)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.4	24.3	7.8	8.0	8.1	8.1	720.0	495.0
2	24.2	24.7	7.9	8.2	7.3	8.1	665.0	449.0
3	25.4	24.0	8.1	8.3	7.7	8.0	574.0	480.0
4	24.0	24.6	8.3	8.2	7.8	7.8	571.0	468.0
5	24.9	25.5	8.2	8.3	7.7	7.4	546.0	468.0
6	24.6	24.3	8.4	8.2	8.2	7.6	586.0	453.0
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N	6	6	6	6	6	6	6.0	6.0
Min.	24.0	24.0	7.8	8.0	7.3	7.4	546.0	449.0
Max.	25.4	25.5	8.4	8.3	8.2	8.1	720.0	495.0
Mean	24.6	24.6	8.1	8.2	7.8	7.8	610.3	468.8
S.D.	0.51	0.52	0.23	0.11	0.32	0.29	67.3	17.1
N		12		12		12		12.0
Min.		24.0		7.8		7.3		449.0
Max.		25.5		8.4		8.2		720.0
Mean		24.6		8.2		7.8		539.6
S.D.		0.49		0.18		0.29		87.5

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10/16/2000 1:47 PM

Ceriodaphnia Survival and Reproduction Test-6-Day Survival

Start Date:		Test ID:	TN-00-623	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5	6	7	8	9	10
HARD. CONT.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-724	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
AT0-725	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
AT0-728	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-729	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-730	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
LAB CONT.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Conc-%	Mean	N-Mean	Resp	Not Resp	Total	N	Fisher's Exact P	1-Tailed Critical
HARD. CONT.	1.0000	1.0000	0	10	10	10		
AT0-724	0.9000	0.9000	1	9	10	10	0.5000	0.0500
AT0-725	1.0000	1.0000	0	9	9	9		
AT0-728	0.9000	0.9000	1	9	10	10	0.5000	0.0500
AT0-729	1.0000	1.0000	0	10	10	10		
AT0-730	1.0000	1.0000	0	10	10	10		
LAB CONT.	1.0000	1.0000	0	10	10	10		

Hypothesis Test (1-tail, 0.05)

AT0-724 versus Hardness Control
AT0-728 versus Hardness Control

1-11-01
MW

ToxCalc v5.0.23

Reviewed by:_____

Ceriodaphnia Survival and Reproduction Test-Reproduction

Start Date:	Test ID: TN-00-623	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	CD-Ceriodaphnia dubia
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8	9	10	Std. Dev.
HARD. CONT.	24.000	22.000	25.000	11.000	4.000	19.000	18.000	10.000	14.000	21.000	6.8443
AT0-724	16.000	24.000	20.000	18.000	21.000	17.000	14.000	20.000	30.000	25.000	4.76678
AT0-725	19.000	24.000	26.000	18.000	24.000	19.000	22.000	18.000	23.000		3.00463
AT0-728	8.000	20.000	0.000	29.000	25.000	25.000	27.000	17.000	18.000	20.000	8.97466
AT0-729	9.000	27.000	20.000	20.000	21.000	24.000	17.000	27.000	21.000	20.000	5.18973
AT0-730	19.000	19.000	27.000	20.000	19.000	20.000	23.000	19.000	26.000	23.000	3.06413
LAB CONT.	16.000	24.000	27.000	19.000	23.000	11.000	12.000	20.000	15.000	19.000	5.18973

			Transform: Untransformed				
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N
HARD. CONT.	16.800	1.0000	16.800	4.000	25.000	40.740	10
AT0-724	20.500	1.2202	20.500	14.000	30.000	23.253	10
AT0-725	21.444	1.2765	21.444	18.000	26.000	14.011	9
AT0-728	18.900	1.1250	18.900	0.000	29.000	47.485	10
AT0-729	20.600	1.2262	20.600	9.000	27.000	25.193	10
AT0-730	21.500	1.2798	21.500	19.000	27.000	14.252	10
LAB CONT.	18.600	1.1071	18.600	11.000	27.000	27.902	10

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Kolmogorov D Test indicates normal distribution (p > 0.01)	0.90777	1.035	-0.7377	1.43799
Bartlett's Test indicates equal variances (p = 0.02)	15.2162	16.8119		

ToxCalc v5.0.23

Reviewed by: 1-11-01 W

ATTACHMENT III

Pimephales promelas Chronic Toxicity Testing
Data Sheets

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70023.10
Client: IT
QC Test Number: TN-00-619
Test Material: surface waters
Accession Number: ATO-709 to 713
Dilution Water: N/A
Accession Number: —

TEST ORGANISM
Common Name: fat head minnow
Scientific Name: P. promelas

Beginning Date: 9/~~15~~ 14/00 Time: 1550
Ending Date: 9-21-00 Time: 1515

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Test Container: 1-L beaker
Test Volume: 250 MLS
Test Duration: 7 days

Concentration	Rep	Number of Surviving Organisms							
		Day 0 Date 9/14	Day 1 Date 9/15	Day 2 Date 9/16	Day 3 Date 9/17	Day 4 Date 9/18	Day 5 Date 9/19	Day 6 Date 9/20	Day 7 Date 9/21
Lab control	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
	E	10	10	10	10	10	10	9	9
Hardness control	A	~~9~~ 10	9	9	9	9	9	9	9
	B	10	10	10	10	10	10	10	10
	C	10	~~9~~ (A) 10	9 (A)	9	9	9	9	9
	D	10	10	10	9	9	9	9	9
	E	10	10	10	10	10	10	10	10
Time / Initials		~~1140~~ [illegible]	~~1055~~ 1140 JL WM	1055 WM	1525 JV	1530 MAS	1155 [illegible]	1108 MO	1515 WV

(A) one missing organism

ATS-T10
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70DD3.10
Client: IT
QC Test Number: TN-00-619
Test Material: surface waters
Accession Number: ATD-709 to 713
Dilution Water: N/A
Accession Number: —

TEST ORGANISM
Common Name: fat head minnow
Scientific Name: P. promelas

Beginning Date: 9/14/00 Time: 1550
Ending Date: 9-21-00 Time: 1515

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Test Container: 1-L beaker
Test Volume: 250 MLS
Test Duration: 7 days

Concentration	Rep	Number of Surviving Organisms							
		Day 0 Date 9/14	Day 1 Date 9/15	Day 2 Date 9/16	Day 3 Date 9/17	Day 4 Date 9/18	Day 5 Date 9/19	Day 6 Date 9/20	Day 7 Date 9/21
ATD-709	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
	E	10	10	10	10	10	10	10	10
ATD-710	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
	E	10	10	10	11	11	11	11	11
ATD-711	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
Time / Initials		~~1140~~ ~~JC~~	1140 JC	1120 WM	1525 JV	1530 MAS	1155 MD	1108 /MD	1515 /MD

ATS-T10
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 700003.10
Client: IT
QC Test Number: TN-00-619
Test Material: surface waters
Accession Number: ATD-709 to 713
Dilution Water: N/A
Accession Number: —

TEST ORGANISM
Common Name: fat head minnow
Scientific Name: P. promelas

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Beginning Date: 9/14/00 Time: 1550
Ending Date: 9-21-00 Time: 1515

Test Container: 1-L beaker
Test Volume: 250 mls
Test Duration: 7 days

Concentration	Rep	Number of Surviving Organisms							
		Day 0 Date 9/14	Day 1 Date 9/15	Day 2 Date 9/16	Day 3 Date 9/17	Day 4 Date 9/18	Day 5 Date 9/19	Day 6 Date 9/20	Day 7 Date 9/21
ATD-711 cont.	E	10	10	10	10	10	10	10	10
ATD-712	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	9	9	9	9
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
	E	10	10	10	10	10	10	10	10
ATD-713	A	10	10	10	8	8	8	7	7
	B	10	10	9	9	9	9	9	9
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	10	10	10	10
	E	10	10	10	9	8	8	8	8
Time / Initials		~~1140~~ AZ	1140 SL	1150 WM	1525 JV	1530 VAS	1155 MD	1108/nn	1515 MN

ATS-T10
03/01/00

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-619

Tin Lot: 27 Green Oven Temp (°C): 100°C

	Date	Time	Initials
Loaded tins placed in oven:	9-21-00	1535	VW
Loaded tins removed from oven:	10/4/00	1035	UND
Loaded tins weighed:	10/4/00	1038	UND

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
Lab Control	A	61	27.63	32.38	4.75	10	0.475	
	B	107	26.00	30.28	4.28	10	0.428	
	C	62	26.99	31.64	4.65	10	0.465	
	D	56	28.47	32.87	4.40	10	0.440	
	E	81	28.05	32.67	4.62	9	0.513	
Hardness Control	A	69	27.44	32.32	4.88	9	0.542	
	B	92	27.82	32.70	4.88	10	0.488	
	C	125	27.40	32.04	4.64	9	0.516	
	D	115	29.55	34.10	4.55	9	0.506	
	E	106	27.32	31.62	4.30	10	0.430	

Dry wt. calculations checked (date, initials): 10/4/00 UND
10/12/00 LAH

Biomass calculations checked (date, initials): _____

ATS-T46
/01/00

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-619

Tin Lot: 27 Green Oven Temp (°C): 100°C

	Date	Time	Initials
Loaded tins placed in oven:	9-21-00	1535	MW
Loaded tins removed from oven:	10/4/00	1035	UND
Loaded tins weighed:	10/4/00	1038	UND

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-709	A	95	27.30	31.79	4.49	10	0.449	
	B	26	26.09	31.06	4.97	10	0.497	
	C	103	27.68	32.28	4.60	10	0.460	
	D	32	28.46	33.41	4.95	10	0.495	
	E	11	27.32	32.80	5.48	10	0.548	
ATO-710	A	38	28.64	33.97	5.33	10	0.533	
	B	18	27.36	32.79	5.43	10	0.543	
	C	60	28.37	33.63	5.26	10	0.526	
	D	88	27.40	32.02	4.62	10	0.462	
	E	82	29.39	35.32	5.93	11	0.539	

Dry wt. calculations checked (date, initials): 10/4/00 UND 10/12/00 LAH

Biomass calculations checked (date, initials): _____

ATS-T46
03/01/00

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-619

Tin Lot: 27 Green Oven Temp (°C): 100°C

	Date	Time	Initials
Loaded tins placed in oven:	9-21-00	1535	MW
Loaded tins removed from oven:	10/4/00	1035	YND
Loaded tins weighed:	10/4/00	1038	YND

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-711	A	16	27.58	32.75	5.17	10	0.517	
	B	84	27.93	33.05	5.12	10	0.512	
	C	65	27.54	32.84	5.30	10	0.530	
	D	72	27.32	32.61	5.29	10	0.529	
	E	19	28.64	33.15	4.51	10	0.451	
ATO-712	A	50	28.17	33.71	5.54	10	0.554	
	B	57	26.90	31.73	4.83	9	0.537	
	C	131	27.30	33.04	5.74	10	0.574	
	D	25	29.36	33.86	4.50	10	0.450	
	E	75	27.56	32.79	5.23	10	0.523	

Dry wt. calculations checked (date, initials): 10/4/00 YND 10/12/00 LAH

Biomass calculations checked (date, initials): _____

ATS-T46
03/01/00

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: JT

QC Test Number: ~~70~~ WW-TN-00-619

Tin Lot: 27 Green Oven Temp (°C): 100°C

	Date	Time	Initials
Loaded tins placed in oven:	9-21-00	1535	MJ
Loaded tins removed from oven:	10/4/00	1035	YRD
Loaded tins weighed:	10/4/00	1038	YRD

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATD-713	A	42	25.68	29.91	4.23	7	0.604	
	B	109	28.23	31.73	3.50	9	0.389	
	C	117	27.93	33.09	5.16	10	0.516	
	D	36	28.07	32.67	4.60	10	0.460	
	E	110	27.98	31.32	3.34	8	0.418	

Dry wt. calculations checked (date, initials): 10/4/00 YRD 10/12/00 LAT

Biomass calculations checked (date, initials):

ATS-T46
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70223.10
Client: IT
QC Test Number: TN-00-1019

TEST ORGANISM
Common Name: fat head minnow
Scientific Name: P. promelas

Beginning Date: 9/14/00 Time: 1550
Ending Date: 9/21/00 Time: 1575

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
Lab control		24.4	24.8	24.9	25.1	25.2	24.5	25.8	7.5	8.1	8.7	8.4	8.1	7.5	7.4	7.8	7.5	7.1	8.1	7.6	8.1	7.4	347	307	330	333	320	290	296
Hard control		24.1	24.3	24.5	25.0	24.7	24.1	24.2	8.7	8.4	8.6	8.3	8.4	8.3	8.2	7.6	7.8	7.5	8.2	8.1	8.5	8.6	776	790	771	783	774	782	738
Meter Number		10/166	92/106	72/104	10/103	57	73/104	17/103	14/166	92/106	72/104	10/103	33/108	73/104	17/103	57	57	57	57	57	57	57	12/921	12/921	12/921	23/921	14/920	10/920	12/921
Time		1146	0935	0951	1110	1440	1420	1014	1146	0935	0951	1110	1500	1420	1014	1201	0940	1001	1145	1440	1420	1021	1211	0945	0953	1145	1440	1000	1011
Initials		JN	[illegible]	RD	MAS	RS	VTD	MM	JN	[illegible]	RD	MAS	JS	VTD	M	JN	[illegible]	RD	MAS	RS	VTD	RD	JN	[illegible]	RD	MAS	RS	[illegible]	MM

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-619

TEST ORGANISM
Common Name: fat head minnow
Scientific Name: P. promelas

Beginning Date: 9/14/00 Time: 1550
Ending Date: 9/21/00 Time: 1515

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
AD-709		24.1	24.2	25.0	24.0	24.9	25.1	24.2	9.0	9.0	9.0	8.9	9.0	8.9	8.8	8.3	7.4	7.5	8.5	7.7	7.9	7.8	539	500	467	487	492	430	491
AD-710		24.1	24.2	24.9	24.2	24.7	24.9	24.2	8.5	8.5	8.7	8.4	8.5	8.6	8.5	8.3	7.6	7.5	8.3	7.6	8.0	7.9	543	612	542	590	596	593	571
AD-711		24.1	24.5	24.9	24.1	24.7	24.8	24.4	9.2	9.0	9.1	8.9	8.3	8.8	8.9	8.1	7.6	7.6	8.5	7.5	7.9 8.0	8.1	530	525	505	502	517	521	486
AD-712		24.1	24.5	24.9	24.4	24.7	24.8	24.1	8.3	8.4	8.8	8.0	8.2	8.3	8.2	8.2	7.4	7.4	8.2	7.6	7.9	7.8	279	244	248	237	231	232	246
AD-713		24.0	24.4	25.0	24.2	24.8	24.9	24.0	8.1	8.1	8.4	8.1	8.3	8.4	8.2	8.2	7.6	7.5	8.4	7.8	7.9	8.3	576	556	536	526	514	516	487
Meter Number		10/106	92/106	72/109	10/103	57	92/106	10/103	10/106	92/106	72/109	10/103	99/100	92/106	10/103	57	57	57	57	57	57	57	12/121	12/121	12/94	23/121	11/120	11/120	13/121
Time		1148	0931	0951	1110 1010	1440	1610	1014	1148	0935	0951	1110 1010	1500	1610	1014	1201	0940	1001	1145	1440	1005	1021	1200	0945	0953	1145	1440	1000	1009
Initials		JN	MKL	RD	MAS	AS	JN	MR	JN	MKL	RD	MAS	AS	JN	MR	JN	MKL	RD	MAS	AS	ND	MR	JN	MKL	RD	MS	AS	JN	MR

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-619

TEST ORGANISM
Common Name: fathead minnow
Scientific Name: P. promelas

Beginning Date: 9/14/00 Time: 1550
Ending Date: 9/21/00 Time: 1515

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
Lab Control		24.0 ~~7.0~~	24.4	24.5	25.4	24.6	24.3	24.1	7.6	7.0	7.8	7.8	7.9	8.0	8.0	7.4	6.9	7.1	7.1	6.8	6.7	6.5	318	334	325	331	290	309	308
Hard. Control		24.0	24.8	24.9	25.9	24.4	24.4	24.4	8.3	7.5	8.2	8.2	8.2	8.2	7.9	7.5	6.7	7.1	6.9	7.1	7.7	6.5	785	765	750	800	735 ~~774~~ 25	783	825
Replicate		A	B	C	D	E	A	B																					
Meter Number		92/106	73/104	12/104	12/104	73/104	11/104	11/104	92/106	73/104	12/104	12/104	73/104	11/104	11/104	57	57	57	57	57	57	55	12/021	10/921	73/021	11/000	10/921	73/021	12/020
Time		1115	1020	1023	1320	1040	1030	1430	1115	1020	1023	1130	1040	1030	1430	1148	1035	1029	1125	1050	1045	1431	1120	1038	1040	1130	1045	1035	1425
Initials		gz	wm	MAS	LB	VD	mn	WW	gz	wm	MAS	JS	VD	mn	WW	gz	wm	JS	JS	VD	mn	WW	gz	wm	JS	JS	VD	mn	WW

ATS-T14
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-619

TEST ORGANISM
Common Name: fat head minnow
Scientific Name: P. promelas

Beginning Date: 9/14/00 Time: 1550
Ending Date: 9/21/00 Time: 1575

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) Salinity (ppt) 1	2	3	4	5	6	7
AFD-709		24.2	24.9	24.8	25.4	24.8	24.9	24.8	8.6	8.5	8.5	8.5	8.4	8.3	8.0	7.4	6.8	7.2	6.8	6.6	6.8	6.4	505	507	474	523	481	495	530
								24.2				LS						LS											
AFD-710		24.1	25.2	24.4	25.1	24.3	24.7	8.0	8.5	8.5	8.6	8.5	8.4	8.4	8.3	7.3	7.1	7.1	6.6	6.5	6.7	6.0	628	635	620	620	580	586	593
																7.3													
AFD-711		24.1	25.1	24.6	25.3	24.9	24.4	24.3	8.7	8.5	8.5	8.5	8.4	8.4	8.3	7.4	7.0	6.9	6.6	6.4	6.7	6.6	540	536	530	517	500	514	531
AFD-712		24.1	25.1	24.8	25.3	24.7	24.7	24.1	8.0	8.2	8.0	8.5	7.8	8.2	8.3	7.3	6.8	7.1	6.3	6.5	6.6	6.2	251	248	245	249	245	262	241
															8.0														
AFD-713		24.0	25.3	24.7	25.3	24.7	25.0	24.5	8.2	8.3	8.2	8.2	8.1	8.2	8.0	7.2	6.7	6.8	6.8	6.7	6.7	6.6	565	559	534	551	520	526	561
																											514		
Replicate		A	B	C	D	E	A	B																					
Meter Number		92/100	73/104	12/104	73/104	73/104	11/104	11/104	92/100	73/104	12/104	12/104	73/104	11/104	11/104	57	57	57	57	57	57	55	12/21	12/21	73/21	15/20	15/21	73/21	15/20
Time		1115	1028	1028	1040	1040	1030	1430	1115	1028	1028	1130	1040	1130	1430	1118	1035	1009	1125	1059	1145	1431	1120	1038	1040	1130	1045	1035	1425
Initials		gd	wm	MAS	LS	LS	no	WW	gd	wm	MAS	LS	LS	m	WW	gd	wm	LS	LS	LS	no	WW	gd	wm	LS	LS	LS	hm	WW

12/104 1130 LS

ATS-T14
03/01/00

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70002310

Client: IT

QC Test Number: TN-00-619

TEST ORGANISM INFORMATION

Common Name: fat head minnow

Scientific Name: p. promelas

Lot Number: FH 0-9/14-15 ~~unr~~ 0-9/13-14

Source: EA

Adults Isolated (Time, Date): —

Neonates Pulled (Time, Date): —

Acclimation: —

Age: <24 hrs

Culture Water (T)S/: _____ °C — ppt

TEST SET-UP

TEST INITIATION

Date	Time	Initials	Activity
9/14/00	1456	RD	Dilutions Made
	1456	RD	Test Vessels Filled
	1550	JL/JL RP	Organisms Transferred
			Head Counts

CONCENTRATION SERIES

Test Concentration	Volume Test Material	Final Volume
Lab Control	0	~~0 1500~~ LS 1300ml
Hardness Control	0	

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION

Day	Date	Time	Initials	Sample / Diluent
0	RD	9/14/00	1456	LDO-393 (Lab) LDO-396 (Hard)
1	9/15/00	0950	RSH	LDO-393 (Lab) LDO-396 (Hard)
2		0850 9/16/00	WLM	(HARD) LDO-396 (LAB) LDO-397
3	1100	9/17/00	OV	(Lab) LDO-398 (Hard) LDO-396
4	9/18/00 ~~9/19/00~~ RD	0830 ~~1415~~ RD	LB ~~RD~~	lab ~~LDO-402~~ hard ~~LDO-396~~ RD
5	9/19/00	1415	RD	(lab) LDO-402 (Hard) LDO-396
6	9/20/00	1100	RD	(Lab) LDO-402 (Hard) LDO-396

FEEDING

Food: Artemia 3x/day

Day	Time, Initials, Amount	Time, Initials, Amount	Time, Initials, Amount
0	X	X	1647 3 drops OV
1	0820 3 drops OV	1215 3 drops OV	1630 3 drops OV
2	0915 3 drops	1308 3 drops	1925 3 RD
3	0900 4 OV	1200 4 OV	1615 4 OV
4	0830 5 OV	1200 5 OV	1455 5 OV
5	0830 5 OV	1203 5 OV	1630 5 OV
6	0850 5 OV	1310 5 OV	1630 5 OV

ATS-T27
03/01/00

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70003.10

Client: IT

QC Test Number: TN-DO-619

TEST ORGANISM INFORMATION

Common Name: fat head minnow

Scientific Name: P. promelas

Lot Number: Ft ~~0-9/14-15 MN~~ 0-9/13-14

Source: EA

Adults Isolated (Time, Date): —

Neonates Pulled (Time, Date): —

Acclimation: —

Age: <24hrs.

Culture Water (T/S): °C — ppt

TEST SET-UP

TEST INITIATION

Date	Time	Initials	Activity
9/14/00	1505	MN	Dilutions Made
9/14/00	1522	MN	Test Vessels Filled
9/14/00	1550	GL/JL RD	Organisms Transferred
			Head Counts

CONCENTRATION SERIES

100% Test Concentration	Volume Test Material	Final Volume
ATO-709	1300 ml	1300 ml
ATO-710	↓	↓
ATO-711		
ATO-712		
ATO-713		

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION

Day	Date	Time	Initials	Sample / Diluent
0	9/14/00	1505	MN	ATO-709→713
1	9/15/00	0950	RCL	ATO-709→713
2	9/16/00	0850	WLM	ATO-709→713
3	9/17/00	1100	JN	ATO-709→713
4	9/18/00	0830	LS	ATO-709→713
5	9/19/00	1415	MD	ATO-709→713
6	9/20/00	1102	an	ATO-709→713

FEEDING

Food: Artemia, 3x/day

Day	Time, Initials, Amount	Time, Initials, Amount	Time, Initials, Amount
0	X	X	1647 3ml
1	0820 3ml	1315 3ml	1630 3ml
2	0915 3ml	1303 3ml	1725 3ml
3	0900 4ml	1200 JN 4 drops	1615 JN 4.5 drops
4	0830 5ml	1200 5ml	1655 5ml
5	0830 5ml	1203 5ml	1630 5ml
6	0850 5ml	1310 5ml	1630 5ml

ATS-T27
03/01/00

STATISTICS FOR WATER QUALITY

QC Test: TN-00-619 IT (LAB CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.4	24.0	7.5	7.6	7.8	7.4	347.0	318.0
2	24.8	24.4	8.1	7.0	7.5	6.9	307.0	334.0
3	24.9	24.5	8.7	7.8	7.1	7.1	330.0	325.0
4	25.1	25.4	8.4	7.8	8.1	7.1	333.0	331.0
5	25.2	24.6	8.1	7.9	7.6	6.8	320.0	290.0
6	24.5	24.3	7.5	8.0	8.1	6.7	290.0	309.0
7	25.8	24.1	7.7	8.0	7.4	6.5	296.0	308.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.4	24.0	7.5	7.0	7.1	6.5	290.0	290.0
Max.	25.8	25.4	8.7	8.0	8.1	7.4	347.0	334.0
Mean	25.0	24.5	8.0	7.7	7.7	6.9	317.6	316.4
S.D.	0.47	0.46	0.46	0.35	0.37	0.30	20.8	15.4
N		14		14		14		14.0
Min.		24.0		7.0		6.5		290.0
Max.		25.8		8.7		8.1		347.0
Mean		24.7		7.9		7.3		317.0
S.D.		0.51		0.42		0.50		17.6

1-11-01
WW

10/16/2000 3:21 PM

STATISTICS FOR WATER QUALITY

QC Test: TN-00-619 IT (HARDNESS CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.0	8.7	8.3	7.6	7.5	776.0	785.0
2	24.3	24.8	8.4	7.5	7.8	6.7	790.0	765.0
3	24.5	24.9	8.6	8.2	7.5	7.1	771.0	750.0
4	25.0	25.9	8.3	8.2	8.2	6.9	783.0	808.0
5	24.7	24.4	8.4	8.2	8.1	7.1	774.0	735.0
6	24.1	24.4	8.3	8.2	8.5	7.7	782.0	783.0
7	24.2	24.4	8.3	7.9	8.6	6.5	738.0	825.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.1	24.0	8.3	7.5	7.5	6.5	738.0	735.0
Max.	25.0	25.9	8.7	8.3	8.6	7.7	790.0	825.0
Mean	24.4	24.7	8.4	8.1	8.0	7.1	773.4	778.7
S.D.	0.34	0.61	0.16	0.28	0.43	0.42	16.9	31.6
N		14		14		14		14.0
Min.		24.0		7.5		6.5		735.0
Max.		25.9		8.7		8.6		825.0
Mean		24.6		8.3		7.6		776.1
S.D.		0.50		0.29		0.65		24.5

1-11-01
WW

STATISTICS FOR WATER QUALITY
QC Test: TN-00-619 IT (AT0-709)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.2	9.0	8.6	8.3	7.4	539.0	505.0
2	24.2	24.9	9.0	8.5	7.4	6.8	500.0	507.0
3	25.0	24.8	9.0	8.5	7.5	7.2	467.0	474.0
4	24.0	25.9	8.9	8.5	8.5	6.8	487.0	523.0
5	24.9	24.8	9.0	8.4	7.7	6.6	492.0	481.0
6	25.1	24.9	8.9	8.3	7.9	6.8	489.0	495.0
7	24.2	24.8	8.8	8.0	7.8	6.4	491.0	556.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.2	8.8	8.0	7.4	6.4	467.0	474.0
Max.	25.1	25.9	9.0	8.6	8.5	7.4	539.0	556.0
Mean	24.5	24.9	8.9	8.4	7.9	6.9	495.0	505.9
S.D.	0.48	0.50	0.08	0.20	0.40	0.34	21.9	27.6
N		14		14		14		14.0
Min.		24.0		8.0		6.4		467.0
Max.		25.9		9.0		8.5		556.0
Mean		24.7		8.7		7.4		500.4
S.D.		0.51		0.32		0.64		24.6

10-11-01

STATISTICS FOR WATER QUALITY
QC Test: TN-00-619 IT (AT0-710)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.1	8.5	8.5	8.3	7.3	643.0	628.0
2	24.2	25.2	8.5	8.5	7.6	7.1	612.0	635.0
3	24.9	24.4	8.7	8.6	7.5	7.1	542.0	620.0
4	24.2	25.1	8.4	8.5	8.3	6.6	590.0	620.0
5	24.7	24.3	8.5	8.4	7.6	6.5	596.0	580.0
6	24.9	24.7	8.6	8.4	8.0	6.7	593.0	586.0
7	24.2	24.2	8.5	8.3	7.9	6.0	571.0	593.0
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48								
N	7	7	7	7	7	7	7.0	7.0
Min.	24.1	24.1	8.4	8.3	7.5	6.0	542.0	580.0
Max.	24.9	25.2	8.7	8.6	8.3	7.3	643.0	635.0
Mean	24.5	24.6	8.5	8.5	7.9	6.8	592.4	608.9
S.D.	0.36	0.44	0.10	0.10	0.33	0.45	31.5	22.0
N		14		14		14		14.0
Min.		24.1		8.3		6.0		542.0
Max.		25.2		8.7		8.3		643.0
Mean		24.5		8.5		7.3		600.6
S.D.		0.39		0.10		0.70		27.5

1-11-01
WW

10/16/2000 3:29 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-619 IT (AT0-711)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.1	9.2	8.7	8.1	7.4	530.0	540.0
2	24.5	25.1	9.0	8.5	7.6	7.0	525.0	536.0
3	24.9	24.6	9.1	8.5	7.6	6.9	505.0	530.0
4	24.1	25.3	8.9	8.5	8.5	6.6	502.0	547.0
5	24.7	24.9	8.3	8.4	7.5	6.4	517.0	500.0
6	24.8	24.4	8.8	8.4	7.9	6.7	521.0	514.0
7	24.4	24.3	8.9	8.3	8.1	6.6	486.0	539.0
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48								
N	7	7	7	7	7	7	7.0	7.0
Min.	24.1	24.1	8.3	8.3	7.5	6.4	486.0	500.0
Max.	24.9	25.3	9.2	8.7	8.5	7.4	530.0	547.0
Mean	24.5	24.7	8.9	8.5	7.9	6.8	512.3	529.4
S.D.	0.32	0.44	0.29	0.13	0.36	0.33	15.4	16.6
N		14		14		14		14.0
Min.		24.1		8.3		6.4		486.0
Max.		25.3		9.2		8.5		547.0
Mean		24.6		8.7		7.4		520.9
S.D.		0.38		0.30		0.66		17.8

1-11-00
WW

10/16/2000 3:35 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-619 IT (AT0-712)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.1	24.1	8.3	8.0	8.2	7.3	279.0	251.0
2	24.5	25.1	8.4	8.2	7.4	6.8	244.0	248.0
3	24.9	24.8	8.8	8.0	7.4	7.1	248.0	245.0
4	24.4	25.3	8.0	8.5	8.2	6.3	237.0	249.0
5	24.7	24.7	8.2	7.8	7.6	6.5	231.0	245.0
6	24.8	24.7	8.3	8.2	7.9	6.6	232.0	262.0
7	24.1	24.1	8.2	8.3	7.8	6.2	240.0	241.0
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48								
N	7	7	7	7	7	7	7.0	7.0
Min.	24.1	24.1	8.0	7.8	7.4	6.2	231.0	241.0
Max.	24.9	25.3	8.8	8.5	8.2	7.3	279.0	262.0
Mean	24.5	24.7	8.3	8.1	7.8	6.7	244.4	248.7
S.D.	0.32	0.46	0.25	0.23	0.34	0.41	16.4	6.7
N		14		14		14		14.0
Min.		24.1		7.8		6.2		231.0
Max.		25.3		8.8		8.2		279.0
Mean		24.6		8.2		7.2		246.6
S.D.		0.39		0.25		0.67		12.3

10-11-00
MW

10/16/2000 3:37 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-619 IT (AT0-713)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.0	24.0	8.1	8.2	8.2	7.2	576.0	565.0
2	24.4	25.3	8.1	8.3	7.6	6.7	556.0	559.0
3	25.0	24.7	8.4	8.2	7.5	6.8	538.0	534.0
4	24.2	25.3	8.1	8.2	8.4	6.8	536.0	551.0
5	24.8	24.7	8.3	8.1	7.8	6.7	594.0	520.0
6	24.9	25.0	8.4	8.2	7.9	6.7	596.0	526.0
7	24.0	24.5	8.2	8.0	8.3	6.6	481.0	569.0
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48								
N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.0	8.1	8.0	7.5	6.6	481.0	520.0
Max.	25.0	25.3	8.4	8.3	8.4	7.2	596.0	569.0
Mean	24.5	24.8	8.2	8.2	8.0	6.8	553.9	546.3
S.D.	0.43	0.46	0.14	0.10	0.35	0.20	40.3	19.6
N		14		14		14		14.0
Min.		24.0		8.0		6.6		481.0
Max.		25.3		8.4		8.4		596.0
Mean		24.6		8.2		7.4		550.1
S.D.		0.46		0.12		0.67		30.7

1/11-01
W

10/16/2000 3:39 PM

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:		Test ID:	TN-00-619	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
HARD. CONT.	0.9000	1.0000	1.0000	0.9000	1.0000
AT0-709	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-710	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-711	1.0000	1.0000	1.0000	1.0000	1.0000
AT0-712	1.0000	0.9000	1.0000	1.0000	1.0000
AT0-713	0.7000	0.9000	1.0000	1.0000	0.8000
LAB CONT.	1.0000	1.0000	1.0000	1.0000	0.9000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.9600	1.0000	1.3451	1.2490	1.4120	6.524	5			
AT0-709	1.0000	1.0417	1.4120	1.4120	1.4120	0.000	5			
AT0-710	1.0000	1.0417	1.4135	1.4120	1.4195	0.236	5			
AT0-711	1.0000	1.0417	1.4120	1.4120	1.4120	0.000	5			
AT0-712	0.9800	1.0208	1.3794	1.2490	1.4120	5.284	5			
AT0-713	0.8800	0.9167	1.2343	0.9912	1.4120	15.085	5	1.204	1.860	0.1712
LAB CONT.	0.9800	1.0208	1.3794	1.2490	1.4120	5.284	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93675	0.781	-0.3315	-0.6628
F-Test indicates equal variances (p = 0.17)	4.50208	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.09933	0.10457	0.0307	0.02118	0.26305	1, 8

AT0-713 vs. ~~Co~~ Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01 CLAH

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:		Test ID:	TN-00-619	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5	Std. Dev.
HARD. CONT.	0.5422	0.4880	0.5156	0.5056	0.4300	0.04192
AT0-709	0.4490	0.4970	0.4600	0.4950	0.5480	0.03879
AT0-710	0.5330	0.5430	0.5260	0.4620	0.5391	0.03339
AT0-711	0.5170	0.5120	0.5300	0.5290	0.4510	0.03268
AT0-712	0.5540	0.5367	0.5740	0.4500	0.5230	0.04737
AT0-713	0.6043	0.3889	0.5160	0.4600	0.4175	0.08561
LAB CONT.	0.4750	0.4280	0.4650	0.4400	0.5133	0.03327

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.4963	1.0000	0.4963	0.4300	0.5422	8.448	5			
AT0-709	0.4898	0.9870	0.4898	0.4490	0.5480	7.920	5	0.253	1.860	0.0475
AT0-710	0.5206	1.0491	0.5206	0.4620	0.5430	6.414	5			
AT0-711	0.5078	1.0232	0.5078	0.4510	0.5300	6.435	5			
AT0-712	0.5275	1.0630	0.5275	0.4500	0.5740	8.979	5			
AT0-713	0.4773	0.9619	0.4773	0.3889	0.6043	17.935	5			
LAB CONT.	0.4643	0.9355	0.4643	0.4280	0.5133	7.166	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.97374	0.781	-0.2095	-0.2972
F-Test indicates equal variances (p = 0.88)	1.16798	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.0475	0.09571	0.0001	0.00163	0.80652	1, 8

AT0-709 versus Hardness Control

1-11-01 W

ToxCalc v5.0.23

Reviewed by:_____

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	Test ID: TN-00-619	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5
HARD. CONT.	0.5422	0.4880	0.5156	0.5056	0.4300
AT0-709	0.4490	0.4970	0.4600	0.4950	0.5480
AT0-710	0.5330	0.5430	0.5260	0.4620	0.5391
AT0-711	0.5170	0.5120	0.5300	0.5290	0.4510
AT0-712	0.5540	0.5367	0.5740	0.4500	0.5230
AT0-713	0.6043	0.3889	0.5160	0.4600	0.4175
LAB CONT.	0.4750	0.4280	0.4650	0.4400	0.5133

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.4963	1.0000	0.4963	0.4300	0.5422	8.448	5			
AT0-709	0.4898	0.9870	0.4898	0.4490	0.5480	7.920	5			
AT0-710	0.5206	1.0491	0.5206	0.4620	0.5430	6.414	5			
AT0-711	0.5078	1.0232	0.5078	0.4510	0.5300	6.435	5			
AT0-712	0.5275	1.0630	0.5275	0.4500	0.5740	8.979	5			
AT0-713	0.4773	0.9619	0.4773	0.3889	0.6043	17.935	5	0.444	1.860	0.0793
LAB CONT.	0.4643	0.9355	0.4643	0.4280	0.5133	7.166	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9603	0.781	0.54444	0.47835
F-Test indicates equal variances (p = 0.20)	4.17005	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.07927	0.15973	0.0009	0.00454	0.66873	1, 8

AT0-713 versus Hardness Control

1-11-91 WW

ToxCalc v5.0.23

Reviewed by:_____

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622
Test Material: Surface waters
Accession Number: ATO-724, 725, 728 to 730
Dilution Water: N/A
Accession Number: N/A

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Beginning Date: 9/16/00 Time: ~~1545~~ 1625
Ending Date: 9/23/00 Time: 1600

Test Container: 1L Beaker
Test Volume: 250 mls
Test Duration: 7 days

Concentration	Rep	Number of Surviving Organisms							
		Day 0 Date 9/16	Day 1 Date 9/17	Day 2 Date 9/18	Day 3 Date 9/19	Day 4 Date 9/20	Day 5 Date 9/21	Day 6 Date 9/22	Day 7 Date 9/23
Lab Control	A	10	10	10	10	10	8	8	8
	B	10	10	10	10	10	10	10	10
	C	10	10	10	10	10	10	10	10
	D	10	10	10	10	9	9	8	7
	E	10	10	10	10	8	8	8	8
Hardness Control	A	10	10	10	10	10	10	10	10
	B	10	10	10	10	10	10	10	10
	C	10	10	10	9	9	9	9	9
	D	10	10	10	10	10	9	9	9
	E	10	10	10	9	9	9	9	9
Time / Initials		1712 MR	18 ~~1450~~ 1530 RS	1600 RS	1430 RS	1215 MR	1025 MR	1140 MR	1600 RS

ATS-T10
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622
Test Material: surface waters
Accession Number: ATO-724, 725, 728 & 730
Dilution Water: N/A
Accession Number: N/A

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Beginning Date: 9/16/00 Time: ~~1540~~ 1625
Ending Date: 9/23/00 Time: 1600

Test Container: 1L Beaker
Test Volume: 250mls
Test Duration: 7days

Concentration	Rep	Number of Surviving Organisms							
		Day 0 Date 9/16	Day 1 Date 9/17	Day 2 Date 9/18	Day 3 Date 9/19	Day 4 Date 9/20	Day 5 Date 9/21	Day 6 Date 9/22	Day 7 Date 9/23
ATO- 725	A	10	~~8~~ 8	8	8	8	8	8	8
	B	10	9	9	9	9	9	9	9
	C	10	10	10	10	10	7	7	5
	D	10	10	9	9	9	9	9	9
	E	10	10	10	10	10	10	10	10
ATO- 728	A	10	9	9	9	7	7	7	7
	B	10	10	10	9	8	7	7	7
	C	10	10	10	10	8	6	6	6
	D	10	10	9 (missing)	9	9	9	9	8
	E	10	9	9	9	9	8	6	6
ATO- 730	A	10	10	9	9	9	9	9	9
	B	10	10	10	10	10	10	10	10
	C	10	10	9	9	9	9	9	9
	D	10	10	7	6	5	5	5	5
Time / Initials		1712/ [illegible]	1530 RS	1600 [illegible]	1430 RS	1215 [illegible]	1025 [illegible]	1140 [illegible]	1600 RS

ATS-T10
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622
Test Material: Surface waters
Accession Number: ATO-724, 725, 728 to 730
Dilution Water: N/A
Accession Number: N/A

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Beginning Date: 9/16/00 Time: ~~1540~~ 1625
Ending Date: 9/23/00 Time: 1600

Test Container: 1L Beaker
Test Volume: 250 ml's
Test Duration: 7 days

Concentration	Rep	Number of Surviving Organisms							
		Day 0 Date 9/16	Day 1 Date 9/17	Day 2 Date 9/18	Day 3 Date 9/19	Day 4 Date 9/20	Day 5 Date 9/21	Day 6 Date 9/22	Day 7 Date 9/23
ATO- 724	E	10	10	9	8	8	8	8	8
ATO- 730	A	10	10	9	7	7	7	6	6
	B	10	10	9	9	8	8	8	8
	C	10	10	10	10	9	9	9	9
	D	10	10	9	9	9	7	7	7
	E	10	10	10	10	10	10	10	10
ATO- 729	A	10	9	8	8	8	8	8	8
	B	10	9	9	7	7	7	7	7
	C	10	9	9	9	9	9	8	8
	D	10	9	9	9	9	9	9	9
	E	10	10	9	9	8	8	8	8
Time / Initials		1712 / MM	AS 1530	1600	1430 SZ	1215 MM	1025 MM	1140 MM	1600 SZ

ATS-T10
03/01/00

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-622

Tin Lot: 29 RED Oven Temp (°C): 100°C

	Date	Time	Initials
Loaded tins placed in oven:	9/23/00	1610	SD
Loaded tins removed from oven:	10/4/00	1110	YND
Loaded tins weighed:	10/4/00	1114	YND

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
Lab control	A	40	29.96	33.42	3.46	8	0.433	
	B	94	27.48	31.20	3.72	10	0.372	
	C	6	28.42	32.81	4.39	10	0.439	
	D	53	27.12	29.76	2.64	7	0.377	
	E	3	26.67	29.89	3.22	8	0.403	
Hardness Control	A	66	27.56	31.74	4.18	10	0.418	
	B	38	27.39	31.02	3.63	10	0.363	
	C	12	24.14	28.03	3.89	9	0.432	
	D	58	27.85	31.71	3.86	9	0.429	
	E	102	29.09	32.90	3.81	9	0.423	

Dry wt. calculations checked (date, initials): 10/12/00 LAH

Biomass calculations checked (date, initials): _____

ATS-T46
03/01/00

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-622

Tin Lot: 29 RED Oven Temp (°C): 100°C

	Date	Time	Initials
Loaded tins placed in oven:	9/23/00	1610	SD
Loaded tins removed from oven:	10/4/~~00~~ 00 LAH	1110	MD
Loaded tins weighed:	10/4/00	1114	MD

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-725	A	93	27.93	31.00	3.07	8	0.384	
	B	70	25.56	28.81	3.25	9	0.361	
	C	1	28.23	30.97	2.74	5	0.548	
	D	81	28.17	31.63	3.46	9	0.384	
	E	68	28.35	32.17	3.82	10	0.382	
ATO-728	A	28	29.40	31.87	2.47	7	0.353	
	B	99	26.47	28.90	2.43	7	0.347	
	C	26	26.02	28.24	2.22	6	0.370	
	D	96	27.62	30.67	3.05	8	~~0.381~~ LAH	0.381
	E	45	28.48	30.55	2.07	6	0.345	
ATO-724	A	31	27.63	31.52	3.89	9	0.432	
	B	120	29.18	33.57	4.39	10	0.439	
	C	2	26.00	29.84	3.84	9	0.427	
	D	84	28.94	32.19	3.25	5	0.650	

Dry wt. calculations checked (date, initials): 10/12/00 LAH

Biomass calculations checked (date, initials): _____

WEIGHT DATA (Test Species: P. promelas)

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-622

Tin Lot: 29 RED Oven Temp (°C): 100 °C

	Date	Time	Initials
Loaded tins placed in oven:	9/23/00	1610	BJ
Loaded tins removed from oven:	10/4/00	1110	MD
Loaded tins weighed:	10/4/00	1114	MD

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-724	E	51	27.57	30.51	2.94	8	0.368	
ATO-730	A	41	26.22	28.81	2.59	6	0.432	
	B	65	28.63	31.88	3.25	8	0.406	
	C	14	25.41	29.10	3.69	9	0.410	
	D	85	27.85	30.51	2.66	7	0.380	
	E	7	28.06	31.79	3.73	10	0.373	
ATO-729	A	107	28.61	32.07	3.46	8	0.433	
	B	110	29.70	33.17	3.47	7	0.496	
	C	9	26.12	29.24	3.12	8	0.390	
	D	75	29.41	32.86	3.45	9	0.383	
	E	72	25.54	28.73	3.19	8	0.399	

Dry wt. calculations checked (date, initials): 10/12/00 MH

Biomass calculations checked (date, initials): _____

ATS-T46
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

Beginning Date: 9/16/00 Time: ~~1640~~ 1625 OV
Ending Date: 9/23/00 Time: 1600

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
Lab Control		25.8	25.8	25.1	25.8	25.8	25.9	25.9	8.2	7.9	8.2	8.1	7.9	8.6	8.0	7.2	7.5	7.6	7.4	7.4	7.9	7.4	320	30 331	326	304	276	291	272
Hard Control		24.0	25.1	24.9	24.8	24.0	25.3	24.9	8.5	8.4	8.4	8.4	8.3	8.5	8.7	7.2	8.3	8.3	8.6	8.5	8.3	8.2	1056	1091	1119	1014	1054	1157	1085
Meter Number		12/103	10/103	73/103	12/103	11/104	55	10/103	12/103	10/103	73/103	12/103	11/104	19/103	10/103	57	57	57	57	57	55	57	11/920	73/921	11/920	10/921	73/921	12/920	12/920
Time		1529	1120	1429	1155	1126	9210	1005	1529	1120	1429	1155	1126	930	1005	1529	1040	1412	1200	1020	920	0959	1529	1135	1420	1200	1025	925	1010
Initials		OV	VMS	OV	[illegible]	[illegible]	RS	VMS	OV	VMS	OV	[illegible]	[illegible]	RS	VMS	OV	VMS	OV	[illegible]	VMS	RS	VMS	OV	VMS	OV	[illegible]	VMS	RS	VMS

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

Beginning Date: 9/16/00 Time: 1625
Ending Date: 9/23/00 Time: 1600

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: 24.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
ATO-724		~~25.1~~ 25.1	24.0	25.1	24.0	25.0	25.1	24.3	8.1	8.2	8.1	8.1	8.1	8.3	8.3	8.0	~~8.5~~ 7.7	7.6	7.7	~~7.8~~	~~8.1~~ 8.1	8.0	646	540	564	584	543	557	571
ATO-725		25.1	24.0	25.2	24.0	25.0	24.3	24.0	8.1	8.1	8.1	8.1	8.1	8.3	8.3	7.8	8.5	7.7	7.8	7.7	8.1	8.2	637	535	547	553	520	554	518
ATO-728		25.0	24.0	25.2	24.1	24.4	24.5	24.1	8.1	8.3	8.2	8.3	8.2	8.4	8.4	7.7	8.6	7.7	7.8	8.0	8.1	8.2	690	632	578	582	553	538	517
ATO-729		25.1	24.2	25.4	24.0	24.3	24.2	24.1	8.2	8.3	8.1	8.2	~~8.2~~ 8.2	8.3	8.4	7.6	8.4	7.7	7.9	8.0	8.2	8.2	681	620	567	573	533	567	530
ATO-730		24.4	24.2	25.4	24.0	24.9	24.6	24.3	7.8	7.9	8.1	8.3	8.2	8.4	8.3	8.1	7.3	7.7	7.8	7.7	8.2	8.2	720	665	574	571	546	586	535
Meter Number		57	10/103	73/103	73/121	10/103	55	10/103	73/107	10/103	73/103	73/104	10/103	10/103	10/103	57	57	57	57	57	55	57	11/120	73/121	11/120	11/120	73/121	12/120	12/122
Time		1315	1120	1429	1030	1035	930	1005	1317	1120	1429	1030	1035	930	1005	1315	1040	1419	0955	1020	930	0955	1323	1135	1424	1020	1025	0955	1010
Initials		nn	VAT	ou	[illegible]	[illegible]	[illegible]	[illegible]	nn	VAT	ou	[illegible]	[illegible]	[illegible]	[illegible]	nn	VAT	ou	[illegible]	[illegible]	[illegible]	[illegible]	nn	VAT	ou	[illegible]	[illegible]	[illegible]	[illegible]

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

Beginning Date: 9/16/00 Time: ~~1510~~ 1625 OV
Ending Date: 9/23/00 Time: 1600

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7
Lab Control		24.5	24.8	24.0	24.4	25.0	24.9	24.1	8.1	7.9	8.1	7.8	7.7	7.9	7.8
Hard Control		24.5	24.4	24.7	24.4	25.0	25.0	25.5	8.1	8.8	8.1	8.2	8.4	8.3	8.4
Replicate		A	B	C	D	E	A	B							
Meter Number		12/104	13/103	13/104	10/103	10/103	10/103	11/104	12/104	13/103	13/104	10/103	10/103	10/103	11/104
Time		1040	1450	1410	1110	0920	1025	1535	1040	1450	1410	1110	0920	1025	1535
Initials		MAS	OV	SJ	MD	MD	MD	SJ	MAS	OV	SJ	MD	MD	MD	SJ

Test Conc	Rep	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
Lab Control		7.2	6.5	6.9	~~6.2~~ 7.0 MD	6.9	6.9	7.0	300	357	374	304	293	305	327
Hard Control		7.1	6.4	6.8	~~5.9~~ 6.7 MD	7.0	6.9	7.1	992	1113	1160	1011	1035	1049	~~1247~~ 1249
Replicate		1	2	3	4	5	6	7	1	2	3	4	5	6	7
Meter Number		57	57	55	57	56	57	57	73/121	11/120	12/121	73/121	12/120	12/120	12/120
Time		1055	1433	1413	1105	0925	1015	1535	1050	1442	1410	1125	0935	1030	1535
Initials		JS	OV	SJ	MD	MD	MD	SJ	MAS	OV	SJ	MD	MD	MD	SJ

ATS-T14
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT
QC Test Number: TN-00-622

TEST ORGANISM
Common Name: Fathead minnow
Scientific Name: P. promelas

Beginning Date: 9/16/00 Time: ~~1540~~ 1625
Ending Date: 9/23/00 Time: 1600

TARGET VALUES Temp: 25±1 °C pH: 6.0 - 9.0 DO: ≥4.0 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
ATO-724		25.1	24.6	24.5	24.0	25.7	25.2	25.2	8.2	8.1	8.0	8.1	8.2	8.2	8.1	~~7.2~~ 7.1	6.7	6.9	~~6.0~~ 6.8	6.8	6.4	7.0	~~306~~ 516	504	449	500	456	488	522
ATO-725		25.0	24.7	24.5	24.1	25.8	25.9	25.4	8.1	8.1	8.0	8.2	8.2	8.1	8.1	~~7.1~~ 7.1	6.8	7.0	~~6.5~~ 7.3	7.0	7.2	7.2	501	486	512	460	440	489	496
ATO-728		24.7	25.2	24.7	24.3	25.6	25.2	25.3	8.1	8.0	8.0	8.1	8.1	8.2	8.1	7.2	5.9	6.2	~~6.1~~ 6.9	6.6	5.8	7.6	547	560	487	493	458	469	475
ATO-729		24.7	24.9	24.5	24.4	25.9	25.0	25.4	8.1	8.1	8.0	8.1	8.2	8.2	8.1	7.1	6.8	6.6	~~5.7~~ 6.5	6.9	7.3	7.2	531	521	478	490	452	467	498
ATO-730		24.6	24.5	24.7	24.2	25.8	24.9	25.4	8.1	8.1	8.0	8.1	8.1	8.1	8.1	7.3	6.6	6.2	~~6.1~~ 6.9	6.8	7.2	7.2	550	535	510	472	450	467	484
Replicate		A	B	C	D	E	A	B																					
Meter Number		12/104	73/103	33/104	10/103	10/103	10/103	11/104	12/104	73/103	33/104	10/103	10/103	10/103	11/104	57	57	55	57	55	57	57	73/921	11/920	10/921	73/921	12/920	12/920	12/920
Time		1045	1450	1435	1110	0920	1025	1535	1045	1450	1435	1110	0925	1025	1535	1055	1433	1435	1105	0925	1015	1535	1060	1442	1435	1125	0935	1030	1535
Initials		MAS	✓	[illegible]	MD	MD	MD	[illegible]	MAS	✓	[illegible]	MD	MD	MD	[illegible]	RS	✓	[illegible]	MD	MD	MD	[illegible]	MAS	✓	[illegible]	MD	MD	MD	[illegible]

ATS-T14
03/01/00

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-622

TEST ORGANISM INFORMATION

Common Name: Fat head minnow

Scientific Name: P. promelas

Lot Number: FH-0-9/15/16

Source: EA

Adults Isolated (Time, Date): —

Neonates Pulled (Time, Date): —

Acclimation: —

Age: <24 hrs.

Culture Water (T/S): 23.3 °C — ppt

TEST SET-UP

TEST INITIATION				CONCENTRATION SERIES		
Date	Time	Initials	Activity	Test Concentration	Volume Test Material	Final Volume
9/16/00	1500	RD	Dilutions Made	Lab Control	1500 ml	1500 ml
	1540	OR	Test Vessels Filled			
	1625	OR/KSH	Organisms Transferred	Hardness Control		
	1712	NP	Head Counts			

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION					FEEDING			
					Food: Artemia, 3x/day			
Day	Date	Time	Initials	Sample / Diluent	Day	Time, Initials, Amount	Time, Initials, Amount	Time, Initials, Amount
0	9/16/00	1540	OR	(Lab) LDO-398 (HW) LDO-400	0	X	X	1724 3 mo
1	9/17/00	1300	DN	(Lab) LDO-398 (HW) LDO-400	1	0905 3 OR	1200 DN 3 drops	1615 DN 3 drops
2	9/18/00	1400	DN	(Lab) LDO-402 (HW) LDO-400	2	0837 4 OR	1200 4 OR	1710 4 OR
3	9/19/00	1030	NP	(Lab) LDO-402 (HW) LDO-400	3	0832 4 OR	1205 4 OR	1638 4 OR
4	9/20/00	1035	NP	(hard) LDO-400 (lab) LDO-404	4	0850 5 OR	1310 5 OR	1630 5 OR
5	~~9/21~~ 9/21/00	8945	LS	(HW) LDO-400 (Lab) LDO-404	5	0852 5 OR	1155 5 OR	1647 5 OR
6	9/22/00	1050	NP	(lab) LDO-407 (hard) LDO-411	6	1130 5 drops KO	1320 5 drops KO	1705 5 drops KO

ATS-T27
03/01/00

TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-622

TEST ORGANISM INFORMATION

Common Name: Fathead minnow

Scientific Name: P. promelas

Lot Number: FHO-9/15-16

Source: EA (Lab)

Adults Isolated (Time, Date): —

Neonates Pulled (Time, Date): —

Acclimation: —

Age: <24 hrs.

Culture Water (T/S): 23.3 °C — ppt

TEST SET-UP

TEST INITIATION

Date	Time	Initials	Activity
9/16/00	1500	RD	Dilutions Made
	1540	OL	Test Vessels Filled
	1625	OL/RSH	Organisms Transferred
	1712	RD	Head Counts

CONCENTRATION SERIES

100% Test Concentration	Volume Test Material	Final Volume
ATO-724	1500 ml	1500 ml
ATO-725		
ATO-728		
ATO-729		
ATO-730		

Comments:

INTERMEDIATE DILUTION PREPARATION AND FEEDING

DILUTION PREPARATION

Day	Date	Time	Initials	Sample / Diluent
0	9/16/00	1540	OL	ATO-724, 725, 728, 729, 730
1	9/17/00	1300	ON	ATO-724, 725, 728, 729, 730
2	9/18/00	1400	ON	ATO-724, 725, 728, 729, 730
3	9/19/00	1030	UND	ATO-724, 725, 728, 729, 730
4	9/20/00	1035	UND	ATO-724, 725, 728, 729, 730
5	9/21/00	0945	LS	ATO-724, 725, 728, 729, 730
6	9/22/00	1010	UND	ATO-724, 725, 728, 729, 730

FEEDING

Food: Artemia, 3x/day

Day	Time, Initials, Amount	Time, Initials, Amount	Time, Initials, Amount
0	X	X	1724 RD 3 drops
1	0905 3 OL	1200 OL 3	1615 3 OL
2	0837 4 OL	1200 4 OL	1710 4 OL
3	0830 4 OL	1205 4 OL	1630 4 OL
4	0850 5 OL	1310 5 OL	1630 5 OL
5	0852 5 OL	1155 5 OL	~~1700 5 OL~~
6	1130 5 mg	1320 5 mg	5 1705 mg

STATISTICS FOR WATER QUALITY
QC Test: TN-00-622 IT (LAB CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.8	24.5	8.2	8.1	7.2	7.2	320.0	300.0
2	25.8	24.8	7.9	7.9	7.5	6.5	331.0	357.0
3	25.1	24.0	8.2	8.1	7.6	6.9	320.0	374.0
4	25.8	24.4	8.1	7.8	7.4	7.0	304.0	304.0
5	25.8	25.0	7.9	7.7	7.4	6.9	296.0	293.0
6	25.9	24.9	8.6	7.9	7.9	6.9	291.0	305.0
7	25.9	24.1	8.0	7.8	7.4	7.0	272.0	327.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	25.1	24.0	7.9	7.7	7.2	6.5	272.0	293.0
Max.	25.9	25.0	8.6	8.1	7.9	7.2	331.0	374.0
Mean	25.7	24.5	8.1	7.9	7.5	6.9	304.9	322.9
S.D.	0.28	0.39	0.24	0.15	0.22	0.21	20.4	31.3
N		14		14		14		14.0
Min.		24.0		7.7		6.5		272.0
Max.		25.9		8.6		7.9		374.0
Mean		25.1		8.0		7.2		313.9
S.D.		0.70		0.23		0.36		27.1

1-11-01
MW

10/16/2000 4:05 PM

STATISTICS FOR WATER QUALITY

QC Test: TN-00-622 IT (HARDNESS CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.0	24.5	8.5	8.1	7.2	7.1	1050.0	992.0
2	25.1	24.4	8.4	8.8	8.3	6.4	1091.0	1113.0
3	24.9	24.7	8.4	8.1	8.3	6.8	1119.0	1160.0
4	24.8	24.4	8.4	8.2	8.6	6.7	1014.0	1011.0
5	24.0	25.6	8.3	8.4	8.5	7.0	1054.0	1035.0
6	25.3	25.0	8.5	8.3	8.3	6.9	1157.0	1049.0
7	24.0	25.5	8.7	8.4	8.2	7.1	1085.0	1249.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.4	8.3	8.1	7.2	6.4	1014.0	992.0
Max.	25.3	25.6	8.7	8.8	8.6	7.1	1157.0	1249.0
Mean	24.6	24.9	8.5	8.3	8.2	6.9	1081.4	1087.0
S.D.	0.57	0.51	0.13	0.24	0.46	0.25	47.5	92.4
N		14		14		14		14.0
Min.		24.0		8.1		6.4		992.0
Max.		25.6		8.8		8.6		1249.0
Mean		24.7		8.4		7.5		1084.2
S.D.		0.54		0.20		0.78		70.6

10/16/2000 4:08 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-622 IT (AT0-724)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.1	25.1	8.1	8.2	8.0	7.1	646.0	516.0
2	24.0	24.6	8.2	8.1	7.7	6.7	540.0	504.0
3	25.1	24.5	8.1	8.0	7.6	6.9	564.0	449.0
4	24.0	24.0	8.1	8.1	7.7	6.8	584.0	500.0
5	25.0	25.7	8.1	8.2	7.6	6.8	543.0	456.0
6	25.1	25.2	8.3	8.2	8.1	6.4	559.0	483.0
7	24.3	25.2	8.3	8.1	8.0	7.0	571.0	522.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.0	8.1	8.0	7.6	6.4	540.0	449.0
Max.	25.1	25.7	8.3	8.2	8.1	7.1	646.0	522.0
Mean	24.7	24.9	8.2	8.1	7.8	6.8	572.4	490.0
S.D.	0.53	0.57	0.10	0.08	0.21	0.23	35.9	28.5
N		14		14		14		14.0
Min.		24.0		8.0		6.4		449.0
Max.		25.7		8.3		8.1		646.0
Mean		24.8		8.2		7.3		531.2
S.D.		0.54		0.09		0.56		52.9

1-11-01
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10/16/2000 4:10 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-622 IT (AT0-725)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.1	25.0	8.1	8.1	7.8	7.1	637.0	501.0
2	24.0	24.7	8.1	8.1	8.5	6.8	535.0	486.0
3	25.2	24.5	8.1	8.0	7.7	7.0	547.0	512.0
4	24.0	24.1	8.1	8.2	7.8	7.3	553.0	460.0
5	25.0	25.8	8.1	8.2	7.7	7.0	520.0	440.0
6	24.3	25.9	8.3	8.1	8.1	7.2	554.0	489.0
7	24.0	25.4	8.3	8.1	8.2	7.2	518.0	496.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.1	8.1	8.0	7.7	6.8	518.0	440.0
Max.	25.2	25.9	8.3	8.2	8.5	7.3	637.0	512.0
Mean	24.5	25.1	8.2	8.1	8.0	7.1	552.0	483.4
S.D.	0.56	0.68	0.10	0.07	0.30	0.17	40.3	25.0
N		14		14		14		14.0
Min.		24.0		8.0		6.8		440.0
Max.		25.9		8.3		8.5		637.0
Mean		24.8		8.1		7.5		517.7
S.D.		0.66		0.08		0.52		48.0

1-11-01

10/16/2000 4:12 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-622 IT (AT0-728)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.0	24.7	8.1	8.1	7.7	7.2	690.0	547.0
2	24.0	25.2	8.3	8.0	8.6	5.9	632.0	560.0
3	25.2	24.7	8.2	8.0	7.7	6.2	578.0	487.0
4	24.1	24.3	8.3	8.1	7.8	6.9	582.0	493.0
5	24.4	25.6	8.2	8.1	8.0	6.6	553.0	458.0
6	24.5	25.2	8.4	8.2	8.1	5.8	538.0	469.0
7	24.1	25.3	8.4	8.1	8.2	7.6	517.0	475.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.3	8.1	8.0	7.7	5.8	517.0	458.0
Max.	25.2	25.6	8.4	8.2	8.6	7.6	690.0	560.0
Mean	24.5	25.0	8.3	8.1	8.0	6.6	584.3	498.4
S.D.	0.47	0.45	0.11	0.07	0.32	0.68	59.4	39.5
N		14		14		14		14.0
Min.		24.0		8.0		5.8		458.0
Max.		25.6		8.4		8.6		690.0
Mean		24.7		8.2		7.3		541.4
S.D.		0.52		0.13		0.89		65.8

1-11-01
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10/16/2000 4:13 PM

STATISTICS FOR WATER QUALITY

QC Test: TN-00-622 IT (AT0-729)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	25.1	24.7	8.2	8.1	7.6	7.1	681.0	531.0
2	24.2	24.9	8.3	8.1	8.4	6.8	620.0	521.0
3	25.4	24.5	8.1	8.0	7.7	6.6	567.0	478.0
4	24.0	24.4	8.2	8.1	7.9	6.5	573.0	490.0
5	24.3	25.9	8.2	8.2	8.0	6.9	533.0	452.0
6	24.2	25.0	8.3	8.2	8.2	7.3	567.0	467.0
7	24.1	25.4	8.4	8.1	8.2	7.2	530.0	498.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.4	8.1	8.0	7.6	6.5	530.0	452.0
Max.	25.4	25.9	8.4	8.2	8.4	7.3	681.0	531.0
Mean	24.5	25.0	8.2	8.1	8.0	6.9	581.6	491.0
S.D.	0.55	0.53	0.10	0.07	0.29	0.30	53.0	28.3
N		14		14		14		14.0
Min.		24.0		8.0		6.5		452.0
Max.		25.9		8.4		8.4		681.0
Mean		24.7		8.2		7.5		536.3
S.D.		0.58		0.11		0.63		62.3

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10/16/2000 4:15 PM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-622 IT (AT0-730)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	24.4	24.6	7.8	8.1	8.1	7.3	720.0	550.0
2	24.2	24.5	7.9	8.1	7.3	6.6	665.0	535.0
3	25.4	24.7	8.1	8.0	7.7	6.2	574.0	510.0
4	24.0	24.2	8.3	8.1	7.8	6.9	571.0	472.0
5	24.9	25.8	8.2	8.1	7.7	6.8	546.0	450.0
6	24.6	24.9	8.4	8.1	8.2	7.2	586.0	467.0
7	24.3	25.6	8.3	8.1	8.2	7.2	535.0	484.0
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N	7	7	7	7	7	7	7.0	7.0
Min.	24.0	24.2	7.8	8.0	7.3	6.2	535.0	450.0
Max.	25.4	25.8	8.4	8.1	8.2	7.3	720.0	550.0
Mean	24.5	24.9	8.1	8.1	7.9	6.9	599.6	495.4
S.D.	0.48	0.59	0.22	0.04	0.33	0.39	67.7	37.2
N		14		14		14		14.0
Min.		24.0		7.8		6.2		450.0
Max.		25.8		8.4		8.2		720.0
Mean		24.7		8.1		7.4		547.5
S.D.		0.55		0.16		0.61		75.3

1-11-01
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10/16/2000 4:16 PM

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:		Test ID:	TN-00-622	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
HARD. CONT.	1.0000	1.0000	0.9000	0.9000	0.9000
AT0-724	0.9000	1.0000	0.9000	0.5000	0.8000
AT0-725	0.8000	0.9000	0.5000	0.9000	1.0000
AT0-728	0.7000	0.7000	0.6000	0.8889	0.6000
AT0-729	0.8000	0.7000	0.8000	0.9000	0.8000
AT0-730	0.6000	0.8000	0.9000	0.7000	1.0000
LAB CONT.	0.8000	1.0000	1.0000	0.7000	0.8000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.9400	1.0000	1.3142	1.2490	1.4120	6.792	5			
AT0-724	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5	1.363	1.860	0.2097
AT0-725	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-728	0.6978	0.7423	0.9971	0.8861	1.2310	14.131	5			
AT0-729	0.8000	0.8511	1.1123	0.9912	1.2490	8.222	5			
AT0-730	0.8000	0.8511	1.1291	0.8861	1.4120	18.419	5			
LAB CONT.	0.8600	0.9149	1.2059	0.9912	1.4120	16.090	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.87815	0.781	-1.0118	2.26534
F-Test indicates equal variances (p = 0.09)	6.98087	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.13771	0.14719	0.05906	0.0318	0.21003	1, 8

AT0-724 vs. Control (Hardness)

ToxCalc v5.0.23

Reviewed by: 1-11-01 VW (LMI

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:		Test ID:	TN-00-622	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
HARD. CONT.	1.0000	1.0000	0.9000	0.9000	0.9000
AT0-724	0.9000	1.0000	0.9000	0.5000	0.8000
AT0-725	0.8000	0.9000	0.5000	0.9000	1.0000
AT0-728	0.7000	0.7000	0.6000	0.8889	0.6000
AT0-729	0.8000	0.7000	0.8000	0.9000	0.8000
AT0-730	0.6000	0.8000	0.9000	0.7000	1.0000
LAB CONT.	0.8000	1.0000	1.0000	0.7000	0.8000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.9400	1.0000	1.3142	1.2490	1.4120	6.792	5			
AT0-724	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-725	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5	1.363	1.860	0.2097
AT0-728	0.6978	0.7423	0.9971	0.8861	1.2310	14.131	5			
AT0-729	0.8000	0.8511	1.1123	0.9912	1.2490	8.222	5			
AT0-730	0.8000	0.8511	1.1291	0.8861	1.4120	18.419	5			
LAB CONT.	0.8600	0.9149	1.2059	0.9912	1.4120	16.090	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.87815	0.781	-1.0118	2.26534
F-Test indicates equal variances (p = 0.09)	6.98087	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.13771	0.14719	0.05906	0.0318	0.21003	1, [illegible]

AT0-725 vs. Hardness Control

ToxCalc v5.0.23

Reviewed by: 11-01 UW

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:		Test ID:	TN-00-622	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
HARD. CONT.	1.0000	1.0000	0.9000	0.9000	0.9000
AT0-724	0.9000	1.0000	0.9000	0.5000	0.8000
AT0-725	0.8000	0.9000	0.5000	0.9000	1.0000
AT0-728	0.7000	0.7000	0.6000	0.8889	0.6000
AT0-729	0.8000	0.7000	0.8000	0.9000	0.8000
AT0-730	0.6000	0.8000	0.9000	0.7000	1.0000
LAB CONT.	0.8000	1.0000	1.0000	0.7000	0.8000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.9400	1.0000	1.3142	1.2490	1.4120	6.792	5			
AT0-724	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-725	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
*AT0-728	0.6978	0.7423	0.9971	0.8861	1.2310	14.131	5	4.252	1.860	0.1387
AT0-729	0.8000	0.8511	1.1123	0.9912	1.2490	8.222	5			
AT0-730	0.8000	0.8511	1.1291	0.8861	1.4120	18.419	5			
LAB CONT.	0.8600	0.9149	1.2059	0.9912	1.4120	16.090	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.86998	0.781	1.12072	0.70339
F-Test indicates equal variances (p = 0.40)	2.49169	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.08388	0.08965	0.25146	0.01391	0.00279	1, 8

AT0-728 vs. Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01 VW CL

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:		Test ID:	TN-00-622	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
HARD. CONT.	1.0000	1.0000	0.9000	0.9000	0.9000
AT0-724	0.9000	1.0000	0.9000	0.5000	0.8000
AT0-725	0.8000	0.9000	0.5000	0.9000	1.0000
AT0-728	0.7000	0.7000	0.6000	0.8889	0.6000
AT0-729	0.8000	0.7000	0.8000	0.9000	0.8000
AT0-730	0.6000	0.8000	0.9000	0.7000	1.0000
LAB CONT.	0.8000	1.0000	1.0000	0.7000	0.8000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.9400	1.0000	1.3142	1.2490	1.4120	6.792	5			
AT0-724	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-725	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-728	0.6978	0.7423	0.9971	0.8861	1.2310	14.131	5			
*AT0-729	0.8000	0.8511	1.1123	0.9912	1.2490	8.222	5	3.533	1.860	0.1063
AT0-730	0.8000	0.8511	1.1291	0.8861	1.4120	18.419	5			
LAB CONT.	0.8600	0.9149	1.2059	0.9912	1.4120	16.090	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91042	0.781	0.40756	-1.017
F-Test indicates equal variances (p = 0.96)	1.04969	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.06158	0.06582	0.10191	0.00817	0.0077	1, 8

AT0-729 vs. Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01 JW CLM

Larval Fish Growth and Survival Test-7 Day Survival

Start Date:		Test ID:	TN-00-622	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
HARD. CONT.	1.0000	1.0000	0.9000	0.9000	0.9000
AT0-724	0.9000	1.0000	0.9000	0.5000	0.8000
AT0-725	0.8000	0.9000	0.5000	0.9000	1.0000
AT0-728	0.7000	0.7000	0.6000	0.8889	0.6000
AT0-729	0.8000	0.7000	0.8000	0.9000	0.8000
AT0-730	0.6000	0.8000	0.9000	0.7000	1.0000
LAB CONT.	0.8000	1.0000	1.0000	0.7000	0.8000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.9400	1.0000	1.3142	1.2490	1.4120	6.792	5			
AT0-724	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-725	0.8200	0.8723	1.1605	0.7854	1.4120	20.322	5			
AT0-728	0.6978	0.7423	0.9971	0.8861	1.2310	14.131	5			
AT0-729	0.8000	0.8511	1.1123	0.9912	1.2490	8.222	5			
AT0-730	0.8000	0.8511	1.1291	0.8861	1.4120	18.419	5	1.829	1.860	0.1882
LAB CONT.	0.8600	0.9149	1.2059	0.9912	1.4120	16.090	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9591	0.781	0.34079	0.16816
F-Test indicates equal variances (p = 0.13)	5.42806	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.12072	0.12903	0.0857	0.02561	0.10475	1, 8

AT0-730 vs. Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01 VW CLM

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:		Test ID:	TN-00-622	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5	Std. Dev.
HARD. CONT.	0.4180	0.3630	0.4322	0.4289	0.4233	0.02852
AT0-724	0.4322	0.4390	0.4267	0.6500	0.3675	0.10832
AT0-725	0.3838	0.3611	0.5480	0.3844	0.3820	0.07672
AT0-728	0.3529	0.3471	0.3700	0.3813	0.3450	0.01573
AT0-729	0.4325	0.4957	0.3900	0.3833	0.3988	0.04633
AT0-730	0.4317	0.4063	0.4100	0.3800	0.3730	0.02383
LAB CONT.	0.4325	0.3720	0.4390	0.3771	0.4025	0.03075

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.4131	1.0000	0.4131	0.3630	0.4322	6.904	5			
AT0-724	0.4631	1.1210	0.4631	0.3675	0.6500	23.391	5			
AT0-725	0.4119	0.9970	0.4119	0.3611	0.5480	18.627	5	0.034	1.860	0.0681
AT0-728	0.3593	0.8697	0.3593	0.3450	0.3813	4.379	5			
AT0-729	0.4201	1.0169	0.4201	0.3833	0.4957	11.029	5			
AT0-730	0.4002	0.9688	0.4002	0.3730	0.4317	5.954	5			
LAB CONT.	0.4046	0.9795	0.4046	0.3720	0.4390	7.600	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.79326	0.781	1.88887	4.48996
F-Test indicates equal variances (p = 0.08)	7.23577	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.06807	0.16477	3.8E-06	0.00335	0.97406	1, 8

AT0-725 versus Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01

Larval Fish Growth and Survival Test-7 Day Growth

Start Date:	Test ID: TN-00-622	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAF 91-EPA Freshwater	Test Species:	PP-Pimephales promelas
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5
HARD. CONT.	0.4180	0.3630	0.4322	0.4289	0.4233
AT0-724	0.4322	0.4390	0.4267	0.6500	0.3675
AT0-725	0.3838	0.3611	0.5480	0.3844	0.3820
AT0-728	0.3529	0.3471	0.3700	0.3813	0.3450
AT0-729	0.4325	0.4957	0.3900	0.3833	0.3988
AT0-730	0.4317	0.4063	0.4100	0.3800	0.3730
LAB CONT.	0.4325	0.3720	0.4390	0.3771	0.4025

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
HARD. CONT.	0.4131	1.0000	0.4131	0.3630	0.4322	6.904	5			
AT0-724	0.4631	1.1210	0.4631	0.3675	0.6500	23.391	5			
AT0-725	0.4119	0.9970	0.4119	0.3611	0.5480	18.627	5			
AT0-728	0.3593	0.8697	0.3593	0.3450	0.3813	4.379	5			
AT0-729	0.4201	1.0169	0.4201	0.3833	0.4957	11.029	5			
AT0-730	0.4002	0.9688	0.4002	0.3730	0.4317	5.954	5	0.777	1.860	0.0309
LAB CONT.	0.4046	0.9795	0.4046	0.3720	0.4390	7.600	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.90132	0.781	-0.9997	0.41515
F-Test indicates equal variances (p = 0.74)	1.43292	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.03091	0.07482	0.00042	0.00069	0.45978	1, 8

AT0-730 versus Hardness Control

ToxCalc v5.0.23

Reviewed by: 1-11-01 WW

ATTACHMENT IV

Hyalella azteca Toxicity Testing
Data Sheets

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT Corporation
QC Test Number: TN-644
Test Material: Sediment
Accession Number: ATO-740 to 744
Dilution Water: very hard water
Accession Number: ~~LDO~~ –

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

TEST TYPE: Static / Flowthrough
Renewal / Non-renewal

Beginning Date: 9/22/00 Time: 1700
Ending Date: ~~9/2~~ 10/2/00 Time: 1500

Test Container: 300ml lipless beaker
Test Volume: 275 ml (100 ml sediment / 175 ml water)
Test Duration: 10 days

Concentration	Rep	Number of Surviving Organisms										
		Day 0 Date 9/22	Day 1 Date	Day 2 Date	Day 3 Date	Day 4 Date	Day 5 Date	Day 6 Date	Day 7 Date	Day 8 Date	Day 9 Date	Day 10 Date 10/2
Control	A	10										9
	B	10										10
	C	10										10
	D	10										9
	E	10										8 (1 dead)
	F	10										9
	G	10										10
	H	10										10
ATO-740	A	10										9
	B	10										10
	C	10										10
	D	10										5
	E	10										8 (2 dead)
	F	10										8
Time / Initials		NH 1700										1500 AH, KL

ATS-T11
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT Corporation
QC Test Number: TN-644
Test Material: sediment
Accession Number: ATO-740-744
Dilution Water: very hard water
Accession Number: ~~LDD~~ LWR

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

TEST TYPE: (Static) / Flowthrough
(Renewal) / Non-renewal

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

Test Container: 300 ml lipless beaker
Test Volume: 275 ml (100 ml sediment / 175 ml water)
Test Duration: 10 days

Concentration	Rep	Number of Surviving Organisms										
		Day 0 Date 9/22	~~Day 1~~ Date	~~Day 2~~ Date	~~Day 3~~ Date	~~Day 4~~ Date	~~Day 5~~ Date	~~Day 6~~ Date	~~Day 7~~ Date	~~Day 8~~ Date	~~Day 9~~ Date	Day 10 Date 10/2
ATO-740	G	10										5 (2 dead)
	H	10										7
ATO-741	A	10										~~RA~~ 7
	B	10										8
	C	10										9
	D	10										10
	E	10										7
	F	10										10
	G	10										8
	H	10										9
ATO-742	A	10										9
	B	10										10
	C	10										7
	D	10										8
Time / Initials		1700 RA										1500 LAH, RSH, PL

ATS-T11
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT Corporation
QC Test Number: TN-1644
Test Material: Sediment
Accession Number: ATO-740-744
Dilution Water: very hard water
Accession Number: ~~LDD~~ VAH

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

TEST TYPE: Static / Flowthrough
Renewal / Non-renewal

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

Test Container: 300 ml lipless beaker
Test Volume: 275 ml (100 ml sediment / 175 ml water)
Test Duration: 10 days

Concentration	Rep	Number of Surviving Organisms										
		Day 0 Date 9/22	Day 1 Date	Day 2 Date	Day 3 Date	Day 4 Date	Day 5 Date	Day 6 Date	Day 7 Date	Day 8 Date	Day 9 Date	Day 10 Date 10/2
ATO-742	E	10										9
	F	10										6
	G	10										10
	H	10										7
ATO-743	A	10										9
	B	10										8
	C	10										7
	D	10										10
	E	10										9
	F	10										8
	G	10										9
	H	10										10
ATO-744	A	10										8
	B	10										7
Time / Initials		1700 MY										1500 VAH, RSH, KL

ATS-T11
03/01/00

TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT corporation
QC Test Number: TN-644
Test Material: Sediment
Accession Number: ATO-740-744
Dilution Water: very hard water
Accession Number: ~~100~~ VM

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

TEST TYPE: ~~Static~~ / Flowthrough
~~Renewal~~ / Non-renewal

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

Test Container: 300 ml lipless beaker
Test Volume: 275 ml (100 ml sediment, 175 ml water)
Test Duration: 10 days

Concentration	Rep	Number of Surviving Organisms										
		Day 0 Date 9/22	Day 1 Date	Day 2 Date	Day 3 Date	Day 4 Date	Day 5 Date	Day 6 Date	Day 7 Date	Day 8 Date	Day 9 Date	Day 10 Date 10/2
ATO-744	C	10										10
	D	10										10
	E	10										9
	F	10										9
	G	10										9
	H	10										9
Time / Initials		1700 pcl										1500 LAW, RDT, KL

ATS-T11
03/01/00

WEIGHT DATA (Test Species: H. azteca)

Project Number: 70003.10

Client: IT Corporation

QC Test Number: TN-644

Tin Lot: 29 Red Oven Temp (°C): 100

	Date	Time	Initials
Loaded tins placed in oven:	10/2/00	1710	LAH
Loaded tins removed from oven:	10/3/00	1030	BZ
Loaded tins weighed:	10/3/00	1100	BZ

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
Control	A	114	28.94	31.34	2.40	9	0.267	
	B	17	24.92	27.29	2.37	10	LAH ~~0.240~~ 0.237	
	C	113	29.61	31.54	1.93	10	0.193	
	D	104	27.42	29.42	2.00	9	0.222	
	E	74	26.90	28.12	1.22	8	0.153	
	F	57	26.49	28.24	1.75	9	0.194	
	G	116	28.74	31.24	2.50	10	0.250	
	H	60	26.67	28.82	2.15	10	0.2~~2~~15 LAH	
ATO-740	A	50	27.06	28.67	1.61	9	LAH ~~0.178~~ 0.179	
	B	5	25.84	28.02	2.18	10	LAH ~~0.218~~ 0.218	
	C	37	28.84	31.56	2.72	10	0.~~28~~272 LAH	
	D	87	28.77	30.37	1.60	5	0.320	
	E	24	27.01	28.63	1.62	8	0.203	
	F	103	27.47	29.26	1.79	8	0.224	

Dry wt. calculations checked (date, initials): 10/18/00 LAH

Biomass calculations checked (date, initials): _____

ATS-T46
03/01/00

WEIGHT DATA (Test Species: H. azteca)

Project Number: 7000310

Client: II Corporation

QC Test Number: TN-644

Tin Lot: 29 Red Oven Temp (°C): 100

	Date	Time	Initials
Loaded tins placed in oven:	10/2/00	1710	LAH
Loaded tins removed from oven:	10/3/00	1030	[illegible]
Loaded tins weighed:	10/3/00	1100	[illegible]

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-740	G	92	27.70	28.96	1.26	5	0.252	
	H	117	27.60	29.36	1.76	7	0.251	
ATO-741	A	11	27.80	29.52	1.72	7	~~0.250~~ 0.246	
	B	80	28.72	30.38	1.66	8	0.208	
	C	16	29.53	32.14	2.61	9	0.290	
	D	88	27.17	29.53	2.36	10	~~0.240~~ 0.233	
	E	15	26.94	28.20	1.26	7	0.180	
	F	32	27.64	30.28	2.64	10	0.264	
	G	97	27.45	29.18	1.73	8	~~0.220~~ 0.216	
	H	44	27.82	29.09	1.27	9	0.141	
ATO-742	A	73	28.29	~~30.25~~ 30.25	1.96	9	~~0.220~~ 0.218	
	B	119	28.08	29.96	1.88	10	0.188	
	C	79	28.15	29.79	1.64	7	0.234	
	D	34	26.64	28.28	1.64	8	0.205	

Dry wt. calculations checked (date, initials): 10/18/00 LAH

Biomass calculations checked (date, initials): _____

WEIGHT DATA (Test Species: H. azteca)

Project Number: 70003.10

Client: IT Corporation

QC Test Number: TN-644

Tin Lot: 29 Red Oven Temp (°C): 100

	Date	Time	Initials
Loaded tins placed in oven:	10/2/00	1710	LAH
Loaded tins removed from oven:	10/3/00	1030	SZ
Loaded tins weighed:	10/3/00	1100	SZ

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-742	E	25	29.85	31.60	1.75	9	0.194	
	F	18	27.90	29.16	1.26	6	0.210	
	G	111	28.12	30.17	2.05	10	0.205	
	H	4	28.45	30.25	1.80	7	~~LAH 0.26~~ 0.257	
ATO-743	A	109	29.14	31.19	2.05	9	0.228	
	B	63	28.09	29.66	1.57	8	~~LAH 0.20~~ 0.196	
	C	54	27.75	29.93	2.18	7	0.311	
	D	36	26.54	28.92	2.38	10	~~LAH 0.24~~ 0.238	
	E	67	26.64	28.81	2.17	9	0.241	
	F	86	26.81	28.98	2.17	8	0.271	
	G	21	27.16	29.41	2.25	9	0.250	
	H	76	25.55	28.00	2.45	10	~~LAH 0.25~~ 0.245	
ATO-744	A	90	29.36	~~30.84~~ 30.65	1.29	8	0.161	
	B	95	28.12	29.72	1.60	7	~~LAH 0.23~~ 0.229	

Dry wt. calculations checked (date, initials): 10/18/00 LAH Biomass calculations checked (date, initials): _____

ATS-T46
03/01/00

WEIGHT DATA (Test Species: H. azteca)

Project Number: 70003.10

Client: IT corporation

QC Test Number: TN-644

Tin Lot: 29 Red Oven Temp (°C): 100

	Date	Time	Initials
Loaded tins placed in oven:	10/2/00	1710	LAH
Loaded tins removed from oven:	10/3/00	1030	[illegible]
Loaded tins weighed:	10/3/00	1100	[illegible]

Test Concentration	Rep	Tin #	A Weight of Tin (mg)	B Weight of Tin and Dried Organisms (mg)	B-A Total Dry Organism Weight (mg)	C Number of Organisms Weighed	(B-A)/C Mean Dry Organism Weight (mg)	(if applicable) Mean Biomass (mg/exposed org.)
ATO-744	C	10	26.71	28.78	2.07	10	0.207	
	D	106	26.06	28.23	2.17	10	~~LAH 0.220~~ 0.217	
	E	20	27.91	29.27	1.36	9	0.151	
	F	77	27.41	29.12	1.71	9	0.190	
	G	39	27.29	28.81	1.52	9	~~LAH 0.17~~ 0.169	
	H	100	27.58	29.47	1.89	9	0.210	

Dry wt. calculations checked (date, initials): 10/18/00 LAH Biomass calculations checked (date, initials): _____

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 70003.10
Client: IT Corporation
QC Test Number: TN-00-644

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥ ~~4.0 QAH~~ 2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
Control		22.7							8.5							8.0							1344						
ATO-740		22.7							8.6							7.8							1093						
ATO-741		22.7							8.6							7.8							1084						
ATO-742		22.8							8.6							7.9							1081						
ATO-743		23.0							8.6							8.0							1059						
ATO-744		23.1							8.6							7.9							1047						
Meter Number		11/104							11/104							55							12/920						
Time		1500							1500							1505							1500						
Initials		KSH							KSH							KSH							KSH						

Data transcribed 10/17/00 LAH

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003210 | TEST ORGANISM | Beginning Date: 9/22/00 | Time: 1700

Client: IT Corporation | Common Name: amphipod | Ending Date: 10/2/00 | Time: 1500

QC Test Number: ~~TN-644~~ TN-00-644 | Scientific Name: H. azteca

TARGET VALUES Temp: 23±1 °C | pH: 6.0 - 9.0 | DO: ≥4.0 ~~≥4.0~~ mg/L | Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
Control	A																												
	B	22.8							8.4							6.1							1863						
	C		22.8							8.3							5.9							1845					
	D			22.8							8.4							5.7							1836				
	E				22.1							8.2							6.0							1485			
	F					22.5							8.3							6.9	6.4						1315		
	G						22.5							8.3							~~6.4~~	4.6						1382	
	H							23.3							8.0							~~4.7~~							1234
MID-740	A																												
	B	22.6							8.3							6.0							1237						
	C		22.7							8.0							4.5							1182					
	D			22.8							8.3							4.2							1280				
	E				22.2							8.1							5.1							1208			
	F					22.4							8.3							6.8							1207		
Meter Number		56	57	10/104	12/104	57	17/103	10/103	10/103	12/104	10/101	9/104	12/103	12/103	10/103	55	57	55	57	57	56	56	12/100	11/120	12/121	12/120	73/120	10/100	12/121
Time		1457	950	1005	1040	0955	1045	1300	1431	1000	1005	1040	1000	1045	1300	1437	950	1010	1045	0955	1051	1305	1445	955	1000	1055	1005	100	1255
Initials		nn	BG	RS	MD	~~BT~~	nn	KL	nn	RS	RS	MD	~~BT~~	nn	KL	nn	RS	RS	MD	~~BT~~	nn	KL	nn	RS	RS	MD	~~BT~~	nn	KL

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10 | TEST ORGANISM | Beginning Date: 9/22/00 Time: 1700

Client: IT Corporation | Common Name: amphipod | Ending Date: 10/2/00 Time: 1500

QC Test Number: ~~FU-6444~~ TN-00-644 | Scientific Name: H. azteca

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ~~24.0~~ 2.5 mg/L Salinity: ___ ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
ATO-740	G					~~23~~	22.7							8.3							6.2	KL						1156	
	H							23.7							8.1							~~4.7~~ 4.6							~~1045~~ 1097
ATO-741	A																												
	B	22.5							8.2							6.2							1172						
	C		22.6							8.0							5.3							1172					
	D			22.6							8.2							4.0							1267				
	E				22.3							8.1							5.2							1166			
	F					22.5							8.3							6.8							1122		
	G						22.8							8.2							6.4	4.7						1156	
	H							~~23.0~~ 23.8							8.1							~~4.8~~ 4.8							1088
ATO-742	A																												
	B	22.5							8.3							6.1							1187						
	C		22.7							8.0							4.7							1223					
	D			23.0							8.1							4.5							1291				
Meter Number		55	57	19/104	92/104	57	12/103	19/103	10/103	12/104	10/104	92/104	12/103	12/104	10/103	55	57	55	57	57	56	57	14/420	14/420	12/421	12/420	73/420	10/420	12/421
Time		1137	950	1005	1040	0955	1045	1300	1137	1000	1005	1040	1000	1045	1300	1137	950	1010	1045	0955	1051	1305	1495	955	1000	1055	1005	100	~~1045~~ 1255
Initials		nn	RS	RS	CM	DT	nn	KL	nn	RS	RS	CM	DT	nn	KL	nn	RS	RS	CM	DT	nn	KL	nn	RS	RS	CM	DT	nn	KL

ATS-T14
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.1D
Client: IT Corporation
QC Test Number: ~~TN-00-644~~ TN-00-644

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

TARGET VALUES Temp: 23± °C pH: 6.0 - 9.0 DO: ~~≥4.0~~ ≥2.5 ~~≥4.0~~ mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7
ATO-742	E				8.6 ~~8.0~~ 22.4							8.0			
	F					22.5							8.3		
	G						22.6							8.3	
	H							23.8							8.0
ATO-743	A														
	B	22.6							8.3						
	C		22.6							8.1					
	D			22.8							8.3				
	E				22.0							8.3			
	F					22.5							8.4		
	G						22.7							8.2	
	H							23.4							8.2
ATO-744	A														
	B	22.8							8.2						
Meter Number		55	57	19/104	92/104	57	12/103	10/103	6/104	12/104	18/104	92/104	12/103	12/103	10/103
Time		1437	950	1005	1040	0955	1045	1300	1434	1000	1005	1040	1000	1045	1300
Initials		Rn	RS	RS	KD	RS	Rn	KL	Rn	RS	RS	KD	RS	Rn	KL

Test Conc	Rep	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
ATO-742	E				4.7							1217			
	F					4.9							1142		
	G						7.1							1143	
	H							4.5							1095
ATO-743	A														
	B	6.0							1136						
	C		4.1							1160					
	D			5.1							1324				
	E				ND 6.0							1162			
	F					7.0							1140		
	G						6.7							1173	
	H							4.8							1093
ATO-744	A														
	B	5.5							1138						
Meter Number		55	57	55	57	57	56	56	2/22	1/90	12/92	12/92	73/90	12/92	12/92
Time		1459	950	1010	1045	0955	1051	1305	1445	0955	1020	1055	1005	1100	1255
Initials		Rn	RS	RS	KD	RS	Rn	KL	Rn	RS	RS	KD	RS	Rn	KL

ATS-T14
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 700030.10
Client: IT Corporation
QC Test Number: ~~FH 644~~ TN-00-644

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1750
Ending Date: 10/2/00 Time: 1500

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ~~3.6~~ 24.0-2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7
ATD-744	C		22.6							8.1					
	D			22.8							8.3				
	E				22.2							8.1			
	F					22.5							8.4		
	G						22.8							8.3	
	H							23.5							8.2
Meter Number		15	57	10/104	12/104	57	12/103	10/103	10/103	12/104	10/104	12/104	12/103	12/103	10/103
Time		1437	950	1005	1040	0955	1045	1305	1434	1000	1005	1040	1000	1045	1300
Initials		MN	RS	RS	MD	RS	MN	KL	MN	RS	RS	MD	RS	MN	KL

Test Conc	Rep	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
ATD-744	C		4.7							1168					
	D			3.8							1237				
	E				4.4							1197			
	F					6.8							1130		
	G						6.2	5.2						1160	
	H							5.4							1101
Meter Number		65	57	55	57	57	56	56	12/920	1/920	12/920	12/920	73/920	10/920	12/920
Time		1437	950	1010	1045	0955	1051	1305	1435	955	1020	1055	1005	1100	1255
Initials		MN	RS	RS	MD	RS	MN	KL	MN	RS	RS	MD	RS	MN	KL

ATS-T14
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT Corporation
QC Test Number: ~~TN 0644~~ TN00644

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ~~≥9.0~~ ≥7.0-2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 8	9	10	11	12	13	14	pH 8	9	10	11	12	13	14	Dissolved Oxygen (mg/L) 8	9	10	11	12	13	14	Conductivity (µS/cm) ~~Salinity (ppt)~~ 8	9	10	11	12	13	14
control	A	22.8							8.0	~~8.0~~						5.3							1175						
	B		23.5							8.0							4.4							1077					
	C			23.4							~~7.9~~							~~7.0~~							1145				
	D										8.2							5.6											
	E																												
	F																												
	G																												
	H																												
ATO-740	A	22.7							7.9							4.4							1061						
	B		23.6							8.2							4.1							991					
	C			23.2							~~7.6~~							4.9							961				
	D										8.2																		
	E																												
	F																												
Meter Number		10/103	11/921	57					10/103	10/103	10/104					56	57	57					12/921	11/921	11/920				
Time		1200	1450	0954					1202	1450	0957					1155	1452	0954					1147	1450	0950				
als		MD	KL	DV					MD	KL	DV					MD	KL	DV					MD	KL	DV				

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 700103.10
Client: IT Corporation
QC Test Number: ~~TN-0644~~ TN-00-644

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ~~≥4.0~~ ≥4.0 2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 8	9	10	11	12	13	14	pH 8	9	10	11	12	13	14	Dissolved Oxygen (mg/L) 8	9	10	11	12	13	14	Conductivity (µS/cm) ~~Salinity (ppt)~~ 8	9	10	11	12	13	14
ATO-740	G																												
	H																												
ATO-741	A	22.5							8.0							5.1							1047						
	B		23.3							7.9							3.7							991					
	C			(a)							~~7.6~~ 8.2							4.9							978				
	D																												
	E																												
	F																												
	G																												
	H																												
ATO-742	A	22.6							7.9							4.8	3.3						1071						
	B		~~23.5~~ 23.5							7.9								4.3						975					
	C			(a)							~~7.5~~ 8.2														973				
	D																												
Meter Number		10/103	10/103	57					10/103	10/103	10/114					56	51	57					12/821	11/921	11/920				
Time		1200	1455	0954					1200	1455	0951					1155	1455	0954					1147	1455	0950				
Initials		MD	KL	OR					MD	KL	OR					MD	KL	OR					MD	KL	OR				

(a) temperature not recorded (mistakenly)

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 7000310
Client: IT Corporation
QC Test Number: ~~TN-0644~~ TN-00644 LMH

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1700
Ending Date: 9/26/00 Time: 1500

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ~~≥9.0~~ ≥2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 8	9	10	11	12	13	14	pH 8	9	10	11	12	13	14	Dissolved Oxygen (mg/L) 8	9	10	11	12	13	14	Conductivity (µS/cm) ~~Salinity (ppt)~~ 8	9	10	11	12	13	14
ATO-742	E																												
	F																												
	G																												
	H																												
ATO-743	A	22.5							8.1							4.5							1035						
	B		22.9							8.1							3.7							999					
	C			(a)							~~7.4~~ 7.1							4.2							966				
	D										8.2																		
	E																												
	F																												
	G																												
	H																												
ATO-744	A	22.5							8.0							4.4							1031						
	B		23.5							8.1							3.5							1001					
Meter Number		10/03	11/921	57					10/03	10/03	10/104					56	57	57					12/921	11/921	N/910				
Time		1200	1458	0954					1200	1458	0951					1155	1458	0954					1147	1458	0950				
Initials		MD	KW	ON					MD	KW	ON					MD	KW	ON					MD	KW	ON				

(a) temperature mistakenly not recorded.

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 70003.10
Client: IT Corporation
QC Test Number: ~~TN 644~~ TN 00.644 UM

TEST ORGANISM
Common Name: amphipod
Scientific Name: H. azteca

Beginning Date: 9/22/00 Time: 1700
Ending Date: 10/2/00 Time: 1500

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ~~≥ 7.0~~ ≥ 2.5 UM mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 8	9	10	11	12	13	14	pH 8	9	10	11	12	13	14	Dissolved Oxygen (mg/L) 8	9	10	11	12	13	14	Conductivity (µS/cm) ~~Salinity~~ (ppt) 8	9	10	11	12	13	14
ATD-744	C			23.1							7.8 / 8.2							4.7							964				
	D																												
	E																												
	F																												
	G																												
	H																												
Meter Number		10/103	10/103	57					10/103	10/103	10/104					56	51	57					12/921	11/921	11/920				
Time		1200	1455	0951					1200	1455	0951					1155	1455	0954					1147	1455	0950				
Initials		MR	KL	JN					MR	KL	JN					MR	KL	JN					MR	KL	JN				

SEDIMENT TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70003 ID

Client: IT Corporation

QC Test Number: TN-00-644

TEST ORGANISM INFORMATION

Common Name:	amphipod	Adults Isolated (Time, Date):	—
Scientific Name:	H. azteca	Neonates Pulled (Time, Date):	—
Lot Number:	—	Acclimation: —	Age: 7-14 days
Source:	EA	Culture Water (T/S): — °C	— ppt

TEST INITIATION

Date	Time	Initials	Activity
9/21/00	1500	BL, RD, JL, EV	Sediment Added to Chambers
↓	↓	↓	Overlying Water Added to Chambers
9/22/00	1700	RSH, RD	Organisms Transferred

TEST SET-UP

Sample Number(s): ATO-740, 741, 742, 743, 744

Overyling Water Number: Very Hard Recon. Water

Treatment	Volume Test Sediment	Volume Overlying Water
control	~~175~~ 100 ml sediment	~~100~~ 175 ml water
ATO-740	↓	↓
ATO-741		
ATO-742		
ATO-743		
ATO-744		

TOXICOLOGY LABORATORY BENCH SHEET - RENEWAL RECORD

Project Number: 70003.10

Client: IT Corporation

QC Test Number: ~~IN-644~~ ~~TN-00-644~~

Day	Date		Time	Initials
0	9/22/00	AM	—	—
		PM	1500	RM
1	9/23/00	AM	1027	RM
		PM	1511	RM
2	9/24/00	AM	945	LS
		PM	1530	LS
3	9/25	AM	1045	LS
		PM	1630	KL/LS
4	9/26	AM	1100	UND
		PM	1600	UND
5	9/27/00	AM	0920	BZ
		PM	1530	W
6	9/28/00	AM	0915	RM
		PM	1545	KL
7	9/29/00	AM	1037	RM
		PM	1557	RM
8	9/30/00	AM	1018	RM
		PM	1403	RM
9	10/1/00	AM	0840	KL
		PM		
10	10/2/00	AM	1130	OL
		PM	—	—

* 8.4L. total for renewal *

* 4.2L. each tub *

TOXICOLOGY LABORATORY BENCH SHEET - FEEDING RECORD

Project Number: 7000310

Client: IT Corporation

QC Test Number: TN-00-644

Food: YCT (1.0 ml/replicate daily)

Day	Date	Time	Initials
0	9/22/00	1730	RSH
1	9/23/00	1530	MD
2	9/24/00	1530	SAS
3	9/25/00	1330	SS
4	9/26/00	1300	CMD
5	9/27/00	1012	[illegible]
6	9/28/00	1600	KL
7	9/29/00	1048	MD
8	9/30/00	1025	MD
9	10/1/00	0910	KL
10			
11			
12			
13			
14			
15			
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17			
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19			
20			
21			
22			
23			
24			
25			
26			
27			
28			

STATISTICS FOR WATER QUALITY

QC Test: TN-00-644 IT (CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.7	22.8	8.5	8.4	8.0	6.1	1344.0	1803.0
2		22.8		8.3		5.9		1849.0
3		22.8		8.4		5.7		1836.0
4		22.1		8.2		6.0		1485.0
5		22.5		8.3		6.9		1315.0
6		22.5		8.3		6.4		1382.0
7		23.3		8.0		4.6		1234.0
8		22.8		8.0		5.3		1175.0
9		23.5		8.0		4.4		1079.0
10		23.4		8.2		5.6		1145.0
11								
12								
13								
14								
15								
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37								
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39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	10	1	10	1	10	1.0	10.0
Min.	22.7	22.1	8.5	8.0	8.0	4.4	1344.0	1079.0
Max.	22.7	23.5	8.5	8.4	8.0	6.9	1344.0	1849.0
Mean	22.7	22.9	8.5	8.2	8.0	5.7	1344.0	1430.3
S.D.	#DIV/0!	0.44	#DIV/0!	0.16	#DIV/0!	0.77	#DIV/0!	299.2
N		11		11		11		11.0
Min.		22.1		8.0		4.4		1079.0
Max.		23.5		8.5		8.0		1849.0
Mean		22.8		8.2		5.9		1422.5
S.D.		0.42		0.17		1.01		285.1

1-11-01
MW

10/18/2000 10:15 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-644 IT (AT0-740)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.7	22.6	8.6	8.3	7.8	6.0	1093.0	1237.0
2		22.7		8.0		4.5		1182.0
3		22.8		8.3		4.2		1280.0
4		22.2		8.1		5.1		1208.0
5		22.4		8.3		6.8		1209.0
6		22.7		8.3		6.2		1156.0
7		23.7		8.1		4.6		1097.0
8		22.7		7.9		4.4		1061.0
9		23.6		8.2		4.1		991.0
10		23.2		8.2		4.9		961.0
11								
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42								
43								
44								
45								
46								
47								
48								
N	1	10	1	10	1	10	1.0	10.0
Min.	22.7	22.2	8.6	7.9	7.8	4.1	1093.0	961.0
Max.	22.7	23.7	8.6	8.3	7.8	6.8	1093.0	1280.0
Mean	22.7	22.9	8.6	8.2	7.8	5.1	1093.0	1138.2
S.D.	#DIV/0!	0.49	#DIV/0!	0.14	#DIV/0!	0.93	#DIV/0!	106.8
N		11		11		11		11.0
Min.		22.2		7.9		4.1		961.0
Max.		23.7		8.6		7.8		1280.0
Mean		22.8		8.2		5.3		1134.1
S.D.		0.47		0.19		1.21		102.3

1-11-01
WW

10/18/2000 10:23 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-644 IT (AT0-741)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.7	22.5	8.6	8.2	7.8	6.2	1084.0	1172.0
2		22.6		8.0		5.3		1192.0
3		22.8		8.2		4.0		1267.0
4		22.3		8.1		5.2		1166.0
5		22.5		8.3		6.8		1122.0
6		22.8		8.2		6.4		1156.0
7		23.8		8.1		4.7		1089.0
8		22.5		8.0		5.1		1047.0
9		23.3		7.9		3.7		991.0
10				8.2		4.9		978.0
11								
12								
13								
14								
15								
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43								
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45								
46								
47								
48								
N	1	9	1	10	1	10	1.0	10.0
Min.	22.7	22.3	8.6	7.9	7.8	3.7	1084.0	978.0
Max.	22.7	23.8	8.6	8.3	7.8	6.8	1084.0	1267.0
Mean	22.7	22.8	8.6	8.1	7.8	5.2	1084.0	1118.0
S.D.	#DIV/0!	0.48	#DIV/0!	0.12	#DIV/0!	1.00	#DIV/0!	91.9
N		10		11		11		11.0
Min.		22.3		7.9		3.7		978.0
Max.		23.8		8.6		7.8		1267.0
Mean		22.8		8.2		5.5		1114.9
S.D.		0.45		0.19		1.23		87.8

1-11-01
MW

10/18/2000 10:25 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-644 IT (AT0-742)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.8	22.5	8.6	8.3	7.9	6.1	1081.0	1187.0
2		22.7		8.0		4.7		1223.0
3		23.0		8.1		4.5		1291.0
4		22.4		8.0		4.7		1217.0
5		22.5		8.3		6.9		1142.0
6		22.6		8.3		7.1		1143.0
7		23.8		8.0		4.5		1095.0
8		22.6		7.9		4.8		1071.0
9		23.5		7.9		3.3		975.0
10				8.2		4.3		973.0
11								
12								
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43								
44								
45								
46								
47								
48								
N	1	9	1	10	1	10	1.0	10.0
Min.	22.8	22.4	8.6	7.9	7.9	3.3	1081.0	973.0
Max.	22.8	23.8	8.6	8.3	7.9	7.1	1081.0	1291.0
Mean	22.8	22.8	8.6	8.1	7.9	5.1	1081.0	1131.7
S.D.	#DIV/0!	0.49	#DIV/0!	0.16	#DIV/0!	1.21	#DIV/0!	104.9
N		10		11		11		11.0
Min.		22.4		7.9		3.3		973.0
Max.		23.8		8.6		7.9		1291.0
Mean		22.8		8.1		5.3		1127.1
S.D.		0.46		0.22		1.43		100.7

1-11-01

10/18/2000 10:26 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-644 IT (AT0-743)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	23.0	22.6	8.6	8.3	8.0	6.0	1059.0	1136.0
2		22.8		8.1		4.7		1160.0
3		22.8		8.3		5.1		1224.0
4		22.0		8.3		6.0		1162.0
5		22.5		8.4		7.0		1140.0
6		22.7		8.2		6.7		1173.0
7		23.4		8.2		4.8		1093.0
8		22.5		8.1		4.5		1035.0
9		22.9		8.1		3.7		999.0
10				8.2		4.2		966.0
11								
12								
13								
14								
15								
16								
17								
18								
19								
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21								
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37								
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42								
43								
44								
45								
46								
47								
48								
N	1	9	1	10	1	10	1.0	10.0
Min.	23.0	22.0	8.6	8.1	8.0	3.7	1059.0	966.0
Max.	23.0	23.4	8.6	8.4	8.0	7.0	1059.0	1224.0
Mean	23.0	22.7	8.6	8.2	8.0	5.3	1059.0	1108.8
S.D.	#DIV/0!	0.38	#DIV/0!	0.10	#DIV/0!	1.10	#DIV/0!	83.5
N		10		11		11		11.0
Min.		22.0		8.1		3.7		966.0
Max.		23.4		8.6		8.0		1224.0
Mean		22.7		8.3		5.5		1104.3
S.D.		0.37		0.15		1.33		80.6

1-11-01
WJ

10/18/2000 10:29 AM

STATISTICS FOR WATER QUALITY
QC Test: TN-00-644 IT (AT0-744)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	23.1	22.8	8.6	8.2	7.9	5.5	1047.0	1136.0
2		22.6		8.1		4.7		1168.0
3		22.8		8.3		3.8		1237.0
4		22.2		8.1		4.4		1197.0
5		22.5		8.4		6.8		1130.0
6		22.8		8.3		6.2		1160.0
7		23.5		8.2		5.2		1101.0
8		22.5		8.0		4.4		1031.0
9		23.5		8.1		3.5		1001.0
10		23.1		8.2		4.7		964.0
11								
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45								
46								
47								
48								
N	1	10	1	10	1	10	1.0	10.0
Min.	23.1	22.2	8.6	8.0	7.9	3.5	1047.0	964.0
Max.	23.1	23.5	8.6	8.4	7.9	6.8	1047.0	1237.0
Mean	23.1	22.8	8.6	8.2	7.9	4.9	1047.0	1112.5
S.D.	#DIV/0!	0.43	#DIV/0!	0.12	#DIV/0!	1.03	#DIV/0!	88.3
N		11		11		11		11.0
Min.		22.2		8.0		3.5		964.0
Max.		23.5		8.6		7.9		1237.0
Mean		22.9		8.2		5.2		1106.5
S.D.		0.41		0.17		1.33		86.0

1-11-01
WW

10/18/2000 10:30 AM

~~Larval Fish Growth and Survival Test 7 Day Survival~~ SURVIVAL 10-DAY

Start Date:	Test ID: TN-00-644	Sample ID:	
End Date:	Lab ID:	Sample Type:	Hyalella azteca
Sample Date:	Protocol: ~~EPAF-91-EPA Freshwater~~	Test Species:	~~PP-Pimephales promelas~~
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8
CONTROL	0.9000	1.0000	1.0000	0.9000	0.8000	0.9000	1.0000	1.0000
AT0-740	0.9000	1.0000	1.0000	0.5000	0.8000	0.8000	0.5000	0.7000
AT0-741	0.7000	0.8000	0.9000	1.0000	0.7000	1.0000	0.8000	0.9000
AT0-742	0.9000	1.0000	0.7000	0.8000	0.9000	0.6000	1.0000	0.7000
AT0-743	0.9000	0.8000	0.7000	1.0000	0.9000	0.8000	0.9000	1.0000
AT0-744	0.8000	0.7000	1.0000	1.0000	0.9000	0.9000	0.9000	0.9000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9375	1.0000	1.3128	1.1071	1.4120	8.821	8			
*AT0-740	0.7750	0.8267	1.1062	0.7854	1.4120	22.315	8	2.143	1.761	0.1698
AT0-741	0.8500	0.9067	1.1898	0.9912	1.4120	14.148	8			
AT0-742	0.8250	0.8800	1.1622	0.8861	1.4120	17.137	8			
AT0-743	0.8750	0.9333	1.2221	0.9912	1.4120	12.140	8			
AT0-744	0.8875	0.9467	1.2398	0.9912	1.4120	11.369	8			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94702	0.844	-0.1528	-0.2739
F-Test indicates equal variances (p = 0.06)	4.5441	8.88531		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.10701	0.11446	0.17078	0.03717	0.05012	1, 14

AT0-740 vs. Control

1-7-01
MW

ToxCalc v5.0.23

Reviewed by:_____

~~Larval Fish Growth and Survival Test-7 Day Survival~~ 10-DAY SURVIVAL

Start Date:	Test ID: TN-00-644	Sample ID:	
End Date:	Lab ID:	Sample Type:	Hyalella azteca
Sample Date:	Protocol: ~~EPAF-01-EPA Freshwater~~	Test Species:	~~PP-Pimephales promelas~~
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8
CONTROL	0.9000	1.0000	1.0000	0.9000	0.8000	0.9000	1.0000	1.0000
AT0-740	0.9000	1.0000	1.0000	0.5000	0.8000	0.8000	0.5000	0.7000
AT0-741	0.7000	0.8000	0.9000	1.0000	0.7000	1.0000	0.8000	0.9000
AT0-742	0.9000	1.0000	0.7000	0.8000	0.9000	0.6000	1.0000	0.7000
AT0-743	0.9000	0.8000	0.7000	1.0000	0.9000	0.8000	0.9000	1.0000
AT0-744	0.8000	0.7000	1.0000	1.0000	0.9000	0.9000	0.9000	0.9000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9375	1.0000	1.3128	1.1071	1.4120	8.821	8			
AT0-740	0.7750	0.8267	1.1062	0.7854	1.4120	22.315	8			
AT0-741	0.8500	0.9067	1.1898	0.9912	1.4120	14.148	8	1.702	1.761	0.1272
AT0-742	0.8250	0.8800	1.1622	0.8861	1.4120	17.137	8			
AT0-743	0.8750	0.9333	1.2221	0.9912	1.4120	12.140	8			
AT0-744	0.8875	0.9467	1.2398	0.9912	1.4120	11.369	8			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91661	0.844	-0.001	-0.996
F-Test indicates equal variances (p = 0.34)	2.11333	8.88531		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.07611	0.08141	0.06047	0.02087	0.11084	1, 14

AT0-741 vs. Control

10-11-01

 ToxCalc v5.0.23 Reviewed by:_____

~~Larval Fish Growth and Survival Test-7 Day Survival~~ 10-DAY SURVIVAL

Start Date:	Test ID: TN-00-644	Sample ID:	
End Date:	Lab ID:	Sample Type:	Hyalella azteca
Sample Date:	Protocol: ~~EPAF-91-EPA-Freshwater~~	Test Species:	~~FP-Pimephales promelas~~
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8
CONTROL	0.9000	1.0000	1.0000	0.9000	0.8000	0.9000	1.0000	1.0000
AT0-740	0.9000	1.0000	1.0000	0.5000	0.8000	0.8000	0.5000	0.7000
AT0-741	0.7000	0.8000	0.9000	1.0000	0.7000	1.0000	0.8000	0.9000
AT0-742	0.9000	1.0000	0.7000	0.8000	0.9000	0.6000	1.0000	0.7000
AT0-743	0.9000	0.8000	0.7000	1.0000	0.9000	0.8000	0.9000	1.0000
AT0-744	0.8000	0.7000	1.0000	1.0000	0.9000	0.9000	0.9000	0.9000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9375	1.0000	1.3128	1.1071	1.4120	8.821	8			
AT0-740	0.7750	0.8267	1.1062	0.7854	1.4120	22.315	8			
AT0-741	0.8500	0.9067	1.1898	0.9912	1.4120	14.148	8			
*AT0-742	0.8250	0.8800	1.1622	0.8861	1.4120	17.137	8	1.849	1.761	0.1435
AT0-743	0.8750	0.9333	1.2221	0.9912	1.4120	12.140	8			
AT0-744	0.8875	0.9467	1.2398	0.9912	1.4120	11.369	8			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93046	0.844	-0.0842	-0.8405
F-Test indicates equal variances (p = 0.18)	2.95847	8.88531		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.0876	0.0937	0.0907	0.02654	0.08573	1, 14

AT0-742 vs. Control

10-11-01 MW

ToxCalc v5.0.23

Reviewed by:_____

~~Larval Fish Growth and Survival Test-7 Day Survival~~ 10-DAY SURVIVAL

Start Date:	Test ID: TN-00-644	Sample ID:	
End Date:	Lab ID:	Sample Type:	Hyalella azteca
Sample Date:	Protocol: ~~EPAF-91-EPA Freshwater~~	Test Species:	~~PP-Pimephales promelas~~
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8
CONTROL	0.9000	1.0000	1.0000	0.9000	0.8000	0.9000	1.0000	1.0000
AT0-740	0.9000	1.0000	1.0000	0.5000	0.8000	0.8000	0.5000	0.7000
AT0-741	0.7000	0.8000	0.9000	1.0000	0.7000	1.0000	0.8000	0.9000
AT0-742	0.9000	1.0000	0.7000	0.8000	0.9000	0.6000	1.0000	0.7000
AT0-743	0.9000	0.8000	0.7000	1.0000	0.9000	0.8000	0.9000	1.0000
AT0-744	0.8000	0.7000	1.0000	1.0000	0.9000	0.9000	0.9000	0.9000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9375	1.0000	1.3128	1.1071	1.4120	8.821	8			
AT0-740	0.7750	0.8267	1.1062	0.7854	1.4120	22.315	8			
AT0-741	0.8500	0.9067	1.1898	0.9912	1.4120	14.148	8			
AT0-742	0.8250	0.8800	1.1622	0.8861	1.4120	17.137	8			
AT0-743	0.8750	0.9333	1.2221	0.9912	1.4120	12.140	8	1.363	1.761	0.1172
AT0-744	0.8875	0.9467	1.2398	0.9912	1.4120	11.369	8			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94397	0.844	-0.2565	-0.7831
F-Test indicates equal variances (p = 0.53)	1.64153	8.88531		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.06919	0.07401	0.03292	0.01771	0.1943	1, 1

AT0-743 vs. Control

10-11-01

ToxCalc v5.0.23

Reviewed by:_____

~~Larval Fish Growth and Survival Test-7 Day Survival~~ 10-DAY SURVIVAL

Start Date:	Test ID: TN-00-644	Sample ID:	
End Date:	Lab ID:	Sample Type:	Hyalella azteca
Sample Date:	Protocol: ~~EPAF-01-EPA Freshwater~~	Test Species:	~~PP-Pimephales promelas~~
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8
CONTROL	0.9000	1.0000	1.0000	0.9000	0.8000	0.9000	1.0000	1.0000
AT0-740	0.9000	1.0000	1.0000	0.5000	0.8000	0.8000	0.5000	0.7000
AT0-741	0.7000	0.8000	0.9000	1.0000	0.7000	1.0000	0.8000	0.9000
AT0-742	0.9000	1.0000	0.7000	0.8000	0.9000	0.6000	1.0000	0.7000
AT0-743	0.9000	0.8000	0.7000	1.0000	0.9000	0.8000	0.9000	1.0000
AT0-744	0.8000	0.7000	1.0000	1.0000	0.9000	0.9000	0.9000	0.9000

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9375	1.0000	1.3128	1.1071	1.4120	8.821	8			
AT0-740	0.7750	0.8267	1.1062	0.7854	1.4120	22.315	8			
AT0-741	0.8500	0.9067	1.1898	0.9912	1.4120	14.148	8			
AT0-742	0.8250	0.8800	1.1622	0.8861	1.4120	17.137	8			
AT0-743	0.8750	0.9333	1.2221	0.9912	1.4120	12.140	8			
AT0-744	0.8875	0.9467	1.2398	0.9912	1.4120	11.369	8	1.132	1.761	0.1136

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93672	0.844	-0.5142	-0.3552
F-Test indicates equal variances (p = 0.62)	1.48174	8.88531		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.06674	0.07139	0.0213	0.01664	0.27684	1, 14

AT0-744 vs. Control

10-7-01

 ToxCalc v5.0.23 Reviewed by:_____

~~Larval Fish Growth and Survival Test 7 Day Growth~~ GROWTH

Start Date:	Test ID: TN-00-644	Sample ID:	
End Date:	Lab ID:	Sample Type:	Hyalella azteca
Sample Date:	Protocol: ~~EPAF-01-EPA Freshwater~~	Test Species:	~~PP-Pimephales promelas~~
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5	6	7	8	Std. Dev.
CONTROL	0.2667	0.2370	0.1930	0.2222	0.1525	0.1944	0.2500	0.2150	0.03631
AT0-740	0.1789	0.2180	0.2720	0.3200	0.2025	0.2238	0.2520	0.2514	0.044057
AT0-741	0.2457	0.2075	0.2900	0.2360	0.1800	0.2640	0.2163	0.1411	0.04735
AT0-742	0.2178	0.1880	0.2343	0.2050	0.1944	0.2100	0.2050	0.2571	0.022436
AT0-743	0.2278	0.1963	0.3114	0.2380	0.2411	0.2713	0.2500	0.2450	0.033402
AT0-744	0.1613	0.2286	0.2070	0.2170	0.1511	0.1900	0.1689	0.2100	0.028452

			Transform: Untransformed						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.2164	1.0000	0.2164	0.1525	0.2667	16.782	8			
AT0-740	0.2398	1.1085	0.2398	0.1789	0.3200	18.371	8			
AT0-741	0.2226	1.0287	0.2226	0.1411	0.2900	21.274	8			
AT0-742	0.2140	0.9889	0.2140	0.1880	0.2571	10.486	8			
AT0-743	0.2476	1.1444	0.2476	0.1963	0.3114	13.490	8			
AT0-744	0.1917	0.8862	0.1917	0.1511	0.2286	14.840	8	1.510	1.761	0.0287

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.971297	0.844	-0.34229	-0.5464
F-Test indicates equal variances (p = 0.54)	1.628655	8.885308		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	
Homoscedastic t Test indicates no significant differences	0.028725	0.13277	0.002426	0.001064	0.153283	1, 14

AT0-744 vs. Control

1-11-01
WW

 ToxCalc v5.0.23 Reviewed by:_____

ATTACHMENT V

Eisenia foetida Bioaccumulation Testing
Data Sheets

~~SEDIMENT~~ SOIL TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10

Client: IT Corporation

QC Test Number: TN-00-742

Test Material(s): Soils

Accession Number(s): ATO-735 to 739, 758

Overlying Water: —

Accession Number: —

TEST ORGANISM

Common Name: red worm

Scientific Name: Eisenia foetida

TEST TYPE: (Static) / Flowthrough

Renewal / (Non-renewal)

Beginning Date: 10/31/00 Time: 1500

Ending Date: 11/28/00 Time: 1200

Test Container: 2-L jar

Test Volume: 1,500 g (dry weight)

Test Duration: 28 days

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date 10/31	Day Date 11-01	Day Date	Day 28 Date 11/28	Day Date	Day ~~14~~ Date	Day Date	Day Date	Day Date	Day Date	Day ~~28~~ Date
Control	A	60			60							
	B	60			59							
	C	60			60							
	D	60			60 ~~58~~ VAS							
	E	60			60							
ATO-735	A	60	9*		47							
	B	60			48							
	C	60			37							
	D	60	10*		34							
	E	60			43							
Time / Initials		1500 SB	0820 VAS JB		SM RM KL RSH VAS							

* - # of dead removed

ATS-T12
03/01/00

~~SEDIMENT~~ SOIL TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT Corporation
QC Test Number: TN-00-742
Test Material(s): Soils
Accession Number(s): ATO-735 to 739, 758
Overlying Water: —
Accession Number: —

TEST ORGANISM
Common Name: red worm
Scientific Name: Eisenia foetida

TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)

Beginning Date: 10/31/00 Time: 1500
Ending Date: 11/28/00 Time: 1200

Test Container: 2-L jar
Test Volume: 1,500 g (dry weight)
Test Duration: 28 days

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date MS	Day Date	Day Date	Day 28 Date 11/28	Day Date	Day ~~14~~ Date	Day Date	Day Date	Day Date	Day Date	Day ~~28~~ Date
ATO-736	A	~~60~~ 60			59							
	B	~~60~~ 60			60							
	C	~~60~~ 60			59							
	D	~~30~~ 60			60							
	E	~~30~~ 60			54							
ATO-737	A	~~30~~ 60			58							
	B	~~30~~ 60			59							
	C	~~30~~ 60			59							
	D	~~30~~ 60			51							
	E	~~30~~ 60			60							
Time / Initials		1500 SD			SM, RM, SJ KL, ASH MS							

ATS-T12
03/01/00

SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 7000310
Client: IT Corporation
QC Test Number: TN-00-742
Test Material(s): Soils
Accession Number(s): ATO-735 to 739, 758
Overlying Water: —
Accession Number: —

TEST ORGANISM
Common Name: redworm
Scientific Name: Eisenia foetida

TEST TYPE: (Static) / Flowthrough
Renewal / (Non-renewal)

Beginning Date: 10/31/00 Time: 1500
Ending Date: 11/28/00 Time: 1200

Test Container: 2-L jar
Test Volume: 1,500 g (dry weight)
Test Duration: 28 days

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date 10/31	Day Date	Day Date	Day 28 Date 11/28	Day Date	Day ~~14~~ Date	Day Date	Day Date	Day Date	Day Date	Day ~~28~~ Date
ATO-738	A	60			60							
	B	60			60							
	C	60			60							
	D	60			58							
	E	60			60							
ATO-739	A	60			58							
	B	60			58							
	C	60			59							
	D	60			60							
	E	60			59							
Time / Initials		1500/SB			SM, RM, KL, RSH, VS, MAS							

ATS-T12
03/01/00

SEDIMENT TOXICITY TEST OBSERVATION DATA SHEET

Project Number: 70003.10
Client: IT Corporation
QC Test Number: TN-00-742
Test Material(s): Soils
Accession Number(s): ATD-735 to 739, 758
Overlying Water: –
Accession Number: –

TEST ORGANISM
Common Name: red worm
Scientific Name: Eisenia foetida

TEST TYPE: (Static) / Flowthrough
Renewal (Non-renewal)

Beginning Date: 10/31/00 Time: 1500
Ending Date: 11/28/00 Time: 1200
Test Container: 2-L jar
Test Volume: 1,500 g (dry weight)
Test Duration: 28 days

Treatment	Rep	Number of Surviving Organisms										
		Day 0 Date 10/31	Day Date	Day Date	Day 28 Date 11/28	Day Date	Day ~~14~~ Date	Day Date	Day Date	Day Date	Day Date	Day ~~28~~ Date
ATD-758	A	60	59		59							
	B	60	51		51							
	C	60	58		58							
	D	60	56		56							
	E	60	59		59							
			Dnt									
Time / Initials		1500 JB			SM, RM KL RSH JS MAS							

ATS-T12
03/01/00

~~SEDIMENT~~ SOIL TOXICITY TEST SET-UP BENCH SHEET

Project Number: 70003.10

Client: IT Corporation

QC Test Number: TN-00-742

TEST ORGANISM INFORMATION

Common Name:	red worm	Adults Isolated (Time, Date):	—
Scientific Name:	Eisenia foetida	Neonates Pulled (Time, Date):	—
Lot Number:	EF-017	Acclimation:	<24 hrs. Age: adult
Source:	Smith Worms	Culture Water (T/S):	— °C — ppt

TEST INITIATION

Date	Time	Initials	Activity
10/30/00	1500	LAH, MS, WLM	~~Sediment~~ Soil Added to Chambers
			~~Overlying Water Added to Chambers~~
10/31/00	1500	JB, WLM, MS, RSH	Organisms Transferred

TEST SET-UP

Sample Number(s): ATO-735, 736, 737, 738, 739, 758

Overlying Water Number: —

Treatment	Volume Test ~~Sediment~~ Soil	~~Volume Overlying Water~~
Control	1,500 g (dry weight)	
ATO-735	↓	
ATO-736		
ATO-737		
ATO-738		
ATO-739		
ATO-758		

TOXICOLOGY LABORATORY BENCH SHEET - TEMPERATURE RECORD

Project Number: 70003.10

Client: IT Corporation

QC Test Number: TN-00-742

Day	Date	Time	Initials	Temperature (°C)
0	10/31/00	1640	WAS	22.0
1	11/01/00	1602	LAH	23.1
2	11/02/00	0815	WLW	23.4
3	11/03/00	1622	WAS	23.5
4	11/04/00	1255	NM	23.2
5	11/5/00	1245	KL	23.0
6	11/6/00	1532	RSA	23.1
7	11/7/00	1255	RSA	23.1
8	11/8/00	1445	RSA	23.5
9	11/9/00	1420	EV	23.0
10	11/10/00	1103	[illegible]	23.2
11	~~LS~~ 11/11/00	~~LS~~	~~LS~~	~~LS~~ ~~24.0~~ (a)
12	11/12/00	900	LS	24.0
13	11/13/00	1000	LS	23.1
14	11/14/00	1510	LS	~~23~~ 23.0
15	11/15/00	0914	KL	23.0
16	11/16/00	0900	WAS	23.0
17	11/17/00	0900	WAS	23.0
18	11/18/00			(a)
19	11/19/00			(a)
20	11/20/00	1800	WAS	22.5
21	11/21/00	0855	KL	22.9
22	11/22/00	1140	[illegible]	22.4
23	11/23/00	0933	[illegible]	22.9
24	11/24/00	1000	LS	23.5
25	11/25/00	1400	[illegible]	22.5
26	11/26/00	0857	KL	23.1
27	11/27/00	1510	KL	23.0
28	11/28/00	0900	WAS	23.1

(a) not recorded

PERCENT MOISTURE ANALYSIS (SOILS)

Project Number: 70003.10 Client: IT Corporation QC Test Number: TN-00-742

Oven Temp. (°C): 100 Drying Duration (hours): 17 hours

Wet Weights Measured (date/time/initials): 10/30/00 MAS 1522 Dry Weights Measured (date/time/initials): ~~0825~~ 0825 LAH 10/31/00 RSH

Sample ID	Tin #	A Weight of Tin (g)	B Wt. of Tin & Wet Sample (g)	C=B-A Total Wet Sample Wt. (g)	D Wt. of Tin & Dry Sample (g)	E=D-A Total Dry Sample Wt. (g)	(C-E)100 / C Moisture Content (%)
Control	W1	1.00	21.66	20.66 LAH	13.44	12.44	~~51.52~~ 39.71 LAH
ATO-735	W2	0.99	22.36	21.37	17.35	16.36	23.44
ATO-736	W3	0.99	21.57	20.58	16.07	15.08	26.72
ATO-737	W4	0.99	21.26	20.27	16.13	15.14	25.31
ATO-738	W5	0.99	23.56	22.57	17.55	16.56	26.63
ATO-739	W6	1.00	22.85	21.85	16.29	15.29	30.02
ATO-758	W7	1.00	20.50	19.50	16.32	15.32	21.44
Wet Weights Measured 10/31/00 MAS				Dry Weights Measured 11/1/00 MAS			
Control	W8	0.99	21.62	20.63	13.57	12.58	39.02

ATS-T35
03/01/00

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70003.10

Client: IT

QC Test Number: TN-00-742

Date/Time/Initials	Comments/Activity	
10/31/00 1520	Did initial wet weights of *Eisenia foetida*	WLM

Pan #1 5 worms = 1.66 g (.332 g/worm)
Pan #2 5 worms = 1.51 g (.302 g/worm) $\bar{x}$ = 0.317 g/worm

NOTE: These were the medium large worms at the beginning of the loading period.

VAS (LAH) Soil pH's

Control = not recorded
ATO-735 = 7.8
736 = 6.5
737 = 6.7
738 = 6.2
739 = 7.2
758 = 7.9

STATISTICS FOR WATER QUALITY
QC Test: TN-00-742 IT (EISENIA)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1		22.0						
2		23.1						
3		23.4						
4		23.5						
5		23.2						
6		23.0						
7		23.1						
8		23.1						
9		23.5						
10		23.0						
11		23.2						
12		24.0						
13		23.1						
14		23.0						
15		23.0						
16		23.0						
17		23.0						
18		22.5						
19		22.9						
20		22.4						
21		22.9						
22		23.5						
23		22.5						
24		23.1						
25		23.0						
26		23.1						
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	0	26	0	0	0	0	0.0	0.0
Min.	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0
Max.	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean	#DIV/0!	23.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
S.D.	#DIV/0!	0.39	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
N		26		0		0		0.0
Min.		22.0		0.0		0.0		0.0
Max.		24.0		0.0		0.0		0.0
Mean		23.0		#DIV/0!		#DIV/0!		#DIV/0!
S.D.		0.39		#DIV/0!		#DIV/0!		#DIV/0!

QCd
1/17/01
LMT

1/17/2001 10:15 AM

28-day

Acute Survival Test-~~96-Hr~~ Survival

Start Date:		Test ID:	TN-00-742	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	EF-Eisenia foetida
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
CONTROL	1.0000	0.9833	1.0000	1.0000	1.0000
AT0-735	0.7833	0.8000	0.6167	0.5667	0.7167
AT0-736	0.9833	1.0000	0.9833	1.0000	0.9000
AT0-737	0.9667	0.9833	0.9833	0.8500	1.0000
AT0-738	1.0000	1.0000	1.0000	0.9667	1.0000
AT0-739	0.9667	0.9667	0.9833	1.0000	0.9833
AT0-758	0.9833	0.8500	0.9667	0.9167	0.9833

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9967	1.0000	1.4932	1.4413	1.5062	1.943	5			
*AT0-735	0.6967	0.6990	0.9917	0.8523	1.1071	11.267	5	9.714	1.860	0.0960
AT0-736	0.9733	0.9766	1.4288	1.2490	1.5062	7.391	5			
AT0-737	0.9567	0.9599	1.3898	1.1731	1.5062	9.230	5			
AT0-738	0.9933	0.9967	1.4824	1.3872	1.5062	3.590	5			
AT0-739	0.9800	0.9833	1.4327	1.3872	1.5062	3.436	5			
AT0-758	0.9400	0.9431	1.3442	1.1731	1.4413	8.675	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.921	0.781	-0.348	0.05284
F-Test indicates equal variances (p = 0.02)	14.836	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.02382	0.02396	0.62874	0.00666	1.1E-05	1, 8

AT0-735 vs. Control

ToxCalc v5.0.23

Reviewed by: RAC 1/23/

28-DAY

Acute Survival Test-~~96 Hr~~ Survival

Start Date:		Test ID:	TN-00-742	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	EF-Eisenia foetida
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
CONTROL	1.0000	0.9833	1.0000	1.0000	1.0000
AT0-735	0.7833	0.8000	0.6167	0.5667	0.7167
AT0-736	0.9833	1.0000	0.9833	1.0000	0.9000
AT0-737	0.9667	0.9833	0.9833	0.8500	1.0000
AT0-738	1.0000	1.0000	1.0000	0.9667	1.0000
AT0-739	0.9667	0.9667	0.9833	1.0000	0.9833
AT0-758	0.9833	0.8500	0.9667	0.9167	0.9833

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
CONTROL	0.9967	1.0000	1.4932	1.4413	1.5062	1.943	5		
AT0-735	0.6967	0.6990	0.9917	0.8523	1.1071	11.267	5		
AT0-736	0.9733	0.9766	1.4288	1.2490	1.5062	7.391	5	22.00	19.00
AT0-737	0.9567	0.9599	1.3898	1.1731	1.5062	9.230	5		
AT0-738	0.9933	0.9967	1.4824	1.3872	1.5062	3.590	5		
AT0-739	0.9800	0.9833	1.4327	1.3872	1.5062	3.436	5		
AT0-758	0.9400	0.9431	1.3442	1.1731	1.4413	8.675	5		

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.75471	0.781	-1.7883	4.29226
F-Test indicates equal variances (p = 0.03)	13.2521	23.1539		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

AT0-736 vs. Control

ToxCalc v5.0.23

Reviewed by: RMC 1/23

28 DAY

Acute Survival Test-~~96 Hr~~ Survival

Start Date:		Test ID:	TN-00-742	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	EF-Eisenia foetida
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
CONTROL	1.0000	0.9833	1.0000	1.0000	1.0000
AT0-735	0.7833	0.8000	0.6167	0.5667	0.7167
AT0-736	0.9833	1.0000	0.9833	1.0000	0.9000
AT0-737	0.9667	0.9833	0.9833	0.8500	1.0000
AT0-738	1.0000	1.0000	1.0000	0.9667	1.0000
AT0-739	0.9667	0.9667	0.9833	1.0000	0.9833
AT0-758	0.9833	0.8500	0.9667	0.9167	0.9833

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9967	1.0000	1.4932	1.4413	1.5062	1.943	5			
AT0-735	0.6967	0.6990	0.9917	0.8523	1.1071	11.267	5			
AT0-736	0.9733	0.9766	1.4288	1.2490	1.5062	7.391	5			
AT0-737	0.9567	0.9599	1.3898	1.1731	1.5062	9.230	5	1.758	1.860	0.1094
AT0-738	0.9933	0.9967	1.4824	1.3872	1.5062	3.590	5			
AT0-739	0.9800	0.9833	1.4327	1.3872	1.5062	3.436	5			
AT0-758	0.9400	0.9431	1.3442	1.1731	1.4413	8.675	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.81031	0.781	-1.7436	4.56452
F-Test indicates equal variances (p = 0.01)	19.5563	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates no significant differences	0.02854	0.02871	0.02673	0.00865	0.11683	1,

AT0-737 vs. Control

ToxCalc v5.0.23

Reviewed by: RAC 1/2

28-Day

Acute Survival Test-~~96 Hr~~ Survival

Start Date:		Test ID:	TN-00-742	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	EF-Eisenia foetida
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
CONTROL	1.0000	0.9833	1.0000	1.0000	1.0000
AT0-735	0.7833	0.8000	0.6167	0.5667	0.7167
AT0-736	0.9833	1.0000	0.9833	1.0000	0.9000
AT0-737	0.9667	0.9833	0.9833	0.8500	1.0000
AT0-738	1.0000	1.0000	1.0000	0.9667	1.0000
AT0-739	0.9667	0.9667	0.9833	1.0000	0.9833
AT0-758	0.9833	0.8500	0.9667	0.9167	0.9833

			Transform: Arcsin Square Root					Rank	1-Tailed
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical
CONTROL	0.9967	1.0000	1.4932	1.4413	1.5062	1.943	5		
AT0-735	0.6967	0.6990	0.9917	0.8523	1.1071	11.267	5		
AT0-736	0.9733	0.9766	1.4288	1.2490	1.5062	7.391	5		
AT0-737	0.9567	0.9599	1.3898	1.1731	1.5062	9.230	5		
AT0-738	0.9933	0.9967	1.4824	1.3872	1.5062	3.590	5	27.00	19.00
AT0-739	0.9800	0.9833	1.4327	1.3872	1.5062	3.436	5		
AT0-758	0.9400	0.9431	1.3442	1.1731	1.4413	8.675	5		

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.63829	0.781	-1.9786	3.09361
F-Test indicates equal variances (p = 0.27)	3.36609	23.1539		

Hypothesis Test (1-tail, 0.05)

Wilcoxon Two-Sample Test indicates no significant differences

AT0-738 vs. Control

ToxCalc v5.0.23

Reviewed by: Roe 1/23/

28-Day

Acute Survival Test-~~96 Hr~~ Survival

Start Date:		Test ID:	TN-00-742	Sample ID:	
End Date:		Lab ID:		Sample Type:	
Sample Date:		Protocol:	EPAA 91-EPA Acute	Test Species:	EF-Eisenia foetida
Comments:	IT CORPORATION				

Conc-%	1	2	3	4	5
CONTROL	1.0000	0.9833	1.0000	1.0000	1.0000
AT0-735	0.7833	0.8000	0.6167	0.5667	0.7167
AT0-736	0.9833	1.0000	0.9833	1.0000	0.9000
AT0-737	0.9667	0.9833	0.9833	0.8500	1.0000
AT0-738	1.0000	1.0000	1.0000	0.9667	1.0000
AT0-739	0.9667	0.9667	0.9833	1.0000	0.9833
AT0-758	0.9833	0.8500	0.9667	0.9167	0.9833

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9967	1.0000	1.4932	1.4413	1.5062	1.943	5			
AT0-735	0.6967	0.6990	0.9917	0.8523	1.1071	11.267	5			
AT0-736	0.9733	0.9766	1.4288	1.2490	1.5062	7.391	5			
AT0-737	0.9567	0.9599	1.3898	1.1731	1.5062	9.230	5			
AT0-738	0.9933	0.9967	1.4824	1.3872	1.5062	3.590	5			
*AT0-739	0.9800	0.9833	1.4327	1.3872	1.5062	3.436	5	2.371	1.860	0.0475
AT0-758	0.9400	0.9431	1.3442	1.1731	1.4413	8.675	5			

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.83504	0.781	0.20176	0.34396
F-Test indicates equal variances (p = 0.33)	2.87976	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.00956	0.00962	0.00917	0.00163	0.0452	1, 8

AT0-739 vs. Control

ToxCalc v5.0.23

Reviewed by: RAC 1/23/10

28-Day

Acute Survival Test-~~96 Hr~~ Survival

Start Date:	Test ID: TN-00-742	Sample ID:	
End Date:	Lab ID:	Sample Type:	
Sample Date:	Protocol: EPAA 91-EPA Acute	Test Species:	EF-Eisenia foetida
Comments: IT CORPORATION			

Conc-%	1	2	3	4	5
CONTROL	1.0000	0.9833	1.0000	1.0000	1.0000
AT0-735	0.7833	0.8000	0.6167	0.5667	0.7167
AT0-736	0.9833	1.0000	0.9833	1.0000	0.9000
AT0-737	0.9667	0.9833	0.9833	0.8500	1.0000
AT0-738	1.0000	1.0000	1.0000	0.9667	1.0000
AT0-739	0.9667	0.9667	0.9833	1.0000	0.9833
AT0-758	0.9833	0.8500	0.9667	0.9167	0.9833

			Transform: Arcsin Square Root						1-Tailed	
Conc-%	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
CONTROL	0.9967	1.0000	1.4932	1.4413	1.5062	1.943	5			
AT0-735	0.6967	0.6990	0.9917	0.8523	1.1071	11.267	5			
AT0-736	0.9733	0.9766	1.4288	1.2490	1.5062	7.391	5			
AT0-737	0.9567	0.9599	1.3898	1.1731	1.5062	9.230	5			
AT0-738	0.9933	0.9967	1.4824	1.3872	1.5062	3.590	5			
AT0-739	0.9800	0.9833	1.4327	1.3872	1.5062	3.436	5			
*AT0-758	0.9400	0.9431	1.3442	1.1731	1.4413	8.675	5	2.774	1.860	0.0999

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.90039	0.781	-0.95	1.30588
F-Test indicates equal variances (p = 0.02)	16.1564	23.1539		

Hypothesis Test (1-tail, 0.05)	MSDu	MSDp	MSB	MSE	F-Prob	df
Homoscedastic t Test indicates significant differences	0.02517	0.02532	0.05554	0.00722	0.02416	1, 8

AT0-758 vs. Control

ToxCalc v5.0.23

Reviewed by RAE 1/23/01

ATTACHMENT VI

Lumbriculus variegatus Bioaccumulation Testing
Data Sheets

TOXICITY TEST WATER QUALITY DATA SHEET - NEW SOLUTIONS

Project Number: 7000310
Client: IT Corporation
QC Test Number: TN-00-745

TEST ORGANISM
Common Name: oligochaete
Scientific Name: Lumbriculus variegatus

Beginning Date: 11/2/00 Time: 1500
Ending Date: 11/30/00 Time: 1300

TARGET VALUES Temp: 23 ± 1 °C pH: 6.0 - 9.0 DO: ≥ 2.5 mg/L Salinity: — ppt

	Test Conc	Rep	Temperature (°C) 0	1	2	3	4	5	6	pH 0	1	2	3	4	5	6	Dissolved Oxygen (mg/L) 0	1	2	3	4	5	6	Conductivity (µS/cm) ~~Salinity (ppt)~~ 0	1	2	3	4	5	6
	Control	(A)	22.5							8.3							8.1							1591						
ATO-	745	(A)	22.7							8.2							7.2							1239						
ATO-	746	(A)	22.6							8.1							7.1							1229						
ATO-	747	(A)	22.7							8.1							7.0							1231						
ATO-	748	(A)	22.8							8.1							7.1							1237						
ATO-	749	(A)	22.9							8.0							6.6							1226						
	Meter Number		19/04							19/04							56							19/921						
	Time		1406							1406							1409							1404						
	Initials		WW JN							WW JN							WW JN							WW JN						

ATS-T13
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 7000310
Client: IT Corporation
QC Test Number: TN-00-745

TEST ORGANISM
Common Name: oligochaete
Scientific Name: Lumbriculus variegatus

Beginning Date: 11/2/00 Time: 1500
Ending Date: 11/30/00 Time: 1300

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 1	2	3	4	5	6	7	pH 1	2	3	4	5	6	7	Dissolved Oxygen (mg/L) 1	2	3	4	5	6	7	Conductivity (µS/cm) ~~Salinity (ppt)~~ 1	2	3	4	5	6	7
Control		22.9	23.3	22.7	22.7	22.5	22.8	23.1	8.1	8.4	8.4	8.3	7.8	8.0	8.3	7.3	7.7	7.1	7.7	7.7	8.0	7.8	1507	1737	1120	1605	1409	1335	1191
ATO-745		22.8	22.9	22.5	22.7	23.0	22.2	22.6	8.0	8.3	8.3	8.2	8.0	7.5	8.1	7.3	7.5	7.1	7.6	8.0	7.5	7.3	1098	1301	911	1160	1178	1190	1161
ATO-746		22.8	22.6	22.7	22.7	22.7	22.4	22.7	8.1	8.3	8.3	8.1	8.0	7.9 8.4	8.1	7.7	8.0	7.2	7.8	8.0	7.9	7.7	1094	1247	917	1106	1165	1174	1062
ATO-747		22.6	22.7	22.9	22.5	23.3	22.3	22.7	8.1	8.3	8.3	8.1	8.1	8.3	8.2	7.8	7.9	7.1	7.7	8.0	8.4	7.1	1127	1243	915	1087	1161	1170	1092
ATO-748		22.4	22.8	22.7	22.7	22.7	22.6	22.4	7.9	8.3	8.3	8.0	8.0	8.2	8.2	7.4	8.0	7.1	7.4	7.6	7.7	8.5	1155	1233	904	1088	1156	1190	1098
ATO-749		22.7	23.4	22.8	22.7	22.7	22.4	22.5	7.9	8.2	8.2	8.1	8.0	8.1	8.1	7.4	7.6	7.0	7.5	7.7	7.7	8.2	1138	1227	873	1077	1154	1194	1083
Replicate		B	C	D	E	A	B	C																					
Meter Number		11/103	56	56	11/104	14/104	12/104	56	11/103	11/104	12/104	11/104	14/104	12/104	13/104	56	56	56	56	56	56	56	92/921	92/921	92/921	92/921	11/921	11/921	11/921
Time		1352	1430	1402	1500	1310	1405	1430	1352	1430	1405	1500	1310	1405	1412	1365	1430	1402	1500	1322	1410	1430	1358	1430	1400	1500	1312	1435	1435
Initials		RD	RD	RD	KC	RD	LS	LS	RD	RD	RD	KC	RD	LS	LS	RD	RD	RD	KC	RD	LS	LS	RD	RD	RD	KC	RD	LS	LS

ATS-T14
3/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 7000310
Client: IT Corporation
QC Test Number: TN-00-745

TEST ORGANISM
Common Name: oligochaete
Scientific Name: Lumbriculus variegatus

Beginning Date: 11/2/00 Time: 1500
Ending Date: 11/30/00 Time: 1300

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 8	9	10	11	12	13	14	pH 8	9	10	11	12	13	14	Dissolved Oxygen (mg/L) 8	9	10	11	12	13	14	Conductivity (µS/cm) ~~Salinity (ppt)~~ 8	9	10	11	12	13	14
Control		22.1	22.1	22.1	22.3	22.4	22.1	22.2	8.3	8.4	8.5	7.9	8.3	8.1	8.3	7.6	7.9	8.2	7.6	7.8	7.9	8.0	1280	1332	1326	1430	1435	1329	1390
ATO-745		22.4	22.2	22.1	22.9	22.2	22.2	22.3	8.2	8.4	8.5	7.9	8.1	8.1	8.2	7.5	6.9	8.2	7.7	7.4	7.8	7.7	1154	1178	1107	1288	1267	1173	1162
ATO-746		22.5	22.3	22.1	22.1	22.2	21.8	22.5	8.3	8.4	8.5	8.1	8.2	8.1	8.1	7.9	6.8	8.1	8.0	7.7	8.0	7.8	1170	1172	1103	1281	1251	1187	1163
ATO-747		23.2	23.0	22.5	22.7	22.2	22.2	23.0	8.3	8.4	8.5	8.1	8.2	8.1	8.2	7.8	6.7	8.3	7.8	7.7	7.8	7.7	1151	1168	1088	1262	1263	1189	1163
ATO-748		23.0	22.9	22.3	22.3	22.2	22.3	22.6	8.1	8.3	8.3	8.0	8.2	8.1	8.1	7.5	6.5	7.8	7.5	7.6	7.8	7.5	1160	1138	1102	1255	1266	1190	1160
ATO-749		23.4	22.7	22.2	22.8	22.8	22.3	23.0	8.1	8.3	8.4	8.0	8.1	8.1	8.1	7.3	6.5	8.0	7.7	7.4	7.8	7.1	1157	1122	1091	1257	1250	1173	1165
Replicate		D	E	A	B	C	D	E																					
Meter Number		56	56	10/103	12/104	22/103	13/104	10/103	10/103	12/104	10/103	12/104	22/103	13/104	10/103	56	56	56	56	56	54	56	14/121	14/121	13/121	22/121	10/121	L	L
Time		1125	1511	1220	1350	1425	1450	1350	1125	1510	1220	1350	1425	1450	1350	1125	1511	1220	1355	1428	1451	1355	1125	1510	1220	1352	1420	1449	1400
Initials		SG	nn	LS	KL	MD	WW	MD	SG	nn	LS	KL	MD	WW	MD	SG	nn	LS	KL	MD	WW	MD	SG	nn	LS	KL	MD	WW	MD

ATS-T16
03/01/00

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 7000310
Client: IT Corporation
QC Test Number: TN-00-745

TEST ORGANISM
Common Name: oligochaete
Scientific Name: Lumbriculus variegatus

Beginning Date: 11/2/00 Time: 1500
Ending Date: 11/30/00 Time: 1300

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 15	16	17	18	19	20	21	pH 15	16	17	18	19	20	21	Dissolved Oxygen (mg/L) 15	16	17	18	19	20	21	Conductivity (µS/cm) ~~Salinity (ppt)~~ 15	16	17	18	19	20	21
Control		22.0	22.2	22.1	22.0	16 ~~21.8~~ 21.3	22.2	23.1	8.4	8.3	8.0	8.1	8.3	7.9	8.2	8.1	7.6	8.1	8.0	7.9	7.8	~~8.5~~ 7.8	1411	1428	1391	1531	1249	1261	1278
ATO-745		22.6	22.1	22.0	21.5	21.2	23.1	23.0	8.4	8.1	8.4	8.1	8.3	8.1	8.1	8.0	6.9	7.8	8.2	7.9	7.7	7.6	1275	1260	1234	~~1233~~ 1243 LS	1134	1090	1123
ATO-746		22.0	22.0	22.7	21.4	21.4	23.0	22.6	8.3	8.4	8.4	8.2	8.3	8.0	8.0	8.1	8.1	7.9	8.2	8.0	4.9	8.3	1243	1266	1202	1229	1131	1137	1082
ATO-747		22.5	0.23 ~~22.8~~	22.4	22.1	21.8	23.2	22.9	8.4	8.4	8.5	8.2	8.3	8.2	8.1	8.1	8.2	8.2	8.0	8.1	7.6	8.4	1243	1259	1209	1204	1121	1075	1066
ATO-748		22.1	22.0	22.1	21.9	21.7	22.4	22.9	8.2	8.1	8.4	8.1	8.2	8.1	8.2	7.4	7.3	8.3	7.8	7.6	7.4	7.9	1240	1278	1202	1211	1114	1083	1059
ATO-749		22.0	22.5	22.2	22.3	21.8	22.5	23.4	8.3	7.7	8.4	8.0	8.2	8.1	8.2	7.9	29.4 7.6	8.2	8.2	7.4	7.8	7.9	1249	1269	1190	1210	1115	1085	1021
Replicate		A	B	C	D	E	A	B																					
Meter Number		57	10/103	12/103	17/104	12/103	57	57	10/103	10/103	12/108	12/104	12/108	11/104	11/104	57	57	57	56	56	57	57	11/921	11/921	11/921	11/921	11/921	11/921	10/921
Time		1148	1400	1130	1325	1340	1310	1302	1145	1400	1120	1335	1310	1305	1300	1142	1405	1120	1335	1315	1310	1302	1154	1402	1125	1330	1310	1300	1307
Initials		nn	KL	LS	LS	LS	LS	nn	nn	KL	LS	LS	LS	[illegible]	nn	nn	KL	LS	LS	LS	LS	nn	nn	KL	LS	LS	LS	LS	nn

TOXICITY TEST WATER QUALITY DATA SHEET - OLD SOLUTIONS

Project Number: 7000310
Client: IT Corporation
QC Test Number: TN-00-745

TEST ORGANISM
Common Name: oligochaete
Scientific Name: Lumbriculus variegatus

Beginning Date: 11/2/00 Time: 1500
Ending Date: 11/30/00 Time: 1300

TARGET VALUES Temp: 23±1 °C pH: 6.0 - 9.0 DO: ≥2.5 mg/L Salinity: — ppt

Test Conc	Rep	Temperature (°C) 22	23	24	25	26	27	28	pH 22	23	24	25	26	27	28	Dissolved Oxygen (mg/L) 22	23	24	25	26	27	28	Conductivity (µS/cm) ~~Salinity (ppt)~~ 22	23	24	25	26	27	28
Control		23.1	22.7	23.1	22.8	22.0	22.9	22.8	7.8	8.3	8.0	8.3	8.3	8.0	8.4	8.0	7.8	6.0 6.1	7.9	8.2	8.0	8.0	1190	1223	1163	1307	1222	1288	1319
ATU-745		22.5	22.1	23.0	23.4	21.6	23.1	23.4	8.2	8.2	8.2	8.2	8.3	8.1	8.2	7.4	7.5	7.6	7.9	8.2	8.0	7.5	1167	1120	1092	1255	1229	1281	1182
ATU-746		22.5	22.2	23.9	23.1	22.1	23.4	23.1	8.2	8.4	8.3	8.1	8.4	8.1	8.4	7.9	8.3	7.8	7.5	8.5	8.0	7.7	1097	1137	1094	1250	1257	1294	1232
ATU-747		22.8	22.7	23.3	23.7	22.5	23.7	24.0	8.2	8.4	8.4	8.3	8.4	8.2	8.3	8.2	8.2	7.8	7.8	8.5	8.0	7.5	1094	1123	1082	1248	1231	1301	1177
ATU-748		22.7	22.5	22.8	23.3	21.5	23.3	23.7	8.3	8.2	8.3	8.2	8.2	8.2	8.2	8.2	7.7	7.7	7.3	8.3	8.2	8.2	1100	1122	1084	1245	1228	1294	1205
ATU-749		23.2	22.7	23.1	23.1	22.2	23.1	23.9	8.3	8.2	8.3	8.2	8.2	8.2	8.2	8.1	7.7	7.5	7.6	8.2	8.3	7.8	1090	1120	1078	1248	1226	1291	1191
Replicate		C	D	E	A	B	C	D																					
Meter Number		12/104	11/103	12/104	12/104	12/103	12/104	56	12/104	11/103	12/104	12/104	12/103	12/104	12/104	57	56	56	57	56	56	56	10/921	11/921	12/921	11/921	11/921	11/921	11/921
Time		1145	1217	1232	1335	1402	1405	0850	1145	1217	1232	1335	1402	1405	0850	1150	1200	1240	1337	1412	1407	0850	1155	1210	1238	1331	1407	1405	0850
Initials		LS	WW	KL	KL	KL	WW	SM	LS	WW	KL	KL	KL	WW	SM	LS	WW	KL	KL	KL	WW	SM	LS	WW	KL	KL	KL	WW	SM

SEDIMENT TOXICITY TEST SET-UP BENCH SHEET

Project Number: 7000310

Client: IT Corporation

QC Test Number: TN-00-745

TEST ORGANISM INFORMATION

Common Name: oligochaete

Scientific Name: Lumbriculus variegatus

Lot Number: LV-006

Source: ABS

Adults Isolated (Time, Date): —

Neonates Pulled (Time, Date): —

Acclimation: <24hrs. Age: adult

Culture Water (T/S): 22.7 °C _____ ppt

TEST INITIATION

Date	Time	Initials	Activity
11/1/00	1045	KL/JN	Sediment Added to Chambers
11/1/00 (11/2/00)	1430 (1000)	[illegible]	Overlying Water Added to Chambers
11/2/00	1500	[illegible]	Organisms Transferred

TEST SET-UP

Sample Number(s): ATO-745, 746, 747, 748, 749

Overyling Water Number: Very Hard Water (410mg/L hardness)

Treatment	Volume Test Sediment	Volume Overlying Water
Control	1.1 L	1 L
ATO-745	↓	↓
ATO-746		
ATO-747		
ATO-748		
ATO-749		

TOXICOLOGY LABORATORY BENCH SHEET - RENEWAL RECORD

Project Number: 7000310

Client: IT Corporation

QC Test Number: TN-00-745

Day	Date	Time		Initials
0	11-2-00	AM	1000	[illegible]
		PM	—	—
1	11/3/00	AM	1130	[illegible]
		PM	1600	RD
2	11/4/00	AM	0930	[illegible]
		PM	1515	[illegible]
3	11/5/00	AM	0940	[illegible]
		PM	1445	[illegible]
4	11/6/00	AM	0930	EV
		PM	1530	[illegible]
5	11/7/00	AM	0900	[illegible]
		PM	1500	LS
6	11/8/00	AM	1000	EV
		PM	1435	LS
7	11/9/00	AM	1000	EV
		PM	1430	LS
8	11/10/00	AM	0900	SM
		PM	1500	JG
9	11/11/00	AM	0925	[illegible]
		PM	1600	[illegible]
10	11/12	AM	900	LS
		PM	1300	LS

TOXICOLOGY LABORATORY BENCH SHEET - RENEWAL RECORD

Project Number: 7000310

Client: IT Corporation

QC Test Number: TN-00-745

Day	Date	Time		Initials
~~0~~ 11	11/13	AM	0935	KL
		PM	1400	KL
~~1~~ 12	11/14/00	AM	0840	VW
		PM	1500	UND
~~2~~ 13	11/15/00	AM	0855	KL
		PM	1510	VW
~~3~~ 14	11/16/00	AM	0850	UND
		PM	1500	UND
~~4~~ 15	11/17/00	AM	0930	RM
		PM	1600	SM
~~5~~ 16	11/18/00	AM	0900	VW
		PM	1500	KL
~~6~~ 17	11/19/00	AM	815	LS
		PM	1400	LS
~~7~~ 18	11/20/00	AM	830	LS
		PM	1600	LS
~~8~~ 19	11/21/00	AM	0850	UND
		PM	~~8~~ 1500	LS
~~9~~ 20	11/22/00	AM	815	KL
		PM	~~KL 1600~~ 1400	KL
~~10~~ 21	11/23/00	AM	0930	RM
		PM	1412	RM

TOXICOLOGY LABORATORY BENCH SHEET - RENEWAL RECORD

Project Number: 7000310

Client: IT Corporation

QC Test Number: TN-00-745

Day	Date	Time		Initials
~~0~~ (22)	11/24/00	AM	0930	EV
		PM	1200	LS
~~1~~ (23)	11/25/00	AM	0800	MW
		PM	~~15~~35 UO	UO
~~2~~ (24)	11/26/00	AM	0910	K
		PM	1308	K
~~3~~ (25)	11/27/00	AM	0900	EV
		PM	1350	K
~~4~~ (26)	11/28/00	AM	0850	UO
		PM	1430	KL/UO
~~5~~ (27)	11/29/00	AM	0900	EV/SM
		PM	1430	MW
~~6~~		AM		
		PM		
~~7~~		AM		
		PM		
~~8~~		AM		
		PM		
~~9~~		AM		
		PM		
~~10~~		AM		
		PM		

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 7000310

Client: IT Corporation

QC Test Number: TN-00-745

Date/Time/Initials	Comments/Activity
11/3/00, 0945 (LAH)	
	Control, conductivity = 2,760 µS/cm
	DO = 2.7 to 4.5 mg/L
	ATO-745, DO = 2.0 mg/L — 1,362 µS/cm
	ATO-746, DO = 2.0 mg/L — 1,340 µS/cm
	ATO-747, DO = 2.3 mg/L — 1,350 µS/cm
	ATO-748, DO = 2.0 mg/L — 1,305 µS/cm
	ATO-749, DO = 1.9 mg/L — 1,319 µS/cm
11/3/00 1000	Test chambers put on air due to low DO. levels. — WM/LAH
11/20/00	Test was cold due to night time temp's outside dropping into the 20's. The room temp was bumped up a degree to fix problem.
LS 11/21/00	

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70003.10

Client: IT Corporation

QC Test Number: TN-00-745

Date/Time/Initials	Comments/Activity

Very Hard Water @ 410 mg/L hardness (±10%)
[369–451 mg/L]

$NaHCO_3$ = 88.704 g
$CaSO_4 \cdot 2H_2O$ = 55.44 g
$MgSO_4$ = 55.44 g
KCl = 3.696 g

① Fill blue barrel to 45-gal mark with DI water.
LAH ~~② Remove ~5 gal + discard (want final volume of 45 gal) ← mark 45 gal line~~
③ Remove 10 gal into tank – dissolve $NaHCO_3$, $MgSO_4$, + KCl
④ Dissolve $CaSO_4$ in remaining 35 gal of DI in barrel.

TOXICOLOGY LABORATORY BENCH SHEET

Project Number: 70000310

Client: IT Corporation

QC Test Number: TN-00-745

Date/Time/Initials Comments/Activity

Reserve composite aliquot of overlying water from each sediment for A/H/C.

Day	Date	Initials	6 Samples Taken (✔)
Day 0	11-2-00	JNW	✔
Day 7	11-9-00	EV	✔
Day 14	11/16/00	UW	✔
Day 21	11/23/00	NP	✔
Day 28	11-30-00	UW	✔

STATISTICS FOR WATER QUALITY
QC Test: TN-00-745 IT (CONTROL)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.5	22.9	8.3	8.1	8.1	7.3	1591.0	1507.0
2		23.3		8.4		7.7		1737.0
3		22.7		8.4		7.1		1120.0
4		22.7		8.3		7.7		1605.0
5		22.5		7.8		7.7		1409.0
6		22.8		8.0		8.0		1339.0
7		23.1		8.3		7.8		1191.0
8		22.1		8.3		7.6		1280.0
9		22.1		8.4		7.9		1332.0
10		22.1		8.5		8.2		1326.0
11		22.3		7.9		7.6		1430.0
12		22.4		8.3		7.8		1435.0
13		22.1		8.1		7.9		1329.0
14		22.2		8.3		8.0		1390.0
15		22.0		8.4		8.1		1411.0
16		22.2		8.3		7.6		1420.0
17		22.1		8.0		8.1		1391.0
18		22.0		8.1		8.0		1534.0
19		21.3		8.3		7.9		1269.0
20		22.2		7.9		7.8		1261.0
21		23.1		8.2		7.8		1226.0
22		23.1		7.8		8.0		1190.0
23		22.7		8.3		7.8		1222.0
24		23.1		8.0		6.1		1163.0
25		22.8		8.3		7.9		1309.0
26		22.0		8.3		8.2		1220.0
27		22.9		8.0		8.0		1280.0
28		22.8		8.4		8.0		1319.0
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	28	1	28	1	28	1.0	28.0
Min.	22.5	21.3	8.3	7.8	8.1	6.1	1591.0	1120.0
Max.	22.5	23.3	8.3	8.5	8.1	8.2	1591.0	1737.0
Mean	22.5	22.5	8.3	8.2	8.1	7.8	1591.0	1344.5
S.D.	#DIV/0!	0.48	#DIV/0!	0.20	#DIV/0!	0.41	#DIV/0!	138.4
N		29		29		29		29.0
Min.		21.3		7.8		6.1		1120.0
Max.		23.3		8.5		8.2		1737.0
Mean		22.5		8.2		7.8		1353.0
S.D.		0.47		0.20		0.41		143.4

STATISTICS FOR WATER QUALITY
QC Test: TN-00-745 IT (AT0-745)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.7	22.8	8.2	8.0	7.2	7.3	1239.0	1098.0
2		22.9		8.3		7.5		1301.0
3		22.5		8.3		7.1		911.0
4		22.7		8.2		7.6		1160.0
5		23.0		8.0		8.0		1178.0
6		22.2		7.5		7.5		1190.0
7		22.6		8.1		7.3		1161.0
8		22.4		8.2		7.5		1150.0
9		22.2		8.4		6.9		1178.0
10		22.1		8.5		8.2		1107.0
11		22.0		7.9		7.7		1288.0
12		22.2		8.1		7.4		1267.0
13		22.2		8.1		7.8		1173.0
14		22.3		8.2		7.7		1160.0
15		22.6		8.4		8.0		1275.0
16		22.1		8.1		6.9		1260.0
17		22.0		8.4		7.8		1234.0
18		21.5		8.1		8.2		1243.0
19		21.2		8.3		7.9		1134.0
20		23.1		8.1		7.7		1090.0
21		23.0		8.1		7.6		1123.0
22		22.5		8.2		7.4		1167.0
23		22.1		8.2		7.5		1120.0
24		23.0		8.2		7.6		1092.0
25		23.4		8.2		7.9		1255.0
26		21.6		8.3		8.2		1229.0
27		23.1		8.1		8.0		1281.0
28		23.6		8.2		7.5		1182.0
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	28	1	28	1	28	1.0	28.0
Min.	22.7	21.2	8.2	7.5	7.2	6.9	1239.0	911.0
Max.	22.7	23.6	8.2	8.5	7.2	8.2	1239.0	1301.0
Mean	22.7	22.5	8.2	8.2	7.2	7.6	1239.0	1178.8
S.D.	#DIV/0!	0.57	#DIV/0!	0.19	#DIV/0!	0.35	#DIV/0!	83.0
N		29		29		29		29.0
Min.		21.2		7.5		6.9		911.0
Max.		23.6		8.5		8.2		1301.0
Mean		22.5		8.2		7.6		1180.9
S.D.		0.56		0.19		0.36		82.3

STATISTICS FOR WATER QUALITY
QC Test: TN-00-745 IT (AT0-746)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.6	22.8	8.1	8.1	7.1	7.7	1229.0	1094.0
2		22.6		8.3		8.0		1247.0
3		22.7		8.3		7.2		917.0
4		22.7		8.1		7.8		1106.0
5		22.7		8.0		8.0		1165.0
6		22.4		8.4		7.9		1176.0
7		22.7		8.1		7.7		1062.0
8		22.5		8.3		7.9		1170.0
9		22.3		8.4		6.8		1177.0
10		22.1		8.5		8.1		1103.0
11		22.1		8.1		8.0		1281.0
12		22.2		8.2		7.7		1257.0
13		21.8		8.1		8.0		1187.0
14		22.5		8.1		7.8		1163.0
15		22.0		8.3		8.1		1243.0
16		22.0		8.4		8.1		1266.0
17		22.7		8.4		7.9		1202.0
18		21.4		8.2		8.2		1229.0
19		21.4		8.3		8.0		1131.0
20		23.0		8.0		4.9		1137.0
21		22.6		8.0		8.3		1082.0
22		22.5		8.2		7.9		1091.0
23		22.2		8.4		8.3		1137.0
24		23.0		8.3		7.8		1094.0
25		23.1		8.1		7.5		1250.0
26		22.1		8.4		8.5		1257.0
27		23.4		8.1		8.0		1294.0
28		23.1		8.4		7.7		1230.0
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	28	1	28	1	28	1.0	28.0
Min.	22.6	21.4	8.1	8.0	7.1	4.9	1229.0	917.0
Max.	22.6	23.4	8.1	8.5	7.1	8.5	1229.0	1294.0
Mean	22.6	22.5	8.1	8.2	7.1	7.8	1229.0	1169.6
S.D.	#DIV/0!	0.49	#DIV/0!	0.15	#DIV/0!	0.66	#DIV/0!	84.3
N		29		29		29		29.0
Min.		21.4		8.0		4.9		917.0
Max.		23.4		8.5		8.5		1294.0
Mean		22.5		8.2		7.8		1171.6
S.D.		0.48		0.15		0.66		83.5

STATISTICS FOR WATER QUALITY
QC Test: TN-00-745 IT (AT0-747)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.7	22.6	8.1	8.1	7.0	7.8	1231.0	1127.0
2		22.7		8.3		7.9		1243.0
3		22.9		8.3		7.1		915.0
4		22.5		8.1		7.7		1087.0
5		23.3		8.1		8.0		1161.0
6		22.3		8.3		8.4		1170.0
7		22.7		8.2		7.7		1092.0
8		23.2		8.3		7.8		1151.0
9		23.0		8.4		6.7		1168.0
10		22.5		8.5		8.3		1089.0
11		22.2		8.1		7.8		1262.0
12		22.2		8.2		7.7		1263.0
13		22.2		8.1		7.8		1189.0
14		23.0		8.2		7.7		1163.0
15		22.5		8.4		8.1		1243.0
16		22.3		8.4		8.2		1259.0
17		22.4		8.5		8.2		1209.0
18		22.1		8.2		8.0		1204.0
19		21.8		8.3		8.1		1121.0
20		23.2		8.2		7.6		1075.0
21		22.9		8.1		8.4		1066.0
22		22.8		8.2		8.2		1094.0
23		22.2		8.4		8.2		1123.0
24		23.3		8.4		7.8		1082.0
25		23.7		8.3		7.8		1248.0
26		22.5		8.4		8.5		1231.0
27		23.2		8.2		8.0		1301.0
28		24.0		8.3		7.5		1173.0
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	28	1	28	1	28	1.0	28.0
Min.	22.7	21.8	8.1	8.1	7.0	6.7	1231.0	915.0
Max.	22.7	24.0	8.1	8.5	7.0	8.5	1231.0	1301.0
Mean	22.7	22.7	8.1	8.3	7.0	7.9	1231.0	1161.0
S.D.	#DIV/0!	0.52	#DIV/0!	0.12	#DIV/0!	0.39	#DIV/0!	83.5
N		29		29		29		29.0
Min.		21.8		8.1		6.7		915.0
Max.		24.0		8.5		8.5		1301.0
Mean		22.7		8.3		7.9		1163.4
S.D.		0.51		0.13		0.41		83.0

STATISTICS FOR WATER QUALITY

QC Test: TN-00-745 IT (AT0-748)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.8	22.4	8.1	7.9	7.1	7.4	1237.0	1155.0
2		22.8		8.3		8.0		1233.0
3		22.7		8.3		7.1		904.0
4		22.7		8.0		7.4		1088.0
5		22.7		8.0		7.6		1156.0
6		22.6		8.2		7.7		1190.0
7		22.4		8.2		8.5		1098.0
8		23.0		8.1		7.5		1160.0
9		22.9		8.3		6.5		1138.0
10		22.3		8.3		7.8		1102.0
11		22.3		8.0		7.5		1255.0
12		22.2		8.2		7.6		1266.0
13		22.3		8.1		7.8		1190.0
14		22.6		8.1		7.5		1160.0
15		22.1		8.2		7.4		1240.0
16		22.0		8.1		7.3		1278.0
17		22.1		8.4		8.3		1200.0
18		21.9		8.1		7.8		1211.0
19		21.7		8.2		7.8		1114.0
20		22.6		8.1		7.4		1083.0
21		22.9		8.2		7.9		1059.0
22		22.7		8.3		8.2		1100.0
23		22.5		8.2		7.7		1122.0
24		22.8		8.3		7.7		1084.0
25		23.3		8.2		7.3		1245.0
26		21.5		8.2		8.3		1228.0
27		23.3		8.2		8.2		1294.0
28		23.7		8.2		8.2		1205.0
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	28	1	28	1	28	1.0	28.0
Min.	22.8	21.5	8.1	7.9	7.1	6.5	1237.0	904.0
Max.	22.8	23.7	8.1	8.4	7.1	8.5	1237.0	1294.0
Mean	22.8	22.5	8.1	8.2	7.1	7.7	1237.0	1162.8
S.D.	#DIV/0!	0.49	#DIV/0!	0.11	#DIV/0!	0.43	#DIV/0!	84.1
N		29		29		29		29.0
Min.		21.5		7.9		6.5		904.0
Max.		23.7		8.4		8.5		1294.0
Mean		22.5		8.2		7.7		1165.3
S.D.		0.48		0.11		0.43		83.7

STATISTICS FOR WATER QUALITY
QC Test: TN-00-745 IT (AT0-749)

	Temperature		pH		DO		Conductivity/Salinity	
	New	Old	New	Old	New	Old	New	Old
1	22.9	22.7	8.0	7.9	6.6	7.4	1226.0	1138.0
2		23.4		8.2		7.6		1227.0
3		22.8		8.2		7.0		873.0
4		22.7		8.1		7.5		1077.0
5		22.7		8.0		7.7		1154.0
6		22.4		8.1		7.7		1194.0
7		22.5		8.1		8.2		1093.0
8		23.6		8.1		7.3		1157.0
9		22.7		8.3		6.5		1122.0
10		22.2		8.4		8.0		1097.0
11		22.8		8.0		7.7		1257.0
12		22.8		8.1		7.4		1250.0
13		22.3		8.1		7.8		1173.0
14		23.0		8.1		7.1		1165.0
15		22.0		8.3		7.9		1244.0
16		22.5		7.7		7.6		1269.0
17		22.2		8.4		8.2		1190.0
18		22.3		8.0		8.2		1210.0
19		21.8		8.2		7.4		1115.0
20		22.5		8.1		7.8		1085.0
21		23.4		8.2		7.9		1021.0
22		23.2		8.3		8.1		1090.0
23		22.7		8.2		7.7		1120.0
24		23.1		8.3		7.5		1078.0
25		23.1		8.2		7.6		1248.0
26		22.2		8.2		8.2		1226.0
27		23.1		8.2		8.3		1291.0
28		23.9		8.2		7.8		1194.0
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
N	1	28	1	28	1	28	1.0	28.0
Min.	22.9	21.8	8.0	7.7	6.6	6.5	1226.0	873.0
Max.	22.9	23.9	8.0	8.4	6.6	8.3	1226.0	1291.0
Mean	22.9	22.7	8.0	8.2	6.6	7.7	1226.0	1155.6
S.D.	#DIV/0!	0.50	#DIV/0!	0.15	#DIV/0!	0.41	#DIV/0!	89.3
N		29		29		29		29.0
Min.		21.8		7.7		6.5		873.0
Max.		23.9		8.4		8.3		1291.0
Mean		22.7		8.1		7.6		1158.1
S.D.		0.49		0.15		0.45		88.7

ATTACHMENT VII

Chain-of-Custody Records

09132000EAE

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. ~~[illegible]~~
Page 1 of ____

807053

Project Name/No. [1] Plum Brook Ordnance Works
Sample Team Members [2] M Weisburg, T. Willard
Profit Center No. [3] 3489210
Project Manager [4] Mike Spengberg
Purchase Order No. [6] call for PO
Required Report Date [11] with tox data

Samples Shipment Date [7] 9/13/00
Lab Destination [8] EA Engineering, Science, + Tech
Lab Contact [9] Wayne McCullock
Project Contact/Phone [12] Maureen McMyler / 865-690-3211
Carrier/Waybill No. [13] 8227805163 59

Bill to: [5] Accounts Receivable
312 Directors Dr
Knoxville, TN 37923

Report to: [10] Maureen McMyler
IT Corp
312 Directors Drive
Knoxville, TN 37923

White: To accompany samples
Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
AD2006-0000	/SW006 PBOW-00-SW-WRWP	9/13/00 - 11:15	1 gallon jug	3 gallon	Ice	Chronic Toxicity - P. Promelas - C. Dubia	FOR LAB USE ONLY	ATO-709
AD2007-0000	/SW007 PBOW-00-SW-WRWP	9/13/00 - 11:00	1 gallon jug	3 gallons	Ice	"		ATO-716
AD2008-0000	PBOW-00-SW-WRWP/ SW008	9/13/00 - 11:45	1 gallon jug	3 gallons	Ice	"		ATO-711
AD2009-0000	PBOW-00-SW-WRWP SW009	9/13/00 - 12:20	1 gallon jug	3 gallons	Ice	"		ATO-712
AD2010-0000	PBOW-00-SW-WRWP SW010	9/13/00 - 12:40	1 gallon jug	3 gallons	Ice	"		ATO-713

Special Instructions: [23] START Testing immediately upon receipt

Possible Hazard Identification: [24]
Non-hazard ☒ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☒ Archive ____ (mos.)

Turnaround Time Required: [26]
Normal ☒ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): Project Specific

1. Relinquished by [28] (Signature/Affiliation)	Date: Time:	1. Received by [28] (Signature/Affiliation) Victoria J Williamson	Date: 9-14-00 Time: 0955
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

*See back of form for special instructions.

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: JT

EA Accession Number: ATO-709

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	2.5	9/14	1025	MW
Is ice present?	---	yes			
pH	6.0-9.0	9.4			
TRC (mg/L)	<0.01	<0.01		1040	MW

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✔)	Date	Time	Initials
Ammonia (preserve aliquot)	--	X			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: IT

EA Accession Number: AB-7ID

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	3.9	9/14	1005	VW
Is ice present?	---	yes			
pH	6.0-9.0	8.3			
TRC (mg/L)	<0.01	<0.01		1040	MR

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✔)	Date	Time	Initials
Ammonia (preserve aliquot)	--	X			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: IT

EA Accession Number: ATO-711

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	1.8	9/14	1030	MW
Is ice present?	---	yes			
pH	6.0-9.0	8.0			
TRC (mg/L)	<0.01	<0.01			

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✓)	Date	Time	Initials
Ammonia (preserve aliquot)	--	X			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: TH

EA Accession Number: ATO-712

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	4.3	7/14	1001	VW
Is ice present?	---	yes			
pH	6.0-9.0	7.7			
TRC (mg/L)	<0.01	<0.01		1040	RD

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✔)	Date	Time	Initials
Ammonia (preserve aliquot)	--	X			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: ~~IT~~ IT

EA Accession Number: ATO-713

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	1.9	9/14	1021	VW
Is ice present?	---	yes			
pH	6.0-9.0	8.0			
TRC (mg/L)	<0.01	<0.01		1040	nn

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✔)	Date	Time	Initials
Ammonia (preserve aliquot)	--	X			

IT CORPORATION
A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 090014EA

Project Number: 807053
Samples Shipment Date: 14 SEP 2000
Project Name: PLUM BROOK ORDNANCE WKS
ab Destination: EA ENGINEERING
Sample Coordinator: Chis Freshour
Lab Contact: Wayne McCulloch
Turnaround Time:
Project Contact: Maureen McMyler
Carrier/Waybill No.: Fed Ex/822780516348

Bill To: Accounts Receivable
312 Directors Drive
Knoxville TN 37923

Report To: Maureen McMyler
312 Directors Drive
Knoxville TN 37923

Special Instructions: 36 HOUR TAT

Possible Hazard Indentification:
Non-hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown [X]

Sample Disposal:
Return to Client [ ] Disposal by Lab [X] Archive (mos.)

1. Relinquished By (Signature/Affiliation) Chris Freshour Date: 9/14/00 Time: 16:00
2. Relinquished By (Signature/Affiliation) Date: Time:
3. Relinquished By (Signature/Affiliation) Date: Time:

1. Received By (Signature/Affiliation) Lynda Hartzell Date: 9/15/00 Time: 1720
2. Received By (Signature/Affiliation) Date: Time:
3. Received By (Signature/Affiliation) Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
AC2006	PBOW-00-PRWP-SW006-AC2006-0000	14 SEP 2000	10:50	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N		
AC2007 (A70-724)	PBOW-00-PRWP-SW007-AC2007-0000	14 SEP 2000	10:20	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N	X	recd. 9/15/00
AC2008	PBOW-00-PRWP-SW008-AC2008-0000	14 SEP 2000	10:00	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N		
AC2009	PBOW-00-PRWP-SW009-AC2009-0000	14 SEP 2000	09:40	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N		
AC2010 (A70-725)	PBOW-00-PRWP-SW010-AC2010-0000	14 SEP 2000	09:18	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N	X	recd. 9/15/00

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: IT

EA Accession Number: ATO-724

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	3.3	9/15/00	1720	LAH MSB
Is ice present?	---	Yes	↓	↓	↓
pH	6.0-9.0	7.7	↓	↓	↓
TRC (mg/L)	<0.01	NA	↓	↓	↓

***If outside acceptable range, contact project manager.**

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✓)	Date	Time	Initials
Ammonia (preserve aliquot)	--	NA			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: IT

EA Accession Number: ATO-725

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	3.1	9/15/00	1720	LAA
Is ice present?	---	YES	↓	↓	↓
pH	6.0-9.0	7.7	↓	↓	↓
TRC (mg/L)	<0.01	NA	↓	↓	↓

***If outside acceptable range, contact project manager.**

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✔)	Date	Time	Initials
Ammonia (preserve aliquot)	--	NA			

IT CORPORATION
A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 090014EA

Project Number: 807053

Samples Shipment Date: 14 SEP 2000

Project Name: PLUM BROOK ORDNANCE WKS

ab Destination: EA ENGINEERING

Sample Coordinator: Chis Freshour

Lab Contact: Wayne McCulloch

Turnaround Time:

Project Contact: Maureen McMyler

Carrier/Waybill No.: Fed Ex/822780516348

Bill To: Accounts Receivable
312 Directors Drive
Knoxville TN 37923

Report To: Maureen McMyler
312 Directors Drive
Knoxville TN 37923

Special Instructions: 36 HOUR TAT

Possible Hazard Indentification:

Non-hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown [X]

1. Relinquished By (Signature/Affiliation) Chris Freshour — Date: 9/14/00 Time: 16:00
2. Relinquished By (Signature/Affiliation) — Date: Time:
3. Relinquished By (Signature/Affiliation) — Date: Time:

Sample Disposal:

Return to Client [ ] Disposal by Lab [X] Archive (mos.)

1. Received By (Signature/Affiliation) — Date: 9/16/00 Time: 1700
2. Received By (Signature/Affiliation) — Date: Time:
3. Received By (Signature/Affiliation) — Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
AC2006	PBOW-00-PRWP-SW006-AC2006-0000	14 SEP 2000	10:50	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N	X	ATO-728
AC2007	PBOW-00-PRWP-SW007-AC2007-0000	14 SEP 2000	10:20	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N		
AC2008	PBOW-00-PRWP-SW008-AC2008-0000	14 SEP 2000	10:00	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N	X	ATO-729
AC2009	PBOW-00-PRWP-SW009-AC2009-0000	14 SEP 2000	09:40	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N	X	ATO-730
AC2010	PBOW-00-PRWP-SW010-AC2010-0000	14 SEP 2000	09:18	1 Gal HDPE	3	None except cool to 4 C	Toxicity in surface water (Weber 1989)	N		

recvd. 9/16/00

EA

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: ~~ATTE~~ LAH IT

EA Accession Number: ATO-728

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	27	9/16	1140	nn
Is ice present?	---	Yes	↓	1140	nn
pH	6.0-9.0	7.7	↓	1140	nn
TRC (mg/L)	<0.01	N/A	↓		

***If outside acceptable range, contact project manager.**

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✔)	Date	Time	Initials
Ammonia (preserve aliquot)	--	N/A			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: J+

EA Accession Number: ATU-729

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	2.2	9/16	1140	nn
Is ice present?	---	Yes	↓	1140	nn
pH	6.0-9.0	7.8	↓	1140	nn
TRC (mg/L)	< 0.01	N/A	↓		

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✓)	Date	Time	Initials
Ammonia (preserve aliquot)	--	NA			

SAMPLE CHECK-IN
FOR GENERAL TESTING

Client: It

EA Accession Number: ATU-730

Parameter	Acceptable Range	Measurement*	Date	Time	Initials
Temperature (°C)	≤4	2.7	9/16	1140	ND
Is ice present?	---	Yes	↓	1140	ND
pH	6.0-9.0	7.8	↓	1140	ND
TRC (mg/L)	<0.01	N/A	↓		

*If outside acceptable range, contact project manager.

OTHER PARAMETERS IF REQUIRED (SEE STUDY PLAN):

Parameter	Acceptable Range	(✓)	Date	Time	Initials
Ammonia (preserve aliquot)	--	N/A			

IT CORPORATION
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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 09001500EA2

Project Number: 807053
Samples Shipment Date: 15 SEP 2000
Project Name: PLUM BROOK ORDNANCE WKS
ab Destination: EA ENGINEERING
Sample Coordinator: Chis Freshour
Lab Contact: Wayne McCulloch
Turnaround Time:
Project Contact: Maureen McMyler
Carrier/Waybill No.: Fed Ex/8217 4420 6918

Bill To: Accounts Receivable
312 Directors Drive
Knoxville TN 37923

Report To: Maureen McMyler
312 Directors Drive
Knoxville TN 37923

Special Instructions:

Possible Hazard Indentification:

Non-hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown [X]

1. Relinquished By (Signature/Affiliation) Chris Freshour Date: 9/15/00 Time: 18:00
2. Relinquished By (Signature/Affiliation) Date: Time:
3. Relinquished By (Signature/Affiliation) Date: Time:

Sample Disposal:

Return to Client [ ] Disposal by Lab [X] Archive (mos.)

1. Received By (Signature/Affiliation) Wayne McCulloch Date: 9/16/00 Time: 1115
2. Received By (Signature/Affiliation) Date: Time: (2.7°C)
3. Received By (Signature/Affiliation) Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
AD1006	PBOW-00-WRWP-SD006-AD1006-0000	13 SEP 2000	18:35	~~8~~ Gal BKT 2x2L	1	None except cool to 4 C	Toxicity in sediment (USEPA 2000)	N	X	ATO-740
AD1007	PBOW-00-WRWP-SD007-AD1007-0000	14 SEP 2000	09:40	~~8~~ Gal BKT	1	None except cool to 4 C	Toxicity in sediment (USEPA 2000)	N	X	ATO-741
AD1008	PBOW-00-WRWP-SD008-AD1008-0000	14 SEP 2000	12:40	~~8~~ Gal BKT	1	None except cool to 4 C	Toxicity in sediment (USEPA 2000)	N	X	ATO-742
AD1009	PBOW-00-WRWP-SD009-AD1009-0000	13 SEP 2000	18:25	~~8~~ Gal BKT	1	None except cool to 4 C	Toxicity in sediment (USEPA 2000)	N	X	ATO-743
AD1010	PBOW-00-WRWP-SD010-AD1010-0000	13 SEP 2000	19:05	~~8~~ Gal BKT	1	None except cool to 4 C	Toxicity in sediment (USEPA 2000)	N	X	ATO-744

IT CORPORATION
A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 090015-EA

Project Number: 807053

Project Name: PLUM BROOK ORDNANCE WKS

Sample Coordinator: Chis Freshour

Turnaround Time:

Samples Shipment Date: 15 SEP 2000

ab Destination: EA ENGINEERING

Lab Contact: Wayne McCulloch

Project Contact: Maureen McMyler

Carrier/Waybill No.: Fed Ex/821744206930

Bill To: Accounts Receivable
312 Directors Drive
Knoxville TN 37923

Report To: Maureen McMyler
312 Directors Drive
Knoxville TN 37923

Special Instructions:

Possible Hazard Indentification:

Non-hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown [X]

1. Relinquished By (Signature/Affiliation) Chris Freshour Date: 9/15/00 Time: 17:00
2. Relinquished By (Signature/Affiliation) Date: Time:
3. Relinquished By (Signature/Affiliation) Date: Time:

Sample Disposal:

Return to Client [ ] Disposal by Lab [X] Archive (mos.)

1. Received By (Signature/Affiliation) Wayne McCulloch Date: 9/16/00 Time: 1115
2. Received By (Signature/Affiliation) Date: Time: (2.7°C)
3. Received By (Signature/Affiliation) Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
AC1001	PBOW-00-PRWP-SD001-AC1001-0000	15 SEP 2000	10:00	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-750
AC1002	PBOW-00-PRWP-SD002-AC1002-0000	15 SEP 2000	10:10	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-751
AC1003	PBOW-00-PRWP-SD003-AC1003-0000	15 SEP 2000	11:30	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-752
AC1004	PBOW-00-PRWP-SD004-AC1004-0000	15 SEP 2000	11:40	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-753
AC1005	PBOW-00-PRWP-SD005-AC1005-0000	15 SEP 2000	11:50	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-754

IT CORPORATION

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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 090015-EA

Sample No	Sample Name	Sample Date	Sample Time	Container		Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
AD0001	PBOW-00-WRWP-SD001-AD0001-0000	15 SEP 2000	09:55	~~2~~ Gal BKT 5gal	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATO-735
AD0002	PBOW-00-WRWP-SD002-AD0002-0000	15 SEP 2000	08:45	~~2~~ Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATO-736
AD0003	PBOW-00-WRWP-SD003-AD0003-0000	15 SEP 2000	09:00	~~2~~ Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATO-737
AD0004	PBOW-00-WRWP-SD004-AD0004-0000	15 SEP 2000	09:15	~~2~~ Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATO-738
AD0005	PBOW-00-WRWP-SD005-AD0005-0000	15 SEP 2000	09:30	~~2~~ Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATO-739
AD1001	PBOW-00-WRWP-SD001-AD1001-0000	14 SEP 2000	14:10	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-744-745
AD1002	PBOW-00-WRWP-SD002-AD1002-0000	14 SEP 2000	15:00	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-745-746
AD1003	PBOW-00-WRWP-SD003-AD1003-0000	14 SEP 2000	13:30	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-746-747
AD1004	PBOW-00-WRWP-SD004-AD1004-0000	14 SEP 2000	10:55	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-747-748
AD1005	PBOW-00-WRWP-SD005-AD1005-0000	14 SEP 2000	11:50	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in sediment (USEPA 2000)	N	X	ATO-748-749

IT CORPORATION
A Member of The IT Group

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No: 090018-EA
Page 1 of 1

Project Number: 807053
Samples Shipment Date: 18 SEP 2000
Project Name: PLUM BROOK ORDNANCE WKS
ab Destination: EA ENGINEERING
Sample Coordinator: Chis Freshour
Lab Contact: Wayne McCulloch
Turnaround Time:
Project Contact: Maureen McMyler
Carrier/Waybill No.: Fed Ex/8217 4420 6907

Bill To: Accounts Receivable
312 Directors Drive
Knoxville TN 37923

Report To: Maureen McMyler
312 Directors Drive
Knoxville TN 37923

Special Instructions: 2 WEEK TAT

Possible Hazard Indentification:
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal:
Return to Client ☐ Disposal by Lab ☒ Archive (mos.)

1. Relinquished By (Signature/Affiliation) Chris Fuchs	Date: 9/18/00 Time: 17:00	1. Received By (Signature/Affiliation) Lynda Hatzell	Date: 9/19/00 Time: 1330
2. Relinquished By (Signature/Affiliation)	Date: Time:	2. Received By (Signature/Affiliation)	Date: Time: (5.3°C)
3. Relinquished By (Signature/Affiliation)	Date: Time:	3. Received By (Signature/Affiliation)	Date: Time:

Comments:

Sample No	Sample Name	Sample Date	Sample Time	Container	Ctr Qty	Preservative	Requested Testing Program	Fil	CID	Condition On Receipt
AC0001	PBOW-00-SS-PRWP-SO001-AC0001-0000	15 SEP 2000	15:00	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATD-758
AC0002	PBOW-00-SS-PRWP-SO002-AC0002-0000	15 SEP 2000	15:10	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATD-759
AC0003	PBOW-00-SS-PRWP-SO003-AC0003-0000	15 SEP 2000	15:20	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATD-760
AC0004	PBOW-00-SS-PRWP-SO004-AC0004-0000	15 SEP 2000	15:30	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATD-761
AC0005	PBOW-00-SS-PRWP-SO005-AC0005-0000	15 SEP 2000	15:40	3 Gal BKT	1	None except cool to 4 C	Bioaccumulation in soil (Linder 1992)	N	X	ATD-762

ATTACHMENT VIII

Report Quality Assurance Record

REPORT QUALITY ASSURANCE RECORD

Client: IT Corporation

EA Report Number: 3535

Project Number: 70003.10

Type Analysis: toxicity + bioaccumulatio

Author: L. Hartzell

Test Organisms: C. dubia, P. promelas, H. azteca, E. foetida, L. variegatus

REPORT CHECKLIST

QA/QC ITEM	REVIEWER	DATE
1. Samples collected, transported, and received according to study plan requirements.	Lynda Hartzell	1/17/01
2. Samples prepared and processed according to study plan requirements.	Lynda Hartzell	1/17/01
3. Data collected using calibrated equipment.	Lynda Hartzell	1/17/01
4. Calculations checked:		
- Hand calculations checked	Lynda Hartzell	1/17/01
- Documented and verified statistical procedure used.	Lynda Hartzell	1/17/01
5. Data input/statistical analyses complete and correct.	Richard A. Connelly	1/24/01
6. Reported results and facts checked against original sources.	Richard A. Connelly	1/24/01
7. Data presented in figures and tables correct and in agreement with text.	Richard A. Connelly	1/24/01
8. Results reviewed for compliance with study plan requirements.	Wayne McCulloch	1/21/01

	AUTHOR	DATE
9. Commentary reviewed and resolved.	Lynda Hartzell	1/25/01

10. All study plan and quality assurance/control requirements have been met and the report is approved:

Wayne McCulloch — PROJECT MANAGER — 25 January 2001 DATE

Richard A. Connelly — QUALITY CONTROL OFFICER — 1/24/01 DATE

[illegible] — SENIOR TECHNICAL REVIEWER — 1/25/01 DATE

ATS-Q8
03/01/00

APPENDIX F

SITE-SPECIFIC BIOACCUMULATION FACTOR CALCULATION DETAILS

Table F- 1

Calculation of Bioconcentration Factors for Bioaccumulation of PAH Constituents in Earthworm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)		Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)		Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
Naphthalene	ND 98		NA	ND 49		NA	NA
	ND 84		NA	ND 51		NA	NA
	ND 92		NA	ND 51		NA	NA
	ND 90		NA	ND 51		NA	NA
	ND 80		NA	ND 53		NA	NA
	Final Average Bioconcentration Factor						**NA**
Acenaphthylene	740	B	49	ND 49		24.5	2.0
	240	B	42	ND 51		25.5	1.6
	370	B	46	ND 51		25.5	1.8
	290	B	45	ND 51		25.5	1.8
	740	B	40	ND 53		26.5	1.5
	Final Average Bioconcentration Factor						**1.7**
Acenaphthene	ND 200		NA	ND 99		NA	NA
	380	B	85	ND 100		50	1.7
	840	B	85	ND 100		50	1.7
	380	B	85	ND 100		50	1.7
	360	B	85	ND 100		50	1.7
	Final Average Bioconcentration Factor						**1.7**
Fluorene	18	B	10	ND 9.9		4.95	2.0
	19	B	8.5	6	J	6	1.4
	47	B	9	7.4	J	7.4	1.2
	37	B	9	6.9	J	6.9	1.3
	32	B	8	ND 10		5	1.6
	Final Average Bioconcentration Factor						**1.5**
Phenanthrene	99	B	3.35	32		32	0.1
	32	B	3.35	33		33	0.1
	17	B	3.35	40		40	0.1
	16	B	3.35	40		40	0.1
	48	B	3.35	32		32	0.1
	Final Average Bioconcentration Factor						**0.1**
Anthracene	ND 3.9		1.95	3.6		3.6	0.54
	ND 3.4		NA	ND 2		NA	NA
	ND 3.7		NA	ND 2		NA	NA
	ND 3.6		NA	ND 2		NA	NA
	ND 3.2		1.6	1	J	1	1.6
	Final Average Bioconcentration Factor						**1.07**

Table F- 1

Calculation of Bioconcentration Factors for Bioaccumulation of PAH Constituents in Earthworm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
Fluoranthene	ND 9.8	4.9	76	76	0.06
	ND 8.4	4.2	17	17	0.25
	ND 9.2	4.6	21	21	0.22
	ND 9	4.5	13	13	0.35
	ND 8	4	26	26	0.15
	Final Average Bioconcentration Factor				**0.21**
Pyrene	ND 20	10	55	55	0.18
	ND 17	8.5	120	120	0.07
	ND 18	9	15	15	0.60
	ND 18	9	9 J	9	1.00
	ND 16	8	20	20	0.40
	Final Average Bioconcentration Factor				**0.45**
Benzo(a)anthracene	ND 9.8	4.9	25	25	0.20
	ND 8.4	4.2	49 J	49	0.09
	ND 9.2	4.6	5.9	5.9	0.78
	ND 9	4.5	3.6 J	3.6	1.25
	ND 8	4	6.6	6.6	0.61
	Final Average Bioconcentration Factor				**0.58**
Chrysene	ND 9.8	4.9	26	26	0.19
	ND 8.4	4.2	6.7	6.7	0.63
	ND 9.2	4.6	8.2	8.2	0.56
	ND 9	4.5	4.7 J	4.7	0.96
	ND 8	4	9.2	9.2	0.43
	Final Average Bioconcentration Factor				**0.55**
Benzo(b)fluoranthene	ND 3.9	1.95	33	33	0.06
	ND 3.4	1.7	6	6	0.28
	ND 3.7	1.85	9.5	9.5	0.19
	ND 3.6	1.8	4.8	4.8	0.38
	ND 3.2	1.6	9.9	9.9	0.16
	Final Average Bioconcentration Factor				**0.21**
Benzo(k)fluoranthene	ND 3.9	1.95	19	19	0.10
	ND 3.4	1.7	3.3	3.3	0.52
	ND 3.7	1.85	3.9	3.9	0.47
	ND 3.6	1.8	2.6	2.6	0.69
	ND 3.2	1.6	2.9	2.9	0.55
	Final Average Bioconcentration Factor				**0.47**

Table F- 1

Calculation of Bioconcentration Factors for Bioaccumulation of PAH Constituents in Earthworm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
Benzo(a)pyrene	ND 9.8	4.9	39	39	0.13
	ND 8.4	4.2	7.4	7.4	0.57
	ND 9.2	4.6	9.9	9.9	0.46
	ND 9	4.5	5.5	5.5	0.82
	ND 8	4	12	12	0.33
	Final Average Bioconcentration Factor				**0.46**
Dibenz(a,h)anthracene	ND 39	19.5	22	22	0.89
	ND 34	NA	ND 20	NA	NA
	ND 37	18.5	9.5 J	9.5	1.95
	ND 36	NA	ND 20	NA	NA
	ND 32	NA	ND 21	NA	NA
	Final Average Bioconcentration Factor				**1.42**
Benzo(g,h,I)perylene	ND 16	8	16	16	0.50
	ND 13	NA	ND 8.2	NA	NA
	ND 15	NA	ND 8.2	NA	NA
	ND 14	NA	ND 8.2	NA	NA
	ND 13	NA	ND 8.5	NA	NA
	Final Average Bioconcentration Factor				**0.50**
Indeno(1,2,3-cd)pyrene	8 B	4.9	29	29	0.17
	ND 8.4	4.2	6.8	6.8	0.62
	ND 9.2	4.6	8.3	8.3	0.55
	ND 9	4.5	4.6 J	4.6	0.98
	4.4 B	4	8.6	8.6	0.47
	Final Average Bioconcentration Factor				**0.56**

Table F- 2

Calculation of Bioconcentration Factors for Bioaccumulation of PAH Constituents in Earthworm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)		Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)		Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
Naphthalene	ND 98		NA	ND 49		NA	NA
	ND 84		NA	ND 51		NA	NA
	ND 92		NA	ND 51		NA	NA
	ND 90		NA	ND 51		NA	NA
	ND 80		NA	ND 53		NA	NA
	Final Average Bioconcentration Factor						**NA**
Acenaphthylene	740	B	370	ND 49		24.5	15.1
	240	B	120	ND 51		25.5	4.7
	370	B	185	ND 51		25.5	7.3
	290	B	145	ND 51		25.5	5.7
	740	B	370	ND 53		26.5	14.0
	Final Average Bioconcentration Factor						**9.3**
Acenaphthene	ND 200		NA	ND 99		NA	NA
	380	B	190	ND 100		50	3.8
	840	B	420	ND 100		50	8.4
	380	B	190	ND 100		50	3.8
	360	B	180	ND 100		50	3.6
	Final Average Bioconcentration Factor						**4.9**
Fluorene	18	B	9	ND 9.9		4.95	1.8
	19	B	9.5	6	J	6	1.6
	47	B	23.5	7.4	J	7.4	3.2
	37	B	18.5	6.9	J	6.9	2.7
	32	B	16	ND 10		5	3.2
	Final Average Bioconcentration Factor						**2.5**
Phenanthrene	99	B	49.5	32		32	1.5
	32	B	16	33		33	0.5
	17	B	8.5	40		40	0.2
	16	B	8	40		40	0.2
	48	B	24	32		32	0.8
	Final Average Bioconcentration Factor						**0.6**
Anthracene	ND 3.9		1.95	3.6		3.6	0.54
	ND 3.4		NA	ND 2		NA	NA
	ND 3.7		NA	ND 2		NA	NA
	ND 3.6		NA	ND 2		NA	NA
	ND 3.2		1.6	1	J	1	1.6
	Final Average Bioconcentration Factor						**1.07**

Table F- 2

Calculation of Bioconcentration Factors for Bioaccumulation of PAH Constituents in Earthworm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue	Earthworm Tissue Concentration Utilized	Analytical Result for Soil	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
Fluoranthene	ND 9.8	4.9	76	76	0.06
	ND 8.4	4.2	17	17	0.25
	ND 9.2	4.6	21	21	0.22
	ND 9	4.5	13	13	0.35
	ND 8	4	26	26	0.15
	Final Average Bioconcentration Factor				**0.21**
Pyrene	ND 20	10	55	55	0.18
	ND 17	8.5	120	120	0.07
	ND 18	9	15	15	0.60
	ND 18	9	9 J	9	1.00
	ND 16	8	20	20	0.40
	Final Average Bioconcentration Factor				**0.45**
Benzo(a)anthracene	ND 9.8	4.9	25	25	0.20
	ND 8.4	4.2	49 J	49	0.09
	ND 9.2	4.6	5.9	5.9	0.78
	ND 9	4.5	3.6 J	3.6	1.25
	ND 8	4	6.6	6.6	0.61
	Final Average Bioconcentration Factor				**0.58**
Chrysene	ND 9.8	4.9	26	26	0.19
	ND 8.4	4.2	6.7	6.7	0.63
	ND 9.2	4.6	8.2	8.2	0.56
	ND 9	4.5	4.7 J	4.7	0.96
	ND 8	4	9.2	9.2	0.43
	Final Average Bioconcentration Factor				**0.55**
Benzo(b)fluoranthene	ND 3.9	1.95	33	33	0.06
	ND 3.4	1.7	6	6	0.28
	ND 3.7	1.85	9.5	9.5	0.19
	ND 3.6	1.8	4.8	4.8	0.38
	ND 3.2	1.6	9.9	9.9	0.16
	Final Average Bioconcentration Factor				**0.21**
Benzo(k)fluoranthene	ND 3.9	1.95	19	19	0.10
	ND 3.4	1.7	3.3	3.3	0.52
	ND 3.7	1.85	3.9	3.9	0.47
	ND 3.6	1.8	2.6	2.6	0.69
	ND 3.2	1.6	2.9	2.9	0.55
	Final Average Bioconcentration Factor				**0.47**

Table F- 2

Calculation of Bioconcentration Factors for Bioaccumulation of PAH Constituents in Earthworm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue	Earthworm Tissue Concentration Utilized	Analytical Result for Soil	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
Benzo(a)pyrene	ND 9.8	4.9	39	39	0.13
	ND 8.4	4.2	7.4	7.4	0.57
	ND 9.2	4.6	9.9	9.9	0.46
	ND 9	4.5	5.5	5.5	0.82
	ND 8	4	12	12	0.33
	Final Average Bioconcentration Factor				**0.46**
Dibenz(a,h)anthracene	ND 39	19.5	22	22	0.89
	ND 34	NA	ND 20	NA	NA
	ND 37	18.5	9.5 J	9.5	1.95
	ND 36	NA	ND 20	NA	NA
	ND 32	NA	ND 21	NA	NA
	Final Average Bioconcentration Factor				**1.42**
Benzo(g,h,I)perylene	ND 16	8	16	16	0.50
	ND 13	NA	ND 8.2	NA	NA
	ND 15	NA	ND 8.2	NA	NA
	ND 14	NA	ND 8.2	NA	NA
	ND 13	NA	ND 8.5	NA	NA
	Final Average Bioconcentration Factor				**0.50**
Indeno(1,2,3-cd)pyrene	8 B	4	29	29	0.14
	ND 8.4	4.2	6.8	6.8	0.62
	ND 9.2	4.6	8.3	8.3	0.55
	ND 9	4.6	4.6 J	4.6	1.00
	4.4 B	2.2	8.6	8.6	0.26
	Final Average Bioconcentration Factor				**0.51**

Table F- 3

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
HMX	ND 480	NA	ND 250	NA	NA
	ND 530	NA	ND 250	NA	NA
	ND 500	NA	ND 250	NA	NA
	ND 500	NA	ND 250	NA	NA
	ND 480	NA	ND 250	NA	NA
	Final Average Bioconcentration Factor				**NA**
RDX	ND 480	NA	ND 100	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3,5-Trinitrobenzene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3-Dinitrobenzene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
Nitrobenzene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
Tetryl	ND 710	NA	ND 200	NA	NA
	ND 790	NA	ND 200	NA	NA
	ND 750	NA	ND 200	NA	NA
	ND 750	NA	ND 200	NA	NA
	ND 710	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 3

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
4-Amino-2,6-DNT	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Amino-4,6-DNT	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4,6-Trinitrotoluene	ND 480	NA	ND 100	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,6-Dinitrotoluene	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4-Dinitrotoluene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Nitrotoluene	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 3

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue Central Tendency West Area PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
3-Nitrotoluene	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Nitrotoluene	ND 480	NA	ND 500	NA	NA
	ND 530	NA	ND 500	NA	NA
	ND 500	NA	ND 500	NA	NA
	ND 500	NA	ND 500	NA	NA
	ND 480	NA	ND 500	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 4

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
HMX	ND 480	NA	ND 250	NA	NA
	ND 530	NA	ND 250	NA	NA
	ND 500	NA	ND 250	NA	NA
	ND 500	NA	ND 250	NA	NA
	ND 480	NA	ND 250	NA	NA
	Final Average Bioconcentration Factor				**NA**
RDX	ND 480	NA	ND 100	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3,5-Trinitrobenzene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3-Dinitrobenzene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
Nitrobenzene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
Tetryl	ND 710	NA	ND 200	NA	NA
	ND 790	NA	ND 200	NA	NA
	ND 750	NA	ND 200	NA	NA
	ND 750	NA	ND 200	NA	NA
	ND 710	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 4

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
4-Amino-2,6-DNT	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Amino-4,6-DNT	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4,6-Trinitrotoluene	ND 480	NA	ND 100	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,6-Dinitrotoluene	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4-Dinitrotoluene	ND 240	NA	ND 100	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Nitrotoluene	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 4

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
3-Nitrotoluene	ND 480	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Nitrotoluene	ND 480	NA	ND 500	NA	NA
	ND 530	NA	ND 500	NA	NA
	ND 500	NA	ND 500	NA	NA
	ND 500	NA	ND 500	NA	NA
	ND 480	NA	ND 500	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 5

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Central Tendency
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
HMX	ND 500	NA	ND 250	NA	NA
	Final Average Bioconcentration Factor				**NA**
RDX	ND 500	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3,5-Trinitrobenzene	ND 250	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3-Dinitrobenzene	ND 250	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
Nitrobenzene	ND 250	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
Tetryl	ND 750	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Amino-2,6-DNT	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Amino-4,6-DNT	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4,6-Trinitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,6-Dinitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4-Dinitrotoluene	ND 250	125	1200	1200	0.10
	Final Average Bioconcentration Factor				**0.1**
2-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
3-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Nitrotoluene	ND 500	NA	ND 500	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 6

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Earthworm Tissue
Reasonable Maximum Exposure
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Earthworm Tissue (ug/kg)	Earthworm Tissue Concentration Utilized	Analytical Result for Soil (ug/kg)	Soil Concentration Utilized	Calculated Earthworm Bioconcentration Factor
HMX	ND 500	NA	ND 250	NA	NA
	Final Average Bioconcentration Factor				**NA**
RDX	ND 500	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3,5-Trinitrobenzene	ND 250	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3-Dinitrobenzene	ND 250	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
Nitrobenzene	ND 250	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
Tetryl	ND 750	NA	ND 99	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Amino-2,6-DNT	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Amino-4,6-DNT	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4,6-Trinitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,6-Dinitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4-Dinitrotoluene	ND 250	125	1200	1200	0.10
	Final Average Bioconcentration Factor				**0.1**
2-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
3-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Nitrotoluene	ND 500	NA	ND 500	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 7

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Aquatic Worm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (ug/kg)	Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (ug/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
HMX	ND 500	NA	ND 240	NA	NA
	ND 530	NA	ND 250	NA	NA
	ND 500	NA	ND 250	NA	NA
	ND 480	NA	ND 250	NA	NA
	ND 480	NA	ND 240	NA	NA
	Final Average Bioconcentration Factor				**NA**
RDX	ND 500	NA	ND 98	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	ND 480	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3,5-Trinitrobenzene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3-Dinitrobenzene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
Nitrobenzene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
Tetryl	ND 750	NA	ND 200	NA	NA
	ND 790	NA	ND 200	NA	NA
	ND 750	NA	ND 200	NA	NA
	ND 710	NA	ND 200	NA	NA
	ND 710	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 7

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Aquatic Worm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (ug/kg)	Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (ug/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
4-Amino-2,6-DNT	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Amino-4,6-DNT	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4,6-Trinitrotoluene	ND 500	NA	ND 98	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	ND 480	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,6-Dinitrotoluene	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4-Dinitrotoluene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 7

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Aquatic Worm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (ug/kg)	Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (ug/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
3-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Nitrotoluene	ND 500	NA	ND 490	NA	NA
	ND 530	NA	ND 500	NA	NA
	ND 500	NA	ND 500	NA	NA
	ND 480	NA	ND 500	NA	NA
	ND 480	NA	ND 490	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 8

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Aquatic Worm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (ug/kg)	Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (ug/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
HMX	ND 500	NA	ND 240	NA	NA
	ND 530	NA	ND 250	NA	NA
	ND 500	NA	ND 250	NA	NA
	ND 480	NA	ND 250	NA	NA
	ND 480	NA	ND 240	NA	NA
	Final Average Bioconcentration Factor				**NA**
RDX	ND 500	NA	ND 98	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	ND 480	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3,5-Trinitrobenzene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
1,3-Dinitrobenzene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
Nitrobenzene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
Tetryl	ND 750	NA	ND 200	NA	NA
	ND 790	NA	ND 200	NA	NA
	ND 750	NA	ND 200	NA	NA
	ND 710	NA	ND 200	NA	NA
	ND 710	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 8

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Aquatic Worm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (ug/kg)	Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (ug/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
4-Amino-2,6-DNT	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Amino-4,6-DNT	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4,6-Trinitrotoluene	ND 500	NA	ND 98	NA	NA
	ND 530	NA	ND 100	NA	NA
	ND 500	NA	ND 100	NA	NA
	ND 480	NA	ND 100	NA	NA
	ND 480	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,6-Dinitrotoluene	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
2,4-Dinitrotoluene	ND 250	NA	ND 98	NA	NA
	ND 260	NA	ND 100	NA	NA
	ND 250	NA	ND 100	NA	NA
	ND 240	NA	ND 100	NA	NA
	ND 240	NA	ND 98	NA	NA
	Final Average Bioconcentration Factor				**NA**
2-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 8

Calculation of Bioconcentration Factors for Bioaccumulation of Nitroaromatic Constituents in Aquatic Worm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (ug/kg)	Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (ug/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
3-Nitrotoluene	ND 500	NA	ND 200	NA	NA
	ND 530	NA	ND 200	NA	NA
	ND 500	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	ND 480	NA	ND 200	NA	NA
	Final Average Bioconcentration Factor				**NA**
4-Nitrotoluene	ND 500	NA	ND 490	NA	NA
	ND 530	NA	ND 500	NA	NA
	ND 500	NA	ND 500	NA	NA
	ND 480	NA	ND 500	NA	NA
	ND 480	NA	ND 490	NA	NA
	Final Average Bioconcentration Factor				**NA**

Table F- 9

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Aquatic Worm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (mg/kg)		Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (mg/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
Aluminum	70.1		70.1	9150	9150	0.0077
	25.5		25.5	8690	8690	0.0029
	17.6	J	17.6	17600	17600	0.0010
	47.8		47.8	10600	10600	0.0045
	17.1	J	17.1	12300	12300	0.0014
	Final Average Bioconcentration Factor					**0.0035**
Antimony	ND 0.25		NA	ND 0.76	NA	NA
	ND 0.25		NA	ND 0.70	NA	NA
	ND 0.25		NA	ND 0.85	NA	NA
	ND 0.25		NA	ND 0.69	NA	NA
	ND 0.25		NA	ND 0.84	NA	NA
	Final Average Bioconcentration Factor					**NA**
Arsenic	2	B	0.14	5.1	5.1	0.03
	1.5	B	0.14	3.6	3.6	0.04
	2	B	0.14	7.7	7.7	0.02
	2.9	B	0.14	4.3	4.3	0.03
	2.1	B	0.14	4.9	4.9	0.03
	Final Average Bioconcentration Factor					**0.03**
Barium	58.9	B	0.025	83.9	83.9	0.00030
	65.8	B	0.025	46	46	0.00054
	69.1	B	0.025	126	126	0.00020
	72.8	B	0.025	94.4	94.4	0.00026
	50	B	0.025	102	102	0.00025
	Final Average Bioconcentration Factor					**0.00031**
Cadmium	0.05	B	NA	NA	NA	NA
	0.04	B	NA	NA	NA	NA
	0.06	B	NA	NA	NA	NA
	0.05	B	NA	NA	NA	NA
	ND 0.04		NA	NA	NA	NA
	Final Average Bioconcentration Factor					**NA**
Calcium	236	B	2.15	3220	3220	0.001
	170	B	2.15	2710	2710	0.001
	182	B	2.15	2890	2890	0.001
	205	B	2.15	2880	2880	0.001
	215	B	2.15	3570	3570	0.001
	Final Average Bioconcentration Factor					**0.001**

Table F- 9

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Aquatic Worm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue		Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment		Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
Chromium	0.33	B	0.065	12.9		12.9	0.005
	0.27	B	0.065	11.7		11.7	0.006
	0.28	B	0.065	22.3		22.3	0.003
	0.26	B	0.065	13.9		13.9	0.005
	0.13	B	0.065	16.5		16.5	0.004
	Final Average Bioconcentration Factor						**0.004**
Cobalt	0.28	B	0.025	8.9		8.9	0.003
	0.21	B	0.025	6.4		6.4	0.004
	0.18	B	0.025	11.3		11.3	0.002
	0.31	B	0.025	13.1		13.1	0.002
	0.38	B	0.025	15.2		15.2	0.002
	Final Average Bioconcentration Factor						**0.002**
Copper	3	B	0.23	12.5		12.5	0.02
	4.5	B	0.23	9.2		9.2	0.03
	2.9	B	0.23	18.3		18.3	0.01
	3.2	B	0.23	15.5		15.5	0.01
	3.7	B	0.23	17.6		17.6	0.01
	Final Average Bioconcentration Factor						**0.02**
Iron	824	B	0.95	18000		18000	0.000053
	445	B	1	14100		14100	0.000071
	534	B	0.95	29300		29300	0.000032
	694	B	0.95	17600		17600	0.000054
	346	B	0.95	20900		20900	0.000045
	Final Average Bioconcentration Factor						**0.000051**
Lead	0.88	J	0.88	25	J	25	0.035
	0.31	J	0.31	14.1	J	14.1	0.022
	0.56	J	0.56	23.4	J	23.4	0.024
	0.43	J	0.43	14.7	J	14.7	0.029
	0.25	J	0.25	19.8	J	19.8	0.013
	Final Average Bioconcentration Factor						**0.025**
Magnesium	214	B	0.6	2630		2630	0.00023
	168	B	0.6	2390		2390	0.00025
	171	B	0.6	3880		3880	0.00015
	189	B	0.6	2900		2900	0.00021
	149	B	0.6	3460		3460	0.00017
	Final Average Bioconcentration Factor						**0.00020**

Table F- 9

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Aquatic Worm Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue		Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment		Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
Manganese	5.4	B	0.015	301		301	0.000050
	2.4	B	0.015	142		142	0.000106
	3.3	B	0.015	371		371	0.000040
	4	B	0.015	321		321	0.000047
	2.3	B	0.015	347		347	0.000043
	Final Average Bioconcentration Factor						**0.000057**
Nickel	0.37	J	0.37	16.7	J	16.7	0.022
	0.45	J	0.45	12.3	J	12.3	0.037
	0.27	J	0.27	29	J	29	0.009
	0.27	J	0.27	23.6	J	23.6	0.011
	0.29	J	0.29	23.6	J	23.6	0.012
	Final Average Bioconcentration Factor						**0.018**
Potassium	1170	B	1.8	1070	B	6.35	0.28
	1300	B	1.8	937	B	5.8	0.31
	1230	B	1.8	2420	J	2420	0.0007
	1350	B	1.8	1490	B	5.7	0.32
	821	B	1.8	1880	J	1880	0.0010
	Final Average Bioconcentration Factor						**0.1823**
Sodium	624	B	121.5	549		549	0.22
	689	B	122	268		268	0.46
	658	B	121.5	488		488	0.25
	753	B	121.5	420		420	0.29
	353	B	121.5	426		426	0.29
	Final Average Bioconcentration Factor						**0.30**
Vanadium	0.33	B	0.015	20.2	B	0.145	0.103
	0.04	B	0.015	18	B	0.135	0.1111
	0.17	B	0.015	36.5	B	0.16	0.0938
	0.15	B	0.015	20.5	B	0.13	0.1154
	ND 0.03		0.015	24.8	B	0.16	0.0938
	Final Average Bioconcentration Factor						**0.1035**
Zinc	28.5	B	0.225	56.8		56.8	0.0040
	33.9	B	0.225	47.2		47.2	0.0048
	31	B	0.225	94.8		94.8	0.0024
	35	B	0.225	77.6		77.6	0.0029
	24.5	B	0.225	77.2		77.2	0.0029
	Final Average Bioconcentration Factor						**0.0034**

Table F-10

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Aquatic Worm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (mg/kg)		Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (mg/kg)	Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
Aluminum	70.1		70.1	9150	9150	0.0077
	25.5		25.5	8690	8690	0.0029
	17.6	J	17.6	17600	17600	0.0010
	47.8		47.8	10600	10600	0.0045
	17.1	J	17.1	12300	12300	0.0014
	Final Average Bioconcentration Factor					**0.0035**
Antimony	ND 0.25		NA	ND 0.76	NA	NA
	ND 0.25		NA	ND 0.70	NA	NA
	ND 0.25		NA	ND 0.85	NA	NA
	ND 0.25		NA	ND 0.69	NA	NA
	ND 0.25		NA	ND 0.84	NA	NA
	Final Average Bioconcentration Factor					**NA**
Arsenic	2	B	1	5.1	5.1	0.20
	1.5	B	0.75	3.6	3.6	0.21
	2	B	1	7.7	7.7	0.13
	2.9	B	1.45	4.3	4.3	0.34
	2.1	B	1.05	4.9	4.9	0.21
	Final Average Bioconcentration Factor					**0.22**
Barium	58.9	B	29.45	83.9	83.9	0.35
	65.8	B	32.9	46	46	0.72
	69.1	B	34.55	126	126	0.27
	72.8	B	36.4	94.4	94.4	0.39
	50	B	25	102	102	0.25
	Final Average Bioconcentration Factor					**0.39**
Cadmium	0.05	B	NA	NA	NA	NA
	0.04	B	NA	NA	NA	NA
	0.06	B	NA	NA	NA	NA
	0.05	B	NA	NA	NA	NA
	ND 0.04		NA	NA	NA	NA
	Final Average Bioconcentration Factor					**NA**
Calcium	236	B	118	3220	3220	0.037
	170	B	85	2710	2710	0.031
	182	B	91	2890	2890	0.031
	205	B	102.5	2880	2880	0.036
	215	B	107.5	3570	3570	0.030
	Final Average Bioconcentration Factor					**0.033**

Table F-10

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Aquatic Worm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (mg/kg)		Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (mg/kg)		Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
Chromium	0.33	B	0.165	12.9		12.9	0.013
	0.27	B	0.135	11.7		11.7	0.012
	0.28	B	0.14	22.3		22.3	0.006
	0.26	B	0.13	13.9		13.9	0.009
	0.13	B	0.065	16.5		16.5	0.004
	Final Average Bioconcentration Factor						**0.009**
Cobalt	0.28	B	0.14	8.9		8.9	0.016
	0.21	B	0.105	6.4		6.4	0.016
	0.18	B	0.09	11.3		11.3	0.008
	0.31	B	0.155	13.1		13.1	0.012
	0.38	B	0.19	15.2		15.2	0.013
	Final Average Bioconcentration Factor						**0.013**
Copper	3	B	1.5	12.5		12.5	0.12
	4.5	B	2.25	9.2		9.2	0.24
	2.9	B	1.45	18.3		18.3	0.08
	3.2	B	1.6	15.5		15.5	0.10
	3.7	B	1.85	17.6		17.6	0.11
	Final Average Bioconcentration Factor						**0.13**
Iron	824	B	412	18000		18000	0.023
	445	B	222.5	14100		14100	0.016
	534	B	267	29300		29300	0.009
	694	B	347	17600		17600	0.020
	346	B	173	20900		20900	0.008
	Final Average Bioconcentration Factor						**0.015**
Lead	0.88	J	0.88	25	J	25	0.035
	0.31	J	0.31	14.1	J	14.1	0.022
	0.56	J	0.56	23.4	J	23.4	0.024
	0.43	J	0.43	14.7	J	14.7	0.029
	0.25	J	0.25	19.8	J	19.8	0.013
	Final Average Bioconcentration Factor						**0.025**
Magnesium	214	B	107	2630		2630	0.041
	168	B	84	2390		2390	0.035
	171	B	85.5	3880		3880	0.022
	189	B	94.5	2900		2900	0.033
	149	B	74.5	3460		3460	0.022
	Final Average Bioconcentration Factor						**0.030**
Manganese	5.4	B	2.7	301		301	0.009
	2.4	B	1.2	142		142	0.008
	3.3	B	1.65	371		371	0.004
	4	B	2	321		321	0.006
	2.3	B	1.15	347		347	0.003
	Final Average Bioconcentration Factor						**0.006**

Table F-10

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Aquatic Worm Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Aquatic Worm Tissue (mg/kg)		Aquatic Worm Tissue Concentration Utilized	Analytical Result for Sediment (mg/kg)		Sediment Concentration Utilized	Calculated Aquatic Worm Bioconcentration Factor
Nickel	0.37	J	0.37	16.7	J	16.7	0.022
	0.45	J	0.45	12.3	J	12.3	0.037
	0.27	J	0.27	29	J	29	0.009
	0.27	J	0.27	23.6	J	23.6	0.011
	0.29	J	0.29	23.6	J	23.6	0.012
	Final Average Bioconcentration Factor						**0.018**
Potassium	1170	B	585	1070	B	6.35	92.13
	1300	B	650	937	B	5.8	112.07
	1230	B	615	2420	J	2420	0.25
	1350	B	675	1490	B	5.7	118.42
	821	B	410.5	1880	J	1880	0.22
	Final Average Bioconcentration Factor						**64.62**
Sodium	624	B	312	549		549	0.57
	689	B	344.5	268		268	1.29
	658	B	329	488		488	0.67
	753	B	376.5	420		420	0.90
	353	B	176.5	426		426	0.41
	Final Average Bioconcentration Factor						**0.77**
Vanadium	0.33	B	0.165	20.2	B	0.145	1.138
	0.04	B	0.02	18	B	0.135	0.1481
	0.17	B	0.085	36.5	B	0.16	0.5313
	0.15	B	0.075	20.5	B	0.13	0.5769
	ND 0.03		0.015	24.8	B	0.16	0.0938
	Final Average Bioconcentration Factor						**0.4976**
Zinc	28.5	B	14.25	56.8		56.8	0.25
	33.9	B	16.95	47.2		47.2	0.36
	31	B	15.5	94.8		94.8	0.16
	35	B	17.5	77.6		77.6	0.23
	24.5	B	12.25	77.2		77.2	0.16
	Final Average Bioconcentration Factor						**0.23**

Table F- 11

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	**Analytical Result for Fish Tissue** (mg/kg)		**Fish Tissue Concentration Utilized** (ppm)	**Analytical Result for Surface Water** (ppm)	**Surface Water Concentration Utilized** (ppm)	**Calculated Fish Bioconcentration Factor** (ppm)
Aluminum	106	J	106	0.286	0.286	30
	25	J	25	0.888	0.888	7.1
	11.8	J	11.8	0.313	0.313	3.4
	61.9	J	61.9	13.5	13.5	17.6
				2.61	2.61	
	Average Surface Water Concentration				**3.52**	
	Final Average Bioconcentration Factor					**15**
Antimony	0.09	B	0.035	ND 0.0055	0.00275	12.7
	0.09	B	0.035	ND 0.0055	0.00275	12.7
	0.1	B	0.035	ND 0.0055	0.00275	12.7
	0.14	B	0.035	ND 0.0055	0.00275	12.7
				ND 0.0055	0.00275	
	Average Surface Water Concentration				**0.0028**	
	Final Average Bioconcentration Factor					**13**
Arsenic	ND 0.53		0.265	0.0096	0.0096	39.8
	ND 0.53		0.265	0.0072	0.0072	39.8
	ND 0.53		0.265	0.0072	0.0072	39.8
	ND 0.53		0.265	0.0071	0.0071	39.8
				ND 0.0044	0.0022	
	Average Surface Water Concentration				**0.0067**	
	Final Average Bioconcentration Factor					**40**
Barium	10.1	J	10.1	0.0183	0.0183	203
	1.2	J	1.2	0.022	0.022	24.1
	ND 0.59		0.295	0.0204	0.0204	5.9
	5.7	J	5.7	0.131	0.131	115
				0.0571	0.0571	
	Average Surface Water Concentration				**0.050**	
	Final Average Bioconcentration Factor					**87**
Calcium	9160		9160	15.4	15.4	323
	12200		12200	18.8	18.8	431
	5900		5900	16	16	208
	6980		6980	21.8	21.8	246
				69.6	69.6	
	Average Surface Water Concentration				**28.3**	
	Final Average Bioconcentration Factor					**302**

Table F- 11

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fish Tissue (mg/kg)		Fish Tissue Concentration Utilized (ppm)	Analytical Result for Surface Water (ppm)		Surface Water Concentration Utilized (ppm)	Calculated Fish Bioconcentration Factor (ppm)
Chromium	0.21	J	0.21	ND 0.0008		0.0004	49
	0.12	J	0.12	0.0025	B	0.0004	28
	ND 0.1		0.05	0.0012	B	0.0004	12
	0.11	J	0.11	0.0198		0.0198	25.7
				0.0033	B	0.0004	
	Average Surface Water Concentration					**0.0043**	
	Final Average Bioconcentration Factor						**29**
Cobalt	ND 0.38		NA	ND .0011		0.00055	NA
	ND 0.38		0.19	0.0016		0.0016	40
	ND 0.38		NA	ND 0.0011		0.00055	NA
	ND 0.38		0.19	0.0187		0.0187	40.4
				0.0021		0.0021	
	Average Surface Water Concentration					**0.0047**	
	Final Average Bioconcentration Factor						**40**
Copper	2		2	0.003		0.003	286
	ND 0.42		0.21	0.0029		0.0029	30.0
	ND 0.42		0.21	0.0014		0.0014	30
	0.44	J	0.44	0.0205		0.0205	62.9
				0.0072		0.0072	
	Average Surface Water Concentration					**0.007**	
	Final Average Bioconcentration Factor						**102**
Iron	234	J	234	0.331		0.331	38
	37.6	J	37.6	1.06		1.06	6.1
	20.8	J	20.8	0.284		0.284	3.4
	144	J	144	26		26	23.5
				2.98		2.98	
	Average Surface Water Concentration					**6.13**	
	Final Average Bioconcentration Factor						**18**
Lead	0.52	B	0.11	ND 0.0026		0.0013	23.4
	ND 0.22		NA	ND 0.0026		0.0013	NA
	0.29	B	0.11	ND 0.0026		0.0013	23.4
	0.39	B	0.11	0.0168		0.0168	23.4
				0.0028		0.0028	
	Average Surface Water Concentration					**0.0047**	
	Final Average Bioconcentration Factor						**23**

Table F- 11

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fish Tissue (mg/kg)	Fish Tissue Concentration Utilized (ppm)	Analytical Result for Surface Water (ppm)	Surface Water Concentration Utilized (ppm)	Calculated Fish Bioconcentration Factor (ppm)
Magnesium	456	456	29.7	29.7	17.3
	411	411	43.6	43.6	15.587
	277	277	34	34	10.505
	377	377	9.04	9.04	14.3
			15.5	15.5	
	Average Surface Water Concentration			**26.4**	
			Final Average Bioconcentration Factor		**14**
Manganese	14.7	14.7	0.0913	0.0913	21
	6	6	0.265	0.265	8.4
	4 J	4	0.13	0.13	5.6
	11	11	2.96	2.96	15.49
			0.104	0.104	
	Average Surface Water Concentration			**0.71**	
			Final Average Bioconcentration Factor		**13**
Nickel	ND 0.29	0.145	0.0021	0.0021	14.8
	ND 0.29	0.145	0.0032	0.0032	14.8
	ND 0.29	0.145	0.0021	0.0021	14.8
	ND 0.29	0.145	0.0327	0.0327	14.80
			0.0089	0.0089	
	Average Surface Water Concentration			**0.0098**	
			Final Average Bioconcentration Factor		**15**
Potassium	2460	2460	0.878 B	0.0456	622
	2800	2800	1.81	1.81	708
	2600	2600	0.726 B	0.0456	658
	2380	2380	12.8	12.8	602
			5.06	5.06	
	Average Surface Water Concentration			**3.95**	
			Final Average Bioconcentration Factor		**648**
Sodium	749 J	749	56	56	16.7
	1030	1030	63.2	63.2	22.9
	1020	1020	58.4	58.4	22.7
	681 J	681	27.1	27.1	15.1
			20.1	20.1	
	Average Surface Water Concentration			**45.0**	
			Final Average Bioconcentration Factor		**19**
Vanadium	0.44 J	0.44	0.0075 B	0.00105	419
	ND 0.28	0.14	0.0097 B	0.00105	133
	ND 0.28	0.14	0.0079 B	0.00105	133
	ND 0.28	0.14	0.0327 B	0.00105	133
			0.0076 B	0.00105	
	Average Surface Water Concentration			**0.0011**	
			Final Average Bioconcentration Factor		**205**
Zinc	46.9	46.9	0.014	0.014	1056
	13.1 J	13.1	0.0113	0.0113	295
	21.3 J	21.3	0.0319	0.0319	480

Table F- 11

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Central Tendency
West Area
PBOW Sandusky, Ohio

Constituent	**Analytical Result for Fish Tissue** (mg/kg)	**Fish Tissue Concentration Utilized** (ppm)	**Analytical Result for Surface Water** (ppm)	**Surface Water Concentration Utilized** (ppm)	**Calculated Fish Bioconcentration Factor** (ppm)
	36.3	36.3	0.145	0.145	817
			0.0199	0.0199	
	Average Surface Water Concentration			**0.044**	
	Final Average Bioconcentration Factor				**662**

Table F- 12

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fish Tissue (mg/kg)		Fish Tissue Concentration Utilized (ppm)	Analytical Result for Surface Water (ppm)	Surface Water Concentration Utilized (ppm)	Calculated Fish Bioconcentration Factor (ppm)
Aluminum	106	J	106	0.286	0.286	30
	25	J	25	0.888	0.888	7.1
	11.8	J	11.8	0.313	0.313	3.4
	61.9	J	61.9	13.5	13.5	17.59
				2.61	2.61	
	Average Surface Water Concentration				**3.52**	
	Final Average Bioconcentration Factor					**15**
Antimony	0.09	B	0.045	ND 0.0055	0.00275	16.4
	0.09	B	0.045	ND 0.0055	0.00275	16.4
	0.1	B	0.05	ND 0.0055	0.00275	18.2
	0.14	B	0.07	ND 0.0055	0.00275	25.5
				ND 0.0055	0.00275	
	Average Surface Water Concentration				**0.0028**	
	Final Average Bioconcentration Factor					**18**
Arsenic	ND 0.53		0.265	0.0096	0.0096	39.9
	ND 0.53		0.265	0.0072	0.0072	39.9
	ND 0.53		0.265	0.0071	0.0071	39.9
	ND 0.53		0.265	0.0071	0.0071	39.9
				ND 0.0044	0.0022	
	Average Surface Water Concentration				**0.0066**	
	Final Average Bioconcentration Factor					**40**
Barium	10.1	J	10.1	0.0183	0.0183	203
	1.2	J	1.2	0.022	0.022	24.1
	ND 0.59		0.295	0.0204	0.0204	5.9
	5.7	J	5.7	0.131	0.131	114.5
				0.0571	0.0571	
	Average Surface Water Concentration				**0.050**	
	Final Average Bioconcentration Factor					**87**
Calcium	9160		9160	15.4	15.4	323
	12200		12200	18.8	18.8	431
	5900		5900	16	16	208
	6980		6980	21.8	21.8	246
				69.6	69.6	
	Average Surface Water Concentration				**28.3**	
	Final Average Bioconcentration Factor					**302**

Table F- 12

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fish Tissue (mg/kg)	Fish Tissue Concentration Utilized (ppm)	Analytical Result for Surface Water (ppm)	Surface Water Concentration Utilized (ppm)	Calculated Fish Bioconcentration Factor (ppm)
Chromium	0.21 J	0.21	ND 0.0008	0.0004	49
	0.12 J	0.12	0.0025 B	0.0004	28.0
	ND 0.1	0.05	0.0012 B	0.0004	11.7
	0.11 J	0.11	0.0198	0.0198	25.70
			0.0033 B	0.0004	
	Average Surface Water Concentration			**0.0043**	
	Final Average Bioconcentration Factor				**29**
Cobalt	ND 0.38	NA	ND .0011	0.00055	NA
	ND 0.38	0.19	0.0016	0.0016	40
	ND 0.38	NA	ND 0.0011	0.00055	NA
	ND 0.38	0.19	0.0187	0.0187	40.4
			0.0021	0.0021	
	Average Surface Water Concentration			**0.0047**	
	Final Average Bioconcentration Factor				**40**
Copper	2	2	0.003	0.003	286
	ND 0.42	0.21	0.0029	0.0029	30.0
	ND 0.42	0.21	0.0014	0.0014	30
	0.44 J	0.44	0.0205	0.0205	62.9
			0.0072	0.0072	
	Average Surface Water Concentration			**0.007**	
	Final Average Bioconcentration Factor				**102**
Iron	234 J	234	0.331	0.331	38
	37.6 J	37.6	1.06	1.06	6.1
	20.8 J	20.8	0.284	0.284	3.4
	144 J	144	26	26	23.49
			2.98	2.98	
	Average Surface Water Concentration			**6.13**	
	Final Average Bioconcentration Factor				**18**
Lead	0.52 B	0.26	ND 0.0026	0.0013	55
	ND 0.22	NA	ND 0.0026	0.0013	NA
	0.29 B	0.145	ND 0.0026	0.0013	31
	0.39 B	0.195	0.0168	0.0168	41.5
			0.0028	0.0028	
	Average Surface Water Concentration			**0.0047**	
	Final Average Bioconcentration Factor				**43**

Table F- 12

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fish Tissue (mg/kg)	Fish Tissue Concentration Utilized (ppm)	Analytical Result for Surface Water (ppm)	Surface Water Concentration Utilized (ppm)	Calculated Fish Bioconcentration Factor (ppm)
Magnesium	456	456	29.7	29.7	17.3
	411	411	43.6	43.6	15.59
	277	277	34	34	10.51
	377	377	9.04	9.04	14.3
			15.5	15.5	
	Average Surface Water Concentration			**26.4**	
			Final Average Bioconcentration Factor		**14**
Manganese	14.7	14.7	0.0913	0.0913	21
	6	6	0.265	0.265	8.4
	4 J	4	0.13	0.13	5.6
	11	11	2.96	2.96	15.49
			0.104	0.104	
	Average Surface Water Concentration			**0.71**	
			Final Average Bioconcentration Factor		**13**
Nickel	ND 0.29	0.145	0.0021	0.0021	14.8
	ND 0.29	0.145	0.0032	0.0032	14.8
	ND 0.29	0.145	0.0021	0.0021	14.8
	ND 0.29	0.145	0.0327	0.0327	14.80
			0.0089	0.0089	
	Average Surface Water Concentration			**0.0098**	
			Final Average Bioconcentration Factor		**15**
Potassium	2460	2460	0.878 B	0.0456	622
	2800	2800	1.81	1.81	708
	2600	2600	0.726 B	0.0456	658
	2380	2380	12.8	12.8	602
			5.06	5.06	
	Average Surface Water Concentration			**3.95**	
			Final Average Bioconcentration Factor		**648**
Sodium	749 J	749	56	56	16.7
	1030	1030	63.2	63.2	22.9
	1020	1020	58.4	58.4	22.7
	681 J	681	27.1	27.1	15.1
			20.1	20.1	
	Average Surface Water Concentration			**45.0**	
			Final Average Bioconcentration Factor		**19**
Vanadium	0.44 J	0.44	0.0075 B	0.00105	419.0
	ND 0.28	0.14	0.0097 B	0.00105	133.3
	ND 0.28	0.14	0.0079 B	0.00105	133.3
	ND 0.28	0.14	0.0327 B	0.00105	133.33
			0.0076 B	0.00105	
	Average Surface Water Concentration			**0.0011**	
			Final Average Bioconcentration Factor		**205**
Zinc	46.9	46.9	0.014	0.014	1056
	13.1 J	13.1	0.0113	0.0113	295
	21.3 J	21.3	0.0319	0.0319	480
	36.3	36.3	0.145	0.145	817
			0.0199	0.0199	
	Average Surface Water Concentration			**0.044**	

Table F- 12

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fish Tissue
Reasonable Maximum Exposure
West Area
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fish Tissue (mg/kg)	Fish Tissue Concentration Utilized (ppm)	Analytical Result for Surface Water (ppm)	Surface Water Concentration Utilized (ppm)	Calculated Fish Bioconcentration Factor (ppm)
	Final Average Bioconcentration Factor				662

Table F- 13

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fathead Tissue
Central Tendency
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fatheads Tissue (mg/kg)		Fatheads Tissue Concentration Utilized (ppm)	Average Analytical Result for Surface Water (ppb)	Average Surface Water Concentration Utilized (ppb)	Calculated Fish Bioconcentration Factor
Aluminum	148	J	148	188.14	188.14	786.65
					Final Average Bioconcentration Factor	**786.65**
Antimony	0.16	B	0.0345	2.75	2.75	12.55
					Final Average Bioconcentration Factor	**12.55**
Arsenic	ND 0.53		0.265	2.2	2.2	120.45
					Final Average Bioconcentration Factor	**120.45**
Barium	5.9	J	5.9	83.26	83.26	70.86
					Final Average Bioconcentration Factor	**70.86**
Calcium	8310		8310	114600	114600	72.51
					Final Average Bioconcentration Factor	**72.51**
Chromium	0.72	J	0.72	1.12	1.12	642.86
					Final Average Bioconcentration Factor	**642.86**
Cobalt	ND 0.38		0.19	0.55	0.55	345.45
					Final Average Bioconcentration Factor	**345.45**
Copper	0.43	J	0.43	2.69	2.69	159.85
					Final Average Bioconcentration Factor	**159.85**
Iron	422	J	422	536.8	536.8	786.14
					Final Average Bioconcentration Factor	**786.14**
Lead	0.36	B	0.11	1.3	1.3	84.62
					Final Average Bioconcentration Factor	**84.62**
Magnesium	541		541	26460	26460	20.45
					Final Average Bioconcentration Factor	**20.45**
Manganese	16.3		16.3	121.2	121.2	134.49
					Final Average Bioconcentration Factor	**134.49**
Nickel	0.58	J	0.58	0.8	0.8	725.00
					Final Average Bioconcentration Factor	**725.00**
Phosphorous	124	J	124	74.6	74.6	1662.20
					Final Average Bioconcentration Factor	**1662.20**
Potassium	2440		2440	2072	2072	1177.61
					Final Average Bioconcentration Factor	**1177.61**
Sodium	727	J	727	9638	9638	75.43
					Final Average Bioconcentration Factor	**75.43**
Vanadium	0.58	J	0.58	1.05	1.05	552.38
					Final Average Bioconcentration Factor	**552.38**
Zinc	27.3		27.3	13.66	13.66	1998.54
					Final Average Bioconcentration Factor	**1998.54**

Table F- 14

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Fathead Fish Tissue
Reasonable Maximum Exposure
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Fatheads Tissue (mg/kg)		Fatheads Tissue Concentration Utilized (ppm)	Average Analytical Result for Surface Water (ppb)	Average Surface Water Concentration Utilized (ppb)	Calculated Fish Bioconcentration Factor
Aluminum	148	J	148	188.14	188.14	786.65
					Final Average Bioconcentration Factor	**786.65**
Antimony	0.16	B	0.08	2.75	2.75	29.09
					Final Average Bioconcentration Factor	**29.09**
Arsenic	ND 0.53		0.265	2.2	2.2	120.45
					Final Average Bioconcentration Factor	**120.45**
Barium	5.9	J	5.9	83.26	83.26	70.86
					Final Average Bioconcentration Factor	**70.86**
Calcium	8310		8310	114600	114600	72.51
					Final Average Bioconcentration Factor	**72.51**
Chromium	0.72	J	0.72	1.12	1.12	642.86
					Final Average Bioconcentration Factor	**642.86**
Cobalt	ND 0.38		0.19	0.55	0.55	345.45
					Final Average Bioconcentration Factor	**345.45**
Copper	0.43	J	0.43	2.69	2.69	159.85
					Final Average Bioconcentration Factor	**159.85**
Iron	422	J	422	536.8	536.8	786.14
					Final Average Bioconcentration Factor	**786.14**
Lead	0.36	B	0.18	1.3	1.3	138.46
					Final Average Bioconcentration Factor	**138.46**
Magnesium	541		541	26460	26460	20.45
					Final Average Bioconcentration Factor	**20.45**
Manganese	16.3		16.3	121.2	121.2	134.49
					Final Average Bioconcentration Factor	**134.49**
Nickel	0.58	J	0.58	0.8	0.8	725.00
					Final Average Bioconcentration Factor	**725.00**
Phosphorous	124	J	124	74.6	74.6	1662.20
					Final Average Bioconcentration Factor	**1662.20**
Potassium	2440		2440	2072	2072	1177.61
					Final Average Bioconcentration Factor	**1177.61**
Sodium	727	J	727	9638	9638	75.43
					Final Average Bioconcentration Factor	**75.43**
Vanadium	0.58	J	0.58	1.05	1.05	552.38
					Final Average Bioconcentration Factor	**552.38**
Zinc	27.3		27.3	13.66	13.66	1998.54
					Final Average Bioconcentration Factor	**1998.54**

Table F- 15

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Tadpole Tissue
Central Tendency
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Tadpoles Tissue (mg/kg)		Tadpoles Tissue Concentration Utilized (ppm)	Average Analytical Result for Surface Water (ppb)	Average Surface Water Concentration Utilized (ppb)	Calculated Fish Bioconcentration Factor
Aluminum	541	J	541	188.14	188.14	2875.52
					Final Average Bioconcentration Factor	**2875.52**
Antimony	0.13	B	0.035	2.75	2.75	12.73
					Final Average Bioconcentration Factor	**12.73**
Arsenic	1.5	J	1.5	2.2	2.2	681.82
					Final Average Bioconcentration Factor	**681.82**
Barium	24		24	83.26	83.26	288.25
					Final Average Bioconcentration Factor	**288.25**
Calcium	9670		9670	114600	114600	84.38
					Final Average Bioconcentration Factor	**84.38**
Chromium	1.2		1.2	1.12	1.12	1071.43
					Final Average Bioconcentration Factor	**1071.43**
Cobalt	1	B	0.19	0.55	0.55	345.45
					Final Average Bioconcentration Factor	**345.45**
Copper	1.7		1.7	2.69	2.69	631.97
					Final Average Bioconcentration Factor	**631.97**
Iron	2900	J	2900	536.8	536.8	5402.38
					Final Average Bioconcentration Factor	**5402.38**
Lead	1.4	B	0.11	1.3	1.3	84.62
					Final Average Bioconcentration Factor	**84.62**
Magnesium	1360		1360	26460	26460	51.40
					Final Average Bioconcentration Factor	**51.40**
Manganese	68.8		68.8	121.2	121.2	567.66
					Final Average Bioconcentration Factor	**567.66**
Nickel	2.2		2.2	0.8	0.8	2750.00
					Final Average Bioconcentration Factor	**2750.00**
Phosphorous	162	J	162	74.6	74.6	2171.58
					Final Average Bioconcentration Factor	**2171.58**
Potassium	1840		1840	2072	2072	888.03
					Final Average Bioconcentration Factor	**888.03**
Sodium	1140		1140	9638	9638	118.28
					Final Average Bioconcentration Factor	**118.28**
Vanadium	1.2	J	1.2	1.05	1.05	1142.86
					Final Average Bioconcentration Factor	**1142.86**
Zinc	26		26	13.66	13.66	1903.37
					Final Average Bioconcentration Factor	**1903.37**

Table F- 16

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Tadpole Tissue
Reasonable Maximum Exposure
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Tadpoles Tissue (mg/kg)		Tadpoles Tissue Concentration Utilized (ppm)	Average Analytical Result for Surface Water (ppb)	Average Surface Water Concentration Utilized (ppb)	Calculated Fish Bioconcentration Factor
Aluminum	541	J	541	188.14	188.14	2875.52
					Final Average Bioconcentration Factor	**2875.52**
Antimony	0.13	B	0.065	2.75	2.75	23.64
					Final Average Bioconcentration Factor	**23.64**
Arsenic	1.5	J	1.5	2.2	2.2	681.82
					Final Average Bioconcentration Factor	**681.82**
Barium	24		24	83.26	83.26	288.25
					Final Average Bioconcentration Factor	**288.25**
Calcium	9670		9670	114600	114600	84.38
					Final Average Bioconcentration Factor	**84.38**
Chromium	1.2		1.2	1.12	1.12	1071.43
					Final Average Bioconcentration Factor	**1071.43**
Cobalt	1	B	0.5	0.55	0.55	909.09
					Final Average Bioconcentration Factor	**909.09**
Copper	1.7		1.7	2.69	2.69	631.97
					Final Average Bioconcentration Factor	**631.97**
Iron	2900	J	2900	536.8	536.8	5402.38
					Final Average Bioconcentration Factor	**5402.38**
Lead	1.4	B	0.7	1.3	1.3	538.46
					Final Average Bioconcentration Factor	**538.46**
Magnesium	1360		1360	26460	26460	51.40
					Final Average Bioconcentration Factor	**51.40**
Manganese	68.8		68.8	121.2	121.2	567.66
					Final Average Bioconcentration Factor	**567.66**
Nickel	2.2		2.2	0.8	0.8	2750.00
					Final Average Bioconcentration Factor	**2750.00**
Phosphorous	162	J	162	74.6	74.6	2171.58
					Final Average Bioconcentration Factor	**2171.58**
Potassium	1840		1840	2072	2072	888.03
					Final Average Bioconcentration Factor	**888.03**
Sodium	1140		1140	9638	9638	118.28
					Final Average Bioconcentration Factor	**118.28**
Vanadium	1.2	J	1.2	1.05	1.05	1142.86
					Final Average Bioconcentration Factor	**1142.86**
Zinc	26		26	13.66	13.66	1903.37
					Final Average Bioconcentration Factor	**1903.37**

Table F- 17

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Crayfish Tissue
Central Tendency
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Crayfish Tissue (mg/kg)		Crayfish Tissue Concentration Utilized (ppm)	Average Analytical Result for Surface Water (ppb)	Average Surface Water Concentration Utilized (ppb)	Calculated Fish Bioconcentration Factor
Aluminum	183	J	183	188.14	188.14	972.68
					Final Average Bioconcentration Factor	**972.68**
Antimony	0.08	B	0.035	2.75	2.75	12.73
					Final Average Bioconcentration Factor	**12.73**
Arsenic	ND 0.53		0.265	2.2	2.2	120.45
					Final Average Bioconcentration Factor	**120.45**
Barium	21.3		21.3	83.26	83.26	255.83
					Final Average Bioconcentration Factor	**255.83**
Calcium	23200		23200	114600	114600	202.44
					Final Average Bioconcentration Factor	**202.44**
Chromium	0.56	J	0.56	1.12	1.12	500.00
					Final Average Bioconcentration Factor	**500.00**
Cobalt	ND 0.38		0.19	0.55	0.55	345.45
					Final Average Bioconcentration Factor	**345.45**
Copper	16.6		16.6	2.69	2.69	6171.00
					Final Average Bioconcentration Factor	**6171.00**
Iron	696	J	696	536.8	536.8	1296.57
					Final Average Bioconcentration Factor	**1296.57**
Lead	0.55	B	0.11	1.3	1.3	84.62
					Final Average Bioconcentration Factor	**84.62**
Magnesium	642		642	26460	26460	24.26
					Final Average Bioconcentration Factor	**24.26**
Manganese	89.7		89.7	121.2	121.2	740.10
					Final Average Bioconcentration Factor	**740.10**
Nickel	0.66	J	0.66	0.8	0.8	825.00
					Final Average Bioconcentration Factor	**825.00**
Phosphorous	173	J	173	74.6	74.6	2319.03
					Final Average Bioconcentration Factor	**2319.03**
Potassium	2120		2120	2072	2072	1023.17
					Final Average Bioconcentration Factor	**1023.17**
Sodium	1620		1620	9638	9638	168.08
					Final Average Bioconcentration Factor	**168.08**
Vanadium	0.38	J	0.38	1.05	1.05	361.90
					Final Average Bioconcentration Factor	**361.90**
Zinc	19.3	J	19.3	13.66	13.66	1412.88
					Final Average Bioconcentration Factor	**1412.88**

Table F-18

Calculation of Bioconcentration Factors for Bioaccumulation of Metal Constituents in Crayfish Tissue
Reasonable Maximum Exposure
Pentolite Road
PBOW Sandusky, Ohio

Constituent	Analytical Result for Crayfish Tissue (mg/kg)		Crayfish Tissue Concentration Utilized (ppm)	Average Analytical Result for Surface Water (ppb)	Average Surface Water Concentration Utilized (ppb)	Calculated Fish Bioconcentration Factor
Aluminum	183	J	183	188.14	188.14	972.68
					Final Average Bioconcentration Factor	**972.68**
Antimony	0.08	B	0.04	2.75	2.75	14.55
					Final Average Bioconcentration Factor	**14.55**
Arsenic	ND 0.53		0.265	2.2	2.2	120.45
					Final Average Bioconcentration Factor	**120.45**
Barium	21.3		21.3	83.26	83.26	255.83
					Final Average Bioconcentration Factor	**255.83**
Calcium	23200		23200	114600	114600	202.44
					Final Average Bioconcentration Factor	**202.44**
Chromium	0.56	J	0.56	1.12	1.12	500.00
					Final Average Bioconcentration Factor	**500.00**
Cobalt	ND 0.38		0.19	0.55	0.55	345.45
					Final Average Bioconcentration Factor	**345.45**
Copper	16.6		16.6	2.69	2.69	6171.00
					Final Average Bioconcentration Factor	**6171.00**
Iron	696	J	696	536.8	536.8	1296.57
					Final Average Bioconcentration Factor	**1296.57**
Lead	0.55	B	0.275	1.3	1.3	211.54
					Final Average Bioconcentration Factor	**211.54**
Magnesium	642		642	26460	26460	24.26
					Final Average Bioconcentration Factor	**24.26**
Manganese	89.7		89.7	121.2	121.2	740.10
					Final Average Bioconcentration Factor	**740.10**
Nickel	0.66	J	0.66	0.8	0.8	825.00
					Final Average Bioconcentration Factor	**825.00**
Phosphorous	173	J	173	74.6	74.6	2319.03
					Final Average Bioconcentration Factor	**2319.03**
Potassium	2120		2120	2072	2072	1023.17
					Final Average Bioconcentration Factor	**1023.17**
Sodium	1620		1620	9638	9638	168.08
					Final Average Bioconcentration Factor	**168.08**
Vanadium	0.38	J	0.38	1.05	1.05	361.90
					Final Average Bioconcentration Factor	**361.90**
Zinc	19.3	J	19.3	13.66	13.66	1412.88
					Final Average Bioconcentration Factor	**1412.88**

APPENDIX G

APPLICATION OF ESSENTIAL NUTRIENTS IN ECOLOGICAL RISK ASSESSMENT

G.1.0 Introduction

All forms of living matter require inorganic elements, or minerals, for their normal life processes. All animal tissues and feeds contain inorganic or mineral elements in widely varying amounts and proportions. Minerals that are needed in relatively large amounts are referred to as major or macrominerals; those that are needed in very small amounts are referred to as trace minerals or microminerals. These terms represent quantity designations of the amounts required in an animal's diet and their generally low or trace concentrations in tissues. The major minerals are required in concentrations of greater than 100 parts per million (ppm) and are often reported as a percentage of diet, while trace elements are required at less than 100 ppm and are sometimes reported at the ppb level. Table G-1 presents twenty-four elements known to be required by at least some animal species (McDowell, 1992).

Table G-1
General Macro and Microminerals

Major or Macrominerals	Trace or Microminerals		
Calcium (Ca)	Arsenic (As)*	Iodine (I)	Nickel (Ni)*
Chlorine (Cl)	Boron (B)*	Iron (Fe)	Selenium (Se)
Magnesium (Mg)	Chromium (Cr)	Lead (Pb)*	Silicon (Si)*
Phosphorus (P)	Cobalt (Co)	Lithium (Li)*	Tin (Sn)*
Potassium (K)	Copper (Cu)	Manganese (Mn)	Vanadium (V)*
Sodium (Na)	Fluorine (F)	Molybdenum (Mo)	Zinc (Zn)
Sulfur (S)			

* These elements have not been shown to be essential for livestock or humans consuming typical diets.

The listing of some of the trace elements as essential (e.g., lead, arsenic, tin, vanadium, lithium, and fluorine) is difficult and sometimes tentative, and rests on experiments with only one or more species. In these experiments, diets adequate in all nutrients except the mineral in question produced clinical signs that were prevented or overcome by adding that mineral to the diets (pages 352, 352, 376, 377, 371, and 336 in McDowell [1992], respectively, for Pb, As, Sn, V, Li, and F).

Unlike other nutrients mineral elements cannot be synthesized by living organisms. Minerals act as (1) structural components of body organs and tissues, (2) constituents of body fluids and tissues as electrolytes, and (3) catalysts in enzyme and hormone systems. The most obvious function of mineral elements in the body is to provide structural support (skeleton) for the body. Ca, P, Mg, F, and Si in bones and teeth all contribute to mechanical stability. Birds use Ca to

produce egg shells, and P and S are found in muscle proteins. Minerals are interrelated and balanced against each other, and most often cannot be considered as single elements with independent and self-sufficient roles in the organized bodily processes. The definite relationship of Ca and P in the formation of bones and teeth and the interrelationships of Fe, Cu, and Co (in vitamin B_{12}) in hemoglobin synthesis and red blood cell formation are examples. Sodium, K, Ca, P, and Cl serve individually and collectively in the body fluids. A number of trace elements (i.e., Cu, Zn, Fe, and Se) in addition to certain vitamins (i.e., A, D, E, B_6, and folacin) and other nutrients, are strongly related to adequate immune response (McDowell, 1992).

G.2.0 Mineral Requirements

A series of "safe" dietary levels of potentially toxic elements has been established on the extent to which other elements that affect their absorption and retention are present (McDowell, 1992). Table G-2 presents some of these "safe" dietary levels or mineral requirements for selected species.

Table G-2
Mineral Requirements for Selected Species

Species	Mineral (mg/kg of feed)									
	Ca	**Mg**	**K**	**Na**	**Cu**	**Fe**	**Mn**	**P**	**Se**	**Zn**
Japanese Quail	25,000	500	4,000	1,500	6	100	70	5,000	0.2	50
Rat	5,000	400	3,600	500	5	35	50	4,000	0.10	0.25
Mouse	4,000	500	2000	---	4.5	25	44	4,000	---	30
Cat	8,000	400	4,000	500	5	80	5	6,000	0.1	50
Mink	6,000	440	3,000	---	6	80	44	5,500	0.1	66

To determine whether concentrations of these minerals in the environment exceed safe dietary levels, the mineral requirements were converted to dietary doses using the following equation:

$$\text{Dose (mg/kg-day)} = \text{Diet (mg/kg)} \times \text{FI (kg/day)} \times 1/\text{BW (kg)}$$

where:

Diet (mg/kg) = Mineral requirement for each nutrient;
FI (kg/day) = Food ingestion rate; and
BW (kg/day) = Body weight.

Variables for the species are shown in Table G-3.

Table G-3
Food Ingestion and Body Weights

Species	Food Ingestion (FI) (kg/day)	Body Weight (Kg)
Japanese Quail	0.017 derived from FI(kg/day) = 0.0582*BW(kg)$^{0.651}$ [b]	0.15[a]
Rat	0.08[a]	0.35[a]
Mouse	0.0055[a]	0.03[a]
Cat	0.24 derived from FI(kg/day)=0.0687*BW(kg)$^{0.822}$ [b]	4.5 derived from 10lbs*0.4535923 conversion factor.[c]
Mink	0.137[a]	1.0[a]

a - ORNL, 1996.
b - USEPA, 1993.
c - IT, 1999.

Table G-4 presents the mineral requirements calculated as dietary doses for selected species presented in Table G-3.

Table G-4
Mineral Requirements as a Dietary Dose for Selected Species

Species	Mineral Dose (mg/kg-day)									
	Ca	Mg	K	Na	Cu	Fe	Mn	P	Se	Zn
Japanese Quail	2,833	56.7	453	170	0.7	11.3	7.9	567	0.02	5.7
Rat	1,143	91.4	823	114	1.1	8	11.4	914	0.02	0.06
Mouse	733	92	367	---	0.8	4.6	8.1	733	---	5.5
Cat	427	21	213	26.7	0.3	4.3	0.3	320	0.01	2.7
Mink	822	60	411	---	0.8	11	6	753	0.01	9

G.3.0 Maximum Tolerance Levels

Information concerning the toxicity or tolerance of minerals is incomplete. According to available information, the toxic level of most major minerals is about 10 times the recommended level for young, growing livestock. The toxic levels of trace minerals appear to be highly variable, ranging between 10 and 1,500 times the recommended level. The National Research Council (NRC) publishes maximum tolerance levels for domestic animals. The maximum tolerance level is defined as that dietary level that, when fed for a limited period, will not impair animal performance and should not produce unsafe residues in human food derived from animals. The levels listed in Table G-5 were derived from toxicity data on the designated species. Tolerance levels vary with the species, adaptation, duration of receiving the toxicants, age, physical condition of the animal, and many other factors (McDowell, 1992).

Table G-5
Maximum Tolerance Levels for Domestic Animals

Species	Maximum Tolerance Levels of Dietary Minerals (ppm)									
	Ca[a]	Mg	K	Na (as NaCl)	Cu	Fe	Mn	P	Se	Zn
Poultry	40,000[b] 12,000[c]	(3,000)	(20,000)	20,000	300	1,000	2,000	8,000	20,000	1,000
Rabbits	20,000	(3,000)	(30,000)	(30,000)	200	(500)	(400)	10,000	(20,000)	(500)

Source: McDowell, 1992.

The levels in parentheses were derived by interspecific species extrapolation.

a - Ratio of calcium to phosphorus is important.
b - Laying hen.
c - Other poultry.

Using the same procedure described in Section 2.0, the maximum tolerance levels are converted into dietary doses to determine whether concentrations of these minerals in the environment exceed safe dietary levels. Variables for the domestic animals are shown in Table G-6.

Table G-6
Food Ingestion and Body Weights for Domestic Animals

Species	Food Ingestion (FI) (kg/day)	Body Weight (Kg)
Poultry	0.08 derived from FI(kg/day) = 0.0582*BW(kg)$^{0.651}$ [a]	1.6 (mean weight of male and female chicken) [b]
Rabbits	0.2 derived from FI(kg/day)=0.0687*BW(kg)$^{0.822}$ [a]	3.8 [b]

a - USEPA, 1993.
b - ORNL, 1996.

Table G-7 presents the calculated dietary doses for selected species presented in Table G-6.

Table G-7
Maximum Tolerance Level as a Dietary Dose for Domestic Animals

Species	Dietary Doses (mg/kg-day)									
	Ca	Mg	K	Na (as NaCl)	Cu	Fe	Mn	P	Se	Zn
Poultry	600	150	1,000	1,000	15	50	100	400	1,000	50
Rabbits	1,053	158	1,579	1,579	11	26	21	526	1,053	26

G.4.0 Data Use

Mineral requirements or maximum tolerance levels will be used in ecological risk assessments, as appropriate.

G.5.0 References

IT, 1999. Best professional judgment for cats (*Felis domesticus*) body weight being 10 lbs.

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U.S. Environmental Protection Agency (USEPA). 1993. *Wildlife Exposure Factors Handbook.* EPA/600/R-93/187a, December.

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APPENDIX H

RISK CHARACTERIZATION SPREADSHEETS

Plum Brook Ordnance Works
West Area Red Water Ponds

Chemical Data

Chemical Name	Surface Soil Conc. (mg/kg)	Total Soil Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Soil-to-Plant TF	Shallow-rooted Plant Conc. (mg/kgdw)	Deep-rooted Plant Conc. (mg/kgdw)	Soil-to-Invert. BAF	Invert. Conc. (mg/kgdw)	Food-to-Muscle TF
Organics										
1,3-DNB		2.00E-01		1.49E+00	5.33E+00	0.00E+00	1.07E+00	1.00E-01	0.00E+00	6.37E-07
4-Amino-2,6-DNT		1.50E-01		2.00E+00	2.70E+00	0.00E+00	4.06E-01	1.00E-01	0.00E+00	2.14E-06
Anthracene	2.00E-01	1.90E-01		4.45E+00	1.04E-01	2.07E-02	1.97E-02	1.07E+00	2.14E-01	7.28E-04
Benzo(a)anthracene	2.10E-01	2.10E-01		5.61E+00	2.22E-02	4.65E-03	4.65E-03	5.80E-01	1.22E-01	1.15E-02
Benzo(b)fluoranthene	2.00E-01	2.00E-01		6.06E+00	1.22E-02	2.43E-03	2.43E-03	2.10E-01	4.20E-02	3.35E-02
Benzo(g,h,i)perylene	1.90E-01	1.90E-01		6.51E+00	6.69E-03	1.27E-03	1.27E-03	5.00E-01	9.50E-02	9.77E-02
Benzo(k)fluoranthene	2.10E-01	2.00E-01		6.06E+00	1.22E-02	2.56E-03	2.43E-03	4.70E-01	9.87E-02	3.35E-02
Chrysene	2.10E-01	2.10E-01		5.61E+00	2.22E-02	4.65E-03	4.65E-03	5.50E-01	1.16E-01	1.15E-02
Indeno(1,2,3-cd)pyrene	2.00E-01	1.90E-01		6.51E+00	6.69E-03	1.34E-03	1.27E-03	5.60E-01	1.12E-01	9.77E-02
Phenanthrene	2.10E-01	2.10E-01		4.45E+00	1.04E-01	2.18E-02	2.18E-02	1.00E-01	2.10E-02	7.28E-04
Inorganics										
Iron			1.04E+01	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Lead			2.10E-02	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Manganese			6.30E-01	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA

Plum Brook Ordnance Works
West Area Red Water Ponds

Toxicity Data

Chemical Name	Mammals			Birds		
	LOAEL (mg/kg/d)	Test Species	Body Wt. (kg)	LOAEL (mg/kg/d)	Test Species	Body Wt. (kg)
Organics						
1,3-DNB	1.13E+00	rat	0.35	4.20E+00	red-wing	0.077
4-Amino-2,6-DNT	9.59E+01	rat	0.35	1.78E+01	bobwhite quail	0.19
Anthracene	1.00E+01	mouse	0.03	--	--	--
Benzo(a)anthracene	1.00E+01	mouse	0.03	--	--	--
Benzo(b)fluoranthene	1.00E+01	mouse	0.03	--	--	--
Benzo(g,h,i)perylene	1.00E+01	mouse	0.03	--	--	--
Benzo(k)fluoranthene	1.00E+01	mouse	0.03	--	--	--
Chrysene	1.00E+01	mouse	0.03	--	--	--
Indeno(1,2,3-cd)pyrene	1.00E+01	mouse	0.03	--	--	--
Phenanthrene	1.00E+01	mouse	0.03	--	--	--
Inorganics						
Iron	1.30E+02	rabbit	3.8	2.50E+02	poultry	1.6
Lead	8.00E+01	rat	0.35	3.85E+01	Am. Kestrel	0.13
Manganese	2.84E+02	rat	0.35	9.77E+03	Jap. Quail	0.072

Plum Brook Ordnance Site
West Area Red Water Ponds

Omnivorous Rodent: **Deer mouse *(Peromyscus manicalatus)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Plant/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics																
1,3-DNB	2.49E+00	1.00E+00	2.49E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	2.11E+02	1.00E+00	2.11E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	7.70E-04	6.46E-05	2.39E-03	2.01E-04	1.58E-02	1.32E-03	1.59E-03	0.00E+00	0.00E+00	1.59E-03	1.62E-04
Benzo(a)anthracene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	8.09E-04	6.78E-05	5.37E-04	4.50E-05	8.99E-03	7.53E-04	8.66E-04	0.00E+00	0.00E+00	8.66E-04	1.39E-03
Benzo(b)fluoranthene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	7.70E-04	6.46E-05	2.81E-04	2.35E-05	3.10E-03	2.60E-04	3.48E-04	0.00E+00	0.00E+00	3.48E-04	1.63E-03
Benzo(g,h,i)perylene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	7.32E-04	6.13E-05	1.47E-04	1.23E-05	7.01E-03	5.87E-04	6.61E-04	0.00E+00	0.00E+00	6.61E-04	9.02E-03
Benzo(k)fluoranthene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	8.09E-04	6.78E-05	2.95E-04	2.47E-05	7.28E-03	6.10E-04	7.03E-04	0.00E+00	0.00E+00	7.03E-04	3.29E-03
Chrysene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	8.09E-04	6.78E-05	5.37E-04	4.50E-05	8.52E-03	7.14E-04	8.27E-04	0.00E+00	0.00E+00	8.27E-04	1.33E-03
Indeno(1,2,3-cd)pyrene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	7.70E-04	6.46E-05	1.54E-04	1.29E-05	8.26E-03	6.93E-04	7.70E-04	0.00E+00	0.00E+00	7.70E-04	1.05E-02
Phenanthrene	1.19E+01	1.00E+00	1.19E+01	1.00E+00	1.00E+00	8.09E-04	6.78E-05	2.51E-03	2.11E-04	1.55E-03	1.30E-04	4.08E-04	0.00E+00	0.00E+00	4.08E-04	4.15E-05
Inorganics																
Iron	5.20E+02	1.00E+00	5.20E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E+00	2.97E-03	2.97E-03	0.00E+00
Lead	1.76E+02	1.00E+00	1.76E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E-03	1.77E-05	1.77E-05	0.00E+00
Manganese	6.26E+02	1.00E+00	6.26E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.36E-02	1.50E-04	1.50E-04	0.00E+00
TOTAL							**5.26E-04**		**5.75E-04**		**5.07E-03**	**6.17E-03**		**3.14E-03**	**9.31E-03**	

Body Weight (kg)	0.0148
Water intake (L/d)	0.0022
Food intake (kg(dw)/d)	0.0028
Soil intake (kg/d)	0.000057
Plant intake (kg(dw)/d) – 61% of diet	0.001708
Invertebrate intake (kg(dw)/d) – 39% of diet	0.001092

Plum Brook Ordnance Works
West Area Red Water Ponds

Opportunistic Omnivore: **Raccoon *(Procyon lotor)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																	
1,3-DNB	5.78E-01	1.00E+00	5.78E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	4.91E+01	1.00E+00	4.91E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.71E-04	1.70E-04	4.44E-04	1.60E-04	3.27E-03	1.18E-03	4.12E-07	1.49E-07	1.51E-03	0.00E+00	0.00E+00	1.51E-03
Benzo(a)anthracene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.94E-04	1.78E-04	9.96E-05	3.60E-05	1.86E-03	6.73E-04	3.54E-06	1.28E-06	8.88E-04	0.00E+00	0.00E+00	8.88E-04
Benzo(b)fluoranthene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.71E-04	1.70E-04	5.21E-05	1.88E-05	6.42E-04	2.32E-04	4.15E-06	1.50E-06	4.22E-04	0.00E+00	0.00E+00	4.22E-04
Benzo(g,h,i)perylene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.47E-04	1.61E-04	2.72E-05	9.82E-06	1.45E-03	5.25E-04	2.30E-05	8.31E-06	7.04E-04	0.00E+00	0.00E+00	7.04E-04
Benzo(k)fluoranthene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.94E-04	1.78E-04	5.47E-05	1.98E-05	1.51E-03	5.45E-04	8.39E-06	3.03E-06	7.46E-04	0.00E+00	0.00E+00	7.46E-04
Chrysene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.94E-04	1.78E-04	9.96E-05	3.60E-05	1.77E-03	6.38E-04	3.38E-06	1.22E-06	8.53E-04	0.00E+00	0.00E+00	8.53E-04
Indeno(1,2,3-cd)pyrene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.71E-04	1.70E-04	2.86E-05	1.03E-05	1.71E-03	6.19E-04	2.68E-05	9.68E-06	8.08E-04	0.00E+00	0.00E+00	8.08E-04
Phenanthrene	2.77E+00	1.00E+00	2.77E+00	1.00E+00	1.00E+00	4.94E-04	1.78E-04	4.66E-04	1.68E-04	3.21E-04	1.16E-04	1.06E-07	3.82E-08	4.63E-04	0.00E+00	0.00E+00	4.63E-04
Inorganics																	
Iron	1.21E+02	1.00E+00	1.21E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.77E-01	7.26E-03	7.26E-03
Lead	4.09E+01	1.00E+00	4.09E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-03	4.32E-05	4.32E-05
Manganese	1.45E+02	1.00E+00	1.45E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.31E-02	3.65E-04	3.65E-04
TOTAL							**1.38E-03**		**4.59E-04**		**4.53E-03**		**2.52E-05**	**6.40E-03**		**7.67E-03**	**1.41E-02**

Body Weight (kg)	5.1
Water intake (L/d)	0.43
Food intake (kg(dw)/d)	0.26
Soil intake (kg/d)	0.012
Mouse Intake (kg(dw)/d) -- 5 % of diet	0.013
Plant intake (kg(dw)/d) -- 42% of diet	0.1092
Invertebrate intake (kg(dw)/d) -- 30% of diet	0.078

Plum Brook Ordnance Works
West Area Red Water Ponds

Herbivorous Rodent: **Eastern Cottontail *(Sylvilagus floridanus)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	1.51E+00	1.00E+00	1.51E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	1.28E+02	1.00E+00	1.28E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.06E-03	1.47E-04	1.76E-03	2.43E-04	3.90E-04	0.00E+00	0.00E+00	3.90E-04	7.11E-05
Benzo(a)anthracene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.11E-03	1.54E-04	3.95E-04	5.46E-05	2.09E-04	0.00E+00	0.00E+00	2.09E-04	6.00E-04
Benzo(b)fluoranthene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.06E-03	1.47E-04	2.06E-04	2.86E-05	1.75E-04	0.00E+00	0.00E+00	1.75E-04	1.47E-03
Benzo(g,h,i)perylene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.01E-03	1.39E-04	1.08E-04	1.49E-05	1.54E-04	0.00E+00	0.00E+00	1.54E-04	3.78E-03
Benzo(k)fluoranthene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.11E-03	1.54E-04	2.17E-04	3.00E-05	1.84E-04	0.00E+00	0.00E+00	1.84E-04	1.54E-03
Chrysene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.11E-03	1.54E-04	3.95E-04	5.46E-05	2.09E-04	0.00E+00	0.00E+00	2.09E-04	6.00E-04
Indeno(1,2,3-cd)pyrene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.06E-03	1.47E-04	1.13E-04	1.57E-05	1.62E-04	0.00E+00	0.00E+00	1.62E-04	3.98E-03
Phenanthrene	7.23E+00	1.00E+00	7.23E+00	1.00E+00	1.00E+00	1.11E-03	1.54E-04	1.85E-03	2.56E-04	4.10E-04	0.00E+00	0.00E+00	4.10E-04	7.47E-05
Inorganics														
Iron	3.15E+02	1.00E+00	3.15E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E+00	3.21E-03	3.21E-03	0.00E+00
Lead	1.07E+02	1.00E+00	1.07E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E-03	1.91E-05	1.91E-05	0.00E+00
Manganese	3.79E+02	1.00E+00	3.79E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.12E-02	1.61E-04	1.61E-04	0.00E+00
TOTAL							**1.20E-03**		**6.97E-04**	**1.89E-03**		**3.39E-03**	**5.28E-03**	

Body Weight (kg)	1.132
Water intake (L/d)	0.11
Food intake (kg(dw)/d)	0.096
Soil intake (kg/d)	0.006
Plant intake (kg(dw)/d) – 100% of diet	0.096

Plum Brook Ordnance Works
West Area Red Water Ponds

Insectivorous mammal: **Short-tailed shrew *(Blarina brevicauda)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	3.97E+00	1.00E+00	3.97E+00	1.00E+00	1.00E+00	1.11E-02	2.79E-03	0.00E+00	0.00E+00	2.79E-03	0.00E+00	0.00E+00	2.79E-03	3.74E-08
4-Amino-2,6-DNT	3.37E+02	1.00E+00	3.37E+02	1.00E+00	1.00E+00	8.30E-03	2.46E-05	0.00E+00	0.00E+00	2.46E-05	0.00E+00	0.00E+00	2.46E-05	9.44E-08
Anthracene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.05E-02	5.53E-04	1.14E-01	6.01E-03	6.56E-03	0.00E+00	0.00E+00	6.56E-03	4.81E-04
Benzo(a)anthracene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.16E-02	6.11E-04	6.50E-02	3.42E-03	4.03E-03	0.00E+00	0.00E+00	4.03E-03	4.67E-03
Benzo(b)fluoranthene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.11E-02	5.82E-04	2.24E-02	1.18E-03	1.76E-03	0.00E+00	0.00E+00	1.76E-03	5.95E-03
Benzo(g,h,i)perylene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.05E-02	5.53E-04	5.07E-02	2.67E-03	3.22E-03	0.00E+00	0.00E+00	3.22E-03	3.17E-02
Benzo(k)fluoranthene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.11E-02	5.82E-04	5.26E-02	2.77E-03	3.35E-03	0.00E+00	0.00E+00	3.35E-03	1.13E-02
Chrysene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.16E-02	6.11E-04	6.16E-02	3.24E-03	3.85E-03	0.00E+00	0.00E+00	3.85E-03	4.46E-03
Indeno(1,2,3-cd)pyrene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.05E-02	5.53E-04	5.97E-02	3.14E-03	3.70E-03	0.00E+00	0.00E+00	3.70E-03	3.64E-02
Phenanthrene	1.90E+01	1.00E+00	1.90E+01	1.00E+00	1.00E+00	1.16E-02	6.11E-04	1.12E-02	5.89E-04	1.20E-03	0.00E+00	0.00E+00	1.20E-03	8.81E-05
Inorganics														
Iron	8.29E+02	1.00E+00	8.29E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E+00	1.92E-03	1.92E-03	0.00E+00
Lead	2.81E+02	1.00E+00	2.81E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-03	1.15E-05	1.15E-05	0.00E+00
Manganese	9.97E+02	1.00E+00	9.97E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.66E-02	9.68E-05	9.68E-05	0.00E+00
TOTAL							**7.47E-03**		**2.30E-02**	**3.05E-02**		**2.03E-03**	**3.25E-02**	

Body Weight (kg)	0.015
Water intake (L/d)	0.0023
Food intake (kg(dw)/d)	0.008
Soil intake (kg/d)	0.00083
Invertebrate intake (kg(dw)/d)–100% of diet	0.008

Plum Brook Ordnance Works
West Area Red Water Ponds

Herbivorous Mammal: **White-tailed deer *(Odocoileus virginianus)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics													
1,3-DNB	6.15E-01	1.00E+00	6.15E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	3.50E-04	5.69E-04	5.69E-04	0.00E+00	0.00E+00	5.69E-04
4-Amino-2,6-DNT	5.22E+01	1.00E+00	5.22E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	1.33E-04	2.55E-06	2.55E-06	0.00E+00	0.00E+00	2.55E-06
Anthracene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.31E-06	4.46E-07	6.46E-06	2.20E-06	2.64E-06	0.00E+00	0.00E+00	2.64E-06
Benzo(a)anthracene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.38E-06	4.68E-07	1.53E-06	5.18E-07	9.86E-07	0.00E+00	0.00E+00	9.86E-07
Benzo(b)fluoranthene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.31E-06	4.46E-07	7.98E-07	2.71E-07	7.17E-07	0.00E+00	0.00E+00	7.17E-07
Benzo(g,h,i)perylene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.25E-06	4.23E-07	4.17E-07	1.42E-07	5.65E-07	0.00E+00	0.00E+00	5.65E-07
Benzo(k)fluoranthene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.38E-06	4.68E-07	7.98E-07	2.71E-07	7.39E-07	0.00E+00	0.00E+00	7.39E-07
Chrysene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.38E-06	4.68E-07	1.53E-06	5.18E-07	9.86E-07	0.00E+00	0.00E+00	9.86E-07
Indeno(1,2,3-cd)pyrene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.31E-06	4.46E-07	4.17E-07	1.42E-07	5.87E-07	0.00E+00	0.00E+00	5.87E-07
Phenanthrene	2.94E+00	1.00E+00	2.94E+00	1.00E-02	1.00E-02	1.38E-06	4.68E-07	7.14E-06	2.43E-06	2.89E-06	0.00E+00	0.00E+00	2.89E-06
Inorganics													
Iron	1.28E+02	1.00E+00	1.28E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.16E-01	3.24E-03	3.24E-03
Lead	4.35E+01	1.00E+00	4.35E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.40E-04	1.93E-05	1.93E-05
Manganese	1.54E+02	1.00E+00	1.54E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.52E-02	1.63E-04	1.63E-04
TOTAL							**3.63E-06**		**5.78E-04**	**5.81E-04**		**3.42E-03**	**4.01E-03**

Body Weight (kg)	61
Water intake (L/d)	4
Food intake (kg(dw)/d)	2
Soil intake (kg/d)	0.04
Plant intake (kg(dw)/d) -- 100% of diet	2

Plum Brook Ordnance Works
West Area Red Water Ponds

Insectivorous Bird: **Marsh wren *(Cistothorus palustris)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	4.20E+00	1.00E+00	4.20E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	1.78E+01	1.00E+00	1.78E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	2.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.86E-04
Benzo(a)anthracene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.99E-03	0.00E+00	1.16E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.43E-03
Benzo(b)fluoranthene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	3.99E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E-03
Benzo(g,h,i)perylene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.61E-03	0.00E+00	9.03E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.96E-02
Benzo(k)fluoranthene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.99E-03	0.00E+00	9.38E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-02
Chrysene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.99E-03	0.00E+00	1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E-03
Indeno(1,2,3-cd)pyrene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	1.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.47E-02
Phenanthrene	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	3.99E-03	0.00E+00	2.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.62E-05
Inorganics														
Iron	2.50E+02	1.00E+00	2.50E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.81E+00	1.12E-02	1.12E-02	0.00E+00
Lead	3.85E+01	1.00E+00	3.85E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.67E-03	1.47E-04	1.47E-04	0.00E+00
Manganese	9.77E+03	1.00E+00	9.77E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-01	1.74E-05	1.74E-05	0.00E+00
TOTAL							**0.00E+00**		**0.00E+00**	**0.00E+00**		**1.14E-02**	**1.14E-02**	

Body Weight (kg)	0.01
Water intake (L/d)	0.0027
Food intake (kg(dw)/d)	0.0095
Soil intake (kg/d)	0.00019
Plant intake (kg(dw)/d) -- 0% of diet	0
Invertebrate intake (kg(dw)/d) -- 100% of diet	0.0095

Plum Brook Ordnance Works
West Area Red Water Ponds

Chemical Data

Chemical Name	Surface Soil Conc. (mg/kg)	Total Soil Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Soil-to-Plant TF	Shallow-rooted Plant Conc. (mg/kgdw)	Deep-rooted Plant Conc. (mg/kgdw)	Soil-to-Invert. BAF	Invert. Conc. (mg/kgdw)	Food-to-Muscle TF
Organics										
1,3-DNB		1.25E-01		1.49E+00	5.33E+00	0.00E+00	6.66E-01	1.00E-01	0.00E+00	6.37E-07
4-Amino-2,6-DNT		1.25E-01		2.00E+00	2.70E+00	0.00E+00	3.38E-01	1.00E-01	0.00E+00	2.14E-06
Anthracene	2.00E-01	2.00E-01		4.45E+00	1.04E-01	2.07E-02	2.07E-02	1.07E+00	2.14E-01	7.28E-04
Benzo(a)anthracene	2.00E-01	2.00E-01		5.61E+00	2.22E-02	4.43E-03	4.43E-03	5.80E-01	1.16E-01	1.15E-02
Benzo(b)fluoranthene	2.00E-01	2.00E-01		6.06E+00	1.22E-02	2.43E-03	2.43E-03	2.10E-01	4.20E-02	3.35E-02
Benzo(g,h,i)perylene	2.00E-01	2.00E-01		6.51E+00	6.69E-03	1.34E-03	1.34E-03	5.00E-01	1.00E-01	9.77E-02
Benzo(k)fluoranthene	2.00E-01	2.00E-01		6.06E+00	1.22E-02	2.43E-03	2.43E-03	4.70E-01	9.40E-02	3.35E-02
Chrysene	2.00E-01	2.00E-01		5.61E+00	2.22E-02	4.43E-03	4.43E-03	5.50E-01	1.10E-01	1.15E-02
Indeno(1,2,3-cd)pyrene	2.00E-01	2.00E-01		6.51E+00	6.69E-03	1.34E-03	1.34E-03	5.10E-01	1.02E-01	9.77E-02
Phenanthrene	2.00E-01	2.00E-01		4.45E+00	1.04E-01	2.07E-02	2.07E-02	6.00E-01	1.20E-01	7.28E-04
Inorganics										
Iron			2.11E+01	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Lead			7.70E-02	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Manganese			1.60E+00	---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA

Plum Brook Ordnance Works
West Area Red Water Ponds

Toxicity Data

Chemical Name	Mammals			Birds		
	NOAEL (mg/kg/d)	Test Species	Body Wt. (kg)	NOAEL (mg/kg/d)	Test Species	Body Wt. (kg)
Organics						
1,3-DNB	1.13E-01	rat	0.35	4.20E-01	red-wing	0.077
4-Amino-2,6-DNT	9.59E+00	rat	0.35	7.00E-01	bobwhite quail	0.19
Anthracene	1.00E+00	mouse	0.03	--	--	--
Benzo(a)anthracene	1.00E+00	mouse	0.03	--	--	--
Benzo(b)fluoranthene	1.00E+00	mouse	0.03	--	--	--
Benzo(g,h,i)perylene	1.00E+00	mouse	0.03	--	--	--
Benzo(k)fluoranthene	1.00E+00	mouse	0.03	--	--	--
Chrysene	1.00E+00	mouse	0.03	--	--	--
Indeno(1,2,3-cd)pyrene	1.00E+00	mouse	0.03	--	--	--
Phenanthrene	1.00E+00	mouse	0.03	--	--	--
Inorganics						
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Lead	8.00E+00	rat	0.35	3.85E+00	Am. Kestrel	0.13
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072

Plum Brook Ordnance Site
West Area Red Water Ponds

Omnivorous Rodent — Deer mouse *(Peromyscus maniculatus)*

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Plant/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics																
1,3-DNB	2.49E-01	8.00E+00	3.11E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	2.11E+01	8.00E+00	2.64E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.39E-03	1.61E-02	1.58E-02	1.06E-01	1.27E-01	0.00E+00	0.00E+00	1.27E-01	1.62E-04
Benzo(a)anthracene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	5.11E-04	3.43E-03	8.56E-03	5.74E-02	6.60E-02	0.00E+00	0.00E+00	6.60E-02	1.32E-03
Benzo(b)fluoranthene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.81E-04	1.88E-03	3.10E-03	2.08E-02	2.78E-02	0.00E+00	0.00E+00	2.78E-02	1.63E-03
Benzo(g,h,i)perylene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	1.54E-04	1.03E-03	7.38E-03	4.95E-02	5.57E-02	0.00E+00	0.00E+00	5.57E-02	9.50E-03
Benzo(k)fluoranthene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.81E-04	1.88E-03	6.94E-03	4.65E-02	5.35E-02	0.00E+00	0.00E+00	5.35E-02	3.13E-03
Chrysene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	5.11E-04	3.43E-03	8.12E-03	5.44E-02	6.30E-02	0.00E+00	0.00E+00	6.30E-02	1.26E-03
Indeno(1,2,3-cd)pyrene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	1.54E-04	1.03E-03	7.53E-03	5.05E-02	5.67E-02	0.00E+00	0.00E+00	5.67E-02	9.67E-03
Phenanthrene	1.19E+00	8.00E+00	1.49E-01	1.00E+00	1.00E+00	7.70E-04	5.16E-03	2.39E-03	1.61E-02	8.85E-03	5.94E-02	8.06E-02	0.00E+00	0.00E+00	8.06E-02	1.02E-04
Inorganics																
Iron	1.04E+02	8.00E+00	1.30E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E+00	2.41E-01	2.41E-01	0.00E+00
Lead	1.76E+01	8.00E+00	2.21E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-02	5.19E-03	5.19E-03	0.00E+00
Manganese	1.94E+02	8.00E+00	2.43E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.38E-01	9.80E-03	9.80E-03	0.00E+00
TOTAL							4.13E-02		4.48E-02		4.44E-01	5.30E-01		2.56E-01	7.86E-01	

Body Weight (kg)	0.0148
Water intake (L/d)	0.0022
Food intake (kg(dw)/d)	0.0028
Soil intake (kg/d)	0.000057
Plant intake (kg(dw)/d) – 61% of diet	0.001708
Invertebrate intake (kg(dw)/d) – 39% of diet	0.001092

Plum Brook Ordnance Works
West Area Red Water Ponds

Opportunistic Omnivore: Raccoon *(Procyon lotor)*

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																	
1,3-DNB	5.78E-02	8.00E+00	7.23E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	4.91E+00	8.00E+00	6.14E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	4.44E-04	1.28E-02	3.27E-03	9.45E-02	4.12E-07	1.19E-05	1.21E-01	0.00E+00	0.00E+00	1.21E-01
Benzo(a)anthracene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	9.49E-05	2.74E-03	1.77E-03	5.12E-02	3.37E-06	9.75E-05	6.77E-02	0.00E+00	0.00E+00	6.77E-02
Benzo(b)fluoranthene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	5.21E-05	1.51E-03	6.42E-04	1.86E-02	4.15E-06	1.20E-04	3.38E-02	0.00E+00	0.00E+00	3.38E-02
Benzo(g,h,I)perylene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	2.86E-05	8.27E-04	1.53E-03	4.42E-02	2.42E-05	6.99E-04	5.93E-02	0.00E+00	0.00E+00	5.93E-02
Benzo(k)fluoranthene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	5.21E-05	1.51E-03	1.44E-03	4.15E-02	7.99E-06	2.31E-04	5.69E-02	0.00E+00	0.00E+00	5.69E-02
Chrysene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	9.49E-05	2.74E-03	1.68E-03	4.86E-02	3.22E-06	9.31E-05	6.50E-02	0.00E+00	0.00E+00	6.50E-02
Indeno(1,2,3-cd)pyrene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	2.86E-05	8.27E-04	1.56E-03	4.51E-02	2.46E-05	7.12E-04	6.02E-02	0.00E+00	0.00E+00	6.02E-02
Phenanthrene	2.77E-01	8.00E+00	3.46E-02	1.00E+00	1.00E+00	4.71E-04	1.36E-02	4.44E-04	1.28E-02	1.84E-03	5.30E-02	2.61E-07	7.54E-06	7.94E-02	0.00E+00	0.00E+00	7.94E-02
Inorganics																	
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.78E+00	5.89E-01	5.89E-01
Lead	4.09E+00	8.00E+00	5.12E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.49E-03	1.27E-02	1.27E-02
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-01	2.40E-02	2.40E-02
TOTAL							**1.09E-01**		**3.58E-02**		**3.97E-01**		**1.97E-03**	**5.43E-01**		**6.26E-01**	**1.17E+00**

Body Weight (kg)	5.1
Water Intake (L/d)	0.43
Food Intake (kg(dw)/d)	0.26
Soil Intake (kg/d)	0.012
Mouse Intake (kg(dw)/d) -- 5 % of diet	0.013
Plant Intake (kg(dw)/d) -- 42% of diet	0.1092
Invertebrate intake (kg(dw)/d) -- 30% of diet	0.078

Plum Brook Ordnance Works
West Area Red Water Ponds

Herbivorous Rodent: **Eastern Cottontail *(Sylvilagus floridanus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	1.51E-01	8.00E+00	1.89E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	1.28E+01	8.00E+00	1.60E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.76E-03	1.95E-02	3.12E-02	0.00E+00	0.00E+00	3.12E-02	7.11E-05
Benzo(a)anthracene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	3.76E-04	4.16E-03	1.59E-02	0.00E+00	0.00E+00	1.59E-02	5.72E-04
Benzo(b)fluoranthene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	2.06E-04	2.29E-03	1.40E-02	0.00E+00	0.00E+00	1.40E-02	1.47E-03
Benzo(g,h,i)perylene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.13E-04	1.26E-03	1.30E-02	0.00E+00	0.00E+00	1.30E-02	3.98E-03
Benzo(k)fluoranthene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	2.06E-04	2.29E-03	1.40E-02	0.00E+00	0.00E+00	1.40E-02	1.47E-03
Chrysene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	3.76E-04	4.16E-03	1.59E-02	0.00E+00	0.00E+00	1.59E-02	5.72E-04
Indeno(1,2,3-cd)pyrene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.13E-04	1.26E-03	1.30E-02	0.00E+00	0.00E+00	1.30E-02	3.98E-03
Phenanthrene	7.23E-01	8.00E+00	9.03E-02	1.00E+00	1.00E+00	1.06E-03	1.17E-02	1.76E-03	1.95E-02	3.12E-02	0.00E+00	0.00E+00	3.12E-02	7.11E-05
Inorganics														
Iron	6.30E+01	4.00E+00	1.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E+00	1.30E-01	1.30E-01	0.00E+00
Lead	1.07E+01	8.00E+00	1.34E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E-03	5.60E-03	5.60E-03	0.00E+00
Manganese	1.18E+02	8.00E+00	1.47E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-01	1.06E-02	1.06E-02	0.00E+00
TOTAL							**9.39E-02**		**5.44E-02**	**1.48E-01**		**1.46E-01**	**2.95E-01**	

Body Weight (kg)	1.132
Water intake (L/d)	0.11
Food intake (kg(dw)/d)	0.096
Soil intake (kg/d)	0.006
Plant intake (kg(dw)/d) -- 100% of diet	0.096

Plum Brook Ordnance Works
West Area Red Water Ponds

Insectivorous mammal: **Short-tailed shrew *(Blarina brevicauda)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	3.97E-01	8.00E+00	4.96E-02	1.00E+00	1.00E+00	6.92E-03	1.39E-01	0.00E+00	0.00E+00	1.39E-01	0.00E+00	0.00E+00	1.39E-01	2.34E-08
4-Amino-2,6-DNT	3.37E+01	8.00E+00	4.21E+00	1.00E+00	1.00E+00	6.92E-03	1.64E-03	0.00E+00	0.00E+00	1.64E-03	0.00E+00	0.00E+00	1.64E-03	7.87E-08
Anthracene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	1.14E-01	4.80E-01	5.27E-01	0.00E+00	0.00E+00	5.27E-01	4.84E-04
Benzo(a)anthracene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	6.19E-02	2.60E-01	3.07E-01	0.00E+00	0.00E+00	3.07E-01	4.45E-03
Benzo(b)fluoranthene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	2.24E-02	9.43E-02	1.41E-01	0.00E+00	0.00E+00	1.41E-01	5.95E-03
Benzo(g,h,i)perylene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	5.33E-02	2.25E-01	2.71E-01	0.00E+00	0.00E+00	2.71E-01	3.34E-02
Benzo(k)fluoranthene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	5.01E-02	2.11E-01	2.58E-01	0.00E+00	0.00E+00	2.58E-01	1.09E-02
Chrysene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	5.87E-02	2.47E-01	2.94E-01	0.00E+00	0.00E+00	2.94E-01	4.25E-03
Indeno(1,2,3-cd)pyrene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	5.44E-02	2.29E-01	2.76E-01	0.00E+00	0.00E+00	2.76E-01	3.39E-02
Phenanthrene	1.90E+00	8.00E+00	2.38E-01	1.00E+00	1.00E+00	1.11E-02	4.66E-02	6.40E-02	2.69E-01	3.16E-01	0.00E+00	0.00E+00	3.16E-01	2.90E-04
Inorganics														
Iron	1.66E+02	8.00E+00	2.07E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.24E+00	1.56E-01	1.56E-01	0.00E+00
Lead	2.81E+01	8.00E+00	3.51E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-02	3.36E-03	3.36E-03	0.00E+00
Manganese	3.09E+02	8.00E+00	3.86E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-01	6.35E-03	6.35E-03	0.00E+00
TOTAL							**5.14E-01**		**2.02E+00**	**2.53E+00**		**1.66E-01**	**2.70E+00**	

Body Weight (kg)	0.015
Water intake (L/d)	0.0023
Food intake (kg(dw)/d)	0.008
Soil intake (kg/d)	0.00083
Invertebrate intake (kg(dw)/d)–100% of diet	0.008

Plum Brook Ordnance Works
West Area Red Water Ponds

Herbivorous Mammal: **White-tailed deer *(Odocoileus virginianus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics													
1,3-DNB	6.15E-02	8.00E+00	7.68E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	2.18E-04	2.84E-02	2.84E-02	0.00E+00	0.00E+00	2.84E-02
4-Amino-2,6-DNT	5.22E+00	8.00E+00	6.52E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	1.11E-04	1.70E-04	1.70E-04	0.00E+00	0.00E+00	1.70E-04
Anthracene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	6.80E-06	1.85E-04	2.21E-04	0.00E+00	0.00E+00	2.21E-04
Benzo(a)anthracene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	1.45E-06	3.95E-05	7.51E-05	0.00E+00	0.00E+00	7.51E-05
Benzo(b)fluoranthene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	7.98E-07	2.17E-05	5.73E-05	0.00E+00	0.00E+00	5.73E-05
Benzo(g,h,i)perylene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	4.38E-07	1.19E-05	4.76E-05	0.00E+00	0.00E+00	4.76E-05
Benzo(k)fluoranthene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	7.98E-07	2.17E-05	5.73E-05	0.00E+00	0.00E+00	5.73E-05
Chrysene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	1.45E-06	3.95E-05	7.51E-05	0.00E+00	0.00E+00	7.51E-05
Indeno(1,2,3-cd)pyrene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	4.38E-07	1.19E-05	4.76E-05	0.00E+00	0.00E+00	4.76E-05
Phenanthrene	2.94E-01	8.00E+00	3.68E-02	1.00E-02	1.00E-02	1.31E-06	3.57E-05	6.80E-06	1.85E-04	2.21E-04	0.00E+00	0.00E+00	2.21E-04
Inorganics													
Iron	2.57E+01	8.00E+00	3.21E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.44E-01	2.63E-01	2.63E-01
Lead	4.35E+00	8.00E+00	5.44E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-03	5.66E-03	5.66E-03
Manganese	4.79E+01	8.00E+00	5.98E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.40E-02	1.07E-02	1.07E-02
TOTAL							**2.85E-04**		**2.91E-02**	**2.94E-02**		**2.79E-01**	**3.09E-01**

Body Weight (kg)	61
Water intake (L/d)	4
Food intake (kg(dw)/d)	2
Soil intake (kg/d)	0.04
Plant intake (kg(dw)/d) – 100% of diet	2

Plum Brook Ordnance Works
West Area Red Water Ponds

Insectivorous Bird: **Marsh wren *(Cistothorus palustris)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	4.20E-01	8.00E+00	5.25E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Amino-2,6-DNT	7.00E-01	8.00E+00	8.75E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	2.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.86E-04
Benzo(a)anthracene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.22E-03
Benzo(b)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	3.99E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.72E-03
Benzo(g,h,i)perylene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	9.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E-02
Benzo(k)fluoranthene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	8.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-02
Chrysene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	1.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-03
Indeno(1,2,3-cd)pyrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	9.69E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.17E-02
Phenanthrene	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	3.80E-03	0.00E+00	1.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E-04
Inorganics														
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.70E+00	9.12E-01	9.12E-01	0.00E+00
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-02	4.32E-02	4.32E-02	0.00E+00
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E-01	3.54E-03	3.54E-03	0.00E+00
TOTAL							**0.00E+00**		**0.00E+00**	**0.00E+00**		**9.58E-01**	**9.58E-01**	

Body Weight (kg)	0.01
Water intake (L/d)	0.0027
Food intake (kg(dw)/d)	0.0095
Soil intake (kg/d)	0.00019
Plant intake (kg(dw)/d) -- 0% of diet	0
Invertebrate intake (kg(dw)/d) -- 100% of diet	0.0095

Plum Brook Ord. ..ce Works
West Area Red Water Ponds
Central Tendency

Chemical Data

Chemical Name	Sediment Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Kow (organics)	log Koc (organics) (mL/g)	Koc (organics) (mL/g)	Kd (inorganics) (mL/g)	Foc	Water-to-Fish BCF	Food Chain Multiplier	Water-to-Fish BAF	Fish Conc. (mg/kgww)	Fish Conc. (mg/kgdw)	Sediment-to-Invertebrate BCF	Invert. Conc. (mg/kgww)	Invert Conc. (mg/kgdw)	Food-to-Muscle TF
Organics																	
2-Amino-4,6-Dinitrotoluene	1.40E-01		2.00E+00	1.00E+02	1.97E+00	9.25E+01	—	6.70E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	4.84E-02	4.84E+00	1.94E+01	2.14E-06
Inorganics																	
Aluminum			—	—	—	—			1.50E+01	1.00E+00	1.50E+01	-	0.00E+00	3.50E-03	-	0.00E+00	NA
Arsenic			—	—	—	—			4.00E+01	1.00E+00	4.00E+01	-	0.00E+00	3.00E-02	-	0.00E+00	4.00E-03
Calcium			—	—	—	—			3.02E+02	1.00E+00	3.02E+02	-	0.00E+00	1.00E-03	-	0.00E+00	2.00E-03
Copper			—	—	—	—			1.02E+02	1.00E+00	1.02E+02	-	0.00E+00	2.00E-02	-	0.00E+00	NA
Iron	1.87E+04	1.04E+01	—	—	—	—			1.80E+01	1.00E+00	1.80E+01	-	1.87E+02	5.10E-05	-	9.54E-01	NA
Lead		2.10E-02	—	—	—	—			2.30E+01	1.00E+00	2.30E+01	-	4.83E-01	2.50E-02	-	0.00E+00	NA
Manganese		6.30E-01	—	—	—	—			1.30E+01	1.00E+00	1.30E+01	-	8.19E+00	5.70E-05	-	0.00E+00	NA
Phosphorus			—	—	—	—			NA	1.00E+00	0.00E+00	-	0.00E+00	NA	-	0.00E+00	NA

Plum Brook Ordnance Works
West Area Red Water Ponds

Toxicity Data

Chemical Name	Mammals LOAEL (mg/kg/d)	Mammals Test Species	Mammals Body Wt. (kg)	Birds LOAEL (mg/kg/d)	Birds Test Species	Birds Body Wt. (kg)
Organics						
2-Amino-4,6-Dinitrotoluene	1.39E+02	rat	0.35	1.78E+01	bobwhite quail	0.19
Inorganics						
Aluminum	1.93E+01	mouse	0.03	1.10E+03	ringed dove	0.155
Arsenic	1.26E+00	mouse	0.03	7.38E+00	cowbird	0.049
Calcium	5.27E+03	rabbit	3.8	1.42E+04	Jap. Quail	0.072
Copper	1.51E+01	mink	1	6.17E+01	chicks	0.534
Iron	1.30E+02	rabbit	3.8	2.50E+02	poultry	1.6
Lead	8.00E+01	rat	0.35	3.85E+01	Am. Kestrel	0.13
Manganese	2.84E+02	rat	0.35	9.77E+03	Jap. Quail	0.072
Phosphorus	2.63E+03	rabbit	3.8	2.00E+03	poultry	1.6

Piscivorous Bird: **Great Blue Heron *(Ardea herodias)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Macroinvert Intake (mg/kg-d)	Macroinvert Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
2-Amino-4,6-Dinitrotoluene	1.78E+01	1.00E+00	1.78E+01	1.00E+00	5.02E-04	2.82E-05	0.00E+00	0.00E+00	1.41E-01	7.90E-03	7.92E-03	0.00E+00	0.00E+00	7.92E-03
Inorganics														
Aluminum	1.10E+03	1.00E+00	1.10E+03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	7.38E+00	1.00E+00	7.38E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	1.42E+04	1.00E+00	1.42E+04	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	6.17E+01	1.00E+00	6.17E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.50E+02	1.00E+00	2.50E+02	1.00E+00	6.70E+01	2.68E-01	3.26E+01	1.30E-01	6.92E-03	2.77E-05	3.99E-01	4.72E-01	1.89E-03	4.00E-01
Lead	3.85E+01	1.00E+00	3.85E+01	1.00E+00	0.00E+00	0.00E+00	8.42E-02	2.19E-03	0.00E+00	0.00E+00	2.19E-03	9.53E-04	2.47E-05	2.21E-03
Manganese	9.77E+03	1.00E+00	9.77E+03	1.00E+00	0.00E+00	0.00E+00	1.43E+00	1.46E-04	0.00E+00	0.00E+00	1.46E-04	2.86E-02	2.93E-06	1.49E-04
Phosphorus	2.00E+03	1.00E+00	2.00E+03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL						**2.68E-01**		**1.33E-01**		**2.77E-05**	**4.01E-01**		**1.92E-03**	**4.03E-01**

Body Weight (kg)	2.204
Water intake (L/d)	0.1
Food intake (kg(dw)/d)	0.4
Sediment intake (kg/d)	0.0079
Fish intake (kg(dw)/d) -- 96% of diet	0.384
Macroinvert intake (kg(dw)/d) -- 4% of diet	0.016

Plum Brook Ordnance Works
West Area Red Water Ponds

Omnivorous mammal: **Raccoon *(Procyon lotor)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Aq. Invert. Intake (mg/kg-d)	Aq. Invert. Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
2-Amino-4,6-Dinitrotoluene	7.11E+01	1.00E+00	7.11E+01	1.00E+00	3.29E-04	4.63E-06	2.07E-01	2.91E-03	0.00E+00	0.00E+00	2.92E-03	0.00E+00	0.00E+00	2.92E-03
Inorganics														
Aluminum	5.34E+00	1.00E+00	5.34E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	3.49E-01	1.00E+00	3.49E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	4.89E+03	1.00E+00	4.89E+03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	1.01E+01	1.00E+00	1.01E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.21E+02	1.00E+00	1.21E+02	1.00E+00	4.40E+01	3.64E-01	1.02E-02	8.45E-05	1.91E-01	1.58E-03	3.66E-01	4.38E-01	3.63E-03	3.70E-01
Lead	4.09E+01	1.00E+00	4.09E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.92E-04	1.20E-05	1.20E-05	8.85E-04	2.16E-05	3.36E-05
Manganese	1.45E+02	1.00E+00	1.45E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.35E-03	5.74E-05	5.74E-05	2.66E-02	1.83E-04	2.40E-04
Phosphorus	2.44E+03	1.00E+00	2.44E+03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL						**3.64E-01**		**8.45E-05**		**1.65E-03**	**3.66E-01**		**3.83E-03**	**3.70E-01**

Body Weight (kg)	5.1
Water intake (L/d)	0.215
Food intake (kg(dw)/d)	0.26
Sediment intake (kg/d)	0.012
Aquatic Invert. Intake (kg(dw)/d -- 21% of diet	0.0546
Fish intake (kg(dw)/d) -- 2% of diet	0.0052

Plum Brook Ordnance Works
West Area Red Water Ponds
Reasonable Maximum Exposure

Chemical Data

Chemical Name	Sediment Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Kow (organics)	log Koc (organics) (mL/g)	Koc (organics) (mL/g)	Kd (inorganics) (mL/g)	Foc	Water-to-Fish BCF	Food Chain Multiplier	Water-to-Fish BAF	Fish Conc. (mg/kgww)	Fish Conc. (mg/kgdw)	Sediment-to-Invertebrate BCF	Invert. Conc. (mg/kgww)	Invert Conc. (mg/kgdw)	Food-to-Muscle TF
Organics																	
2-Amino-4,6-Dinitrotoluene	3.00E-01		2.00E+00	1.00E+02	1.97E+00	9.25E+01	—	6.70E-02	1.00E+02	1.00E+00	1.00E+02	0.00E+00	0.00E+00	4.84E-02	4.84E+00	1.94E+01	2.14E-06
Inorganics																	
Aluminum			—	—	—	—	1.50E+03	6.70E-02	1.50E+01	1.00E+00	1.50E+01	-	0.00E+00	3.50E-03	-	0.00E+00	NA
Arsenic			—	—	—	—	2.00E+02	6.70E-02	4.00E+01	1.00E+00	4.00E+01	-	0.00E+00	2.20E-01	-	0.00E+00	4.00E-03
Calcium			—	—	—	—	4.10E+00	6.70E-02	3.02E+02	1.00E+00	3.02E+02	-	0.00E+00	3.30E-02	-	0.00E+00	2.00E-03
Copper			—	—	—	—	3.50E+01	6.70E-02	1.02E+02	1.00E+00	1.02E+02	-	0.00E+00	1.30E-01	-	0.00E+00	NA
Iron	2.43E+04	2.11E+01	—	—	—	—	5.00E+03	6.70E-02	1.80E+01	1.00E+00	1.80E+01	-	3.80E+02	1.50E-02	-	3.65E+02	NA
Lead		7.70E-02	—	—	—	—	4.00E+02	6.70E-02	3.60E+01	1.00E+00	4.30E+01	-	3.31E+00	2.50E-02	-	0.00E+00	NA
Manganese		1.60E+00	—	—	—	—	1.00E+03	6.70E-02	1.30E+01	1.00E+00	1.30E+01	-	2.08E+01	6.00E-03	-	0.00E+00	NA
Phosphorus			—	—	—	—	3.50E+00	6.70E-02	NA	1.00E+00	0.00E+00	-	0.00E+00	0.00E+00	-	0.00E+00	NA

Plum Brook Ordnance Works
West Area Red Water Ponds

Toxicity Data

Chemical Name	Mammals			Birds		
	NOAEL (mg/kg/d)	Test Species	Body Wt. (kg)	NOAEL (mg/kg/d)	Test Species	Body Wt. (kg)
Organics						
2-Amino-4,6-Dinitrotoluene	1.39E+01	rat	0.35	7.00E-01	Bobwhite quail	0.19
Inorganics						
Aluminum	1.93E+00	mouse	0.03	1.10E+02	ringed dove	0.155
Arsenic	1.26E-01	mouse	0.03	2.46E+00	cowbird	0.049
Calcium	1.05E+03	rabbit	3.8	2.83E+03	Jap. Quail	0.072
Copper	1.17E+01	mink	1	4.70E+01	chicks	0.534
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Lead	8.00E+00	rat	0.35	3.85E+00	Am. Kestrel	0.13
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072
Phosphorus	5.26E+02	rabbit	3.8	4.00E+02	poultry	1.6

Plum Brook Ordnance Works
West Area Red Water Ponds

Piscivorous Bird: **Great Blue Heron *(Ardea herodias)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Macroinvert Intake (mg/kg-d)	Macroinvert Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
2-Amino-4,6-Dinitrotoluene	7.00E-01	8.00E+00	8.75E-02	1.00E+00	1.08E-03	1.23E-02	0.00E+00	0.00E+00	1.41E-01	1.61E+00	1.62E+00	0.00E+00	0.00E+00	1.62E+00
Inorganics														
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	2.46E+00	8.00E+00	3.08E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	2.83E+03	8.00E+00	3.54E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	4.70E+01	8.00E+00	5.88E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E+00	8.71E+01	1.39E+01	6.62E+01	1.06E+01	2.65E+00	4.23E-01	2.49E+01	9.57E-01	1.53E-01	2.51E+01
Lead	3.85E+00	8.00E+00	4.81E-01	1.00E+00	0.00E+00	0.00E+00	5.77E-01	1.20E+00	0.00E+00	0.00E+00	1.20E+00	3.49E-03	7.26E-03	1.21E+00
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	0.00E+00	0.00E+00	3.62E+00	2.97E-02	0.00E+00	0.00E+00	2.97E-02	7.26E-02	5.94E-04	3.03E-02
Phosphorus	4.00E+02	8.00E+00	5.00E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL						**1.39E+01**		**1.18E+01**		**4.23E-01**	**2.62E+01**		**1.61E-01**	**2.63E+01**

Body Weight (kg)	2.204
Water intake (L/d)	0.1
Food intake (kg(dw)/d)	0.4
Sediment intake (kg/d)	0.0079
Fish intake (kg(dw)/d) -- 96% of diet	0.384
Macroinvert intake (kg(dw)/d) -- 4% of diet	0.016

Plum Brook Ordnance Works
West Area Red Water Ponds

Omnivorous mammal: **Raccoon *(Procyon lotor)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (sed./sw.)	Sediment Intake (mg/kg-d)	Sediment Hazard Quotient	Aq. Invert. Intake (mg/kg-d)	Aq. Invert. Hazard Quotient	Fish Intake (mg/kg-d)	Fish Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics														
2-Amino-4,6-Dinitrotoluene	7.11E+00	8.00E+00	8.89E-01	1.00E+00	7.06E-04	7.94E-04	2.07E-01	2.33E-01	0.00E+00	0.00E+00	2.34E-01	0.00E+00	0.00E+00	2.34E-01
Inorganics														
Aluminum	5.34E-01	8.00E+00	6.68E-02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	3.49E-02	8.00E+00	4.36E-03	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Calcium	9.78E+02	8.00E+00	1.22E+02	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Copper	7.79E+00	8.00E+00	9.73E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	5.72E+01	1.89E+01	3.90E+00	1.29E+00	3.87E-01	1.28E-01	2.04E+01	8.90E-01	2.95E-01	2.07E+01
Lead	4.09E+00	8.00E+00	5.12E-01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E-03	6.60E-03	6.60E-03	3.25E-03	6.34E-03	1.29E-02
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.12E-02	3.77E-03	3.77E-03	6.75E-02	1.20E-02	1.57E-02
Phosphorus	4.89E+02	8.00E+00	6.11E+01	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL						**1.89E+01**		**1.29E+00**		**1.39E-01**	**2.04E+01**		**3.13E-01**	**2.07E+01**

Body Weight (kg)	5.1
Water intake (L/d)	0.215
Food intake (kg(dw)/d)	0.26
Sediment intake (kg/d)	0.012
Aquatic Invert. Intake (kg(dw)/d -- 21% of diet	0.0546
Fish intake (kg(dw)/d) -- 2% of diet	0.0052

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Chemical Data

Chemical Name	Surface Soil Conc. (mg/kg)	Total Soil Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Soil-to-Plant TF	Shallow-rooted Plant Conc. (mg/kgdw)	Deep-rooted Plant Conc. (mg/kgdw)	Soil-to-Invert. BAF	Invert. Conc. (mg/kgdw)	Food-to-Muscle TF
Organics										
1,3-DNB	2.00E-01	4.80E-01		1.49E+00	5.33E+00	1.07E+00	2.56E+00	1.00E-01	2.00E-02	6.37E-07
4-Amino-2,6-DNT				2.00E+00	2.70E+00	0.00E+00	0.00E+00	1.00E-01	0.00E+00	2.14E-06
Nitrobenzene				1.87E+00	3.21E+00	0.00E+00	0.00E+00	1.00E-01	0.00E+00	1.57E-06
1,3,5-TNB	2.00E-01	1.80E+00		1.18E+00	8.05E+00	1.61E+00	1.45E+01	1.00E-01	2.00E-02	3.05E-07
Inorganics										
Aluminum				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Antimony				---	5.60E-04	0.00E+00	0.00E+00	1.00E+00	0.00E+00	4.00E-05
Iron				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Magnesium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02
Manganese				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Potassium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Toxicity Data

Chemical Name	Mammals			Birds		
	LOAEL (mg/kg/d)	Test Species	Body Wt. (kg)	LOAEL (mg/kg/d)	Test Species	Body Wt. (kg)
Organics						
1,3-DNB	1.13E+00	rat	0.35	4.20E+00	red winged black bird	0.077
4-Amino-2,6-DNT	9.59E+01	rat	0.35	1.78E+01	Bobwhite quail	0.19
Nitrobenzene	2.30E+00	rat	0.03	4.20E+00	red winged black bird	0.077
1,3,5-TNB	1.33E+01	rat	0.35	4.20E+00	red winged black bird	0.077
Inorganics						
Aluminum	1.93E+01	mouse	0.03	1.10E+03	ringed dove	0.155
Antimony	1.25E+00	mouse	0.03	–	–	–
Iron	1.30E+02	rabbit	3.8	2.50E+02	poultry	1.6
Magnesium	7.90E+02	rabbit	3.8	7.50E+02	poultry	1.6
Manganese	2.84E+02	rat	0.35	9.77E+03	Jap. Quail	0.072
Potassium	7.90E+03	rabbit	3.8	5.00E+03	poultry	1.6

Plum Brook O. ..nce Site
Pentolite Road Red Water Ponds

Omnivorous Rodent: Deer mouse *(Peromyscus manicalatus)*

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Plant/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics																
1,3-DNB	2.49E+00	1.00E+00	2.49E+00	1.00E+00	1.00E+00	7.70E-04	3.09E-04	1.23E-01	4.94E-02	1.48E-03	5.92E-04	5.03E-02	0.00E+00	0.00E+00	5.03E-02	9.35E-07
4-Amino-2,6-DNT	2.11E+02	1.00E+00	2.11E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	2.74E+00	1.00E+00	2.74E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	2.94E+01	1.00E+00	2.94E+01	1.00E+00	1.00E+00	7.70E-04	2.62E-05	1.86E-01	6.33E-03	1.48E-03	5.03E-05	6.41E-03	0.00E+00	0.00E+00	6.41E-03	6.71E-07
Inorganics																
Aluminum	2.30E+01	1.00E+00	2.30E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	1.49E+00	1.00E+00	1.49E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.20E+02	1.00E+00	5.20E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	3.16E+03	1.00E+00	3.16E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	6.26E+02	1.00E+00	6.26E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	3.16E+04	1.00E+00	3.16E+04	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**3.35E-04**		**5.57E-02**		**6.42E-04**	**5.67E-02**		**0.00E+00**	**5.67E-02**	

Body Weight (kg)	0.0148
Water intake (L/d)	0.0022
Food intake (kg(dw)/d)	0.0028
Soil intake (kg/d)	0.000057
Plant intake (kg(dw)/d) – 61% of diet	0.001708
Invertebrate intake (kg(dw)/d) – 39% of diet	0.001092

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Opportunistic Omnivore: **Raccoon *(Procyon lotor)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																	
1,3-DNB	5.78E-01	1.00E+00	5.78E-01	1.00E+00	1.00E+00	4.71E-04	8.14E-04	2.28E-02	3.95E-02	3.06E-04	5.29E-04	2.38E-09	4.12E-09	4.08E-02	0.00E+00	0.00E+00	4.08E-02
4-Amino-2,6-DNT	4.91E+01	1.00E+00	4.91E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	6.37E-01	1.00E+00	6.37E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	6.81E+00	1.00E+00	6.81E+00	1.00E+00	1.00E+00	4.71E-04	6.91E-05	3.45E-02	5.06E-03	3.06E-04	4.49E-05	1.71E-09	2.51E-10	5.18E-03	0.00E+00	0.00E+00	5.18E-03
Inorganics																	
Aluminum	5.34E+00	1.00E+00	5.34E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	3.46E-01	1.00E+00	3.46E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.21E+02	1.00E+00	1.21E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	7.34E+02	1.00E+00	7.34E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	1.45E+02	1.00E+00	1.45E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	7.34E+03	1.00E+00	7.34E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**8.83E-04**		**4.45E-02**		**5.74E-04**		**4.37E-09**	**4.60E-02**		**0.00E+00**	**4.60E-02**

Body Weight (kg)	5.1
Water intake (L/d)	0.43
Food intake (kg(dw)/d)	0.26
Soil intake (kg/d)	0.012
Mouse Intake (kg(dw)/d) -- 5 % of diet	0.013
Plant intake (kg(dw)/d) -- 42% of diet	0.1092
Invertebrate intake (kg(dw)/d) -- 30% of diet	0.078

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Herbivorous Rodent: **Eastern Cottontail *(Sylvilagus floridanus)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	1.51E+00	1.00E+00	1.51E+00	1.00E+00	1.00E+00	1.06E-03	7.02E-04	9.04E-02	5.99E-02	6.06E-02	0.00E+00	0.00E+00	6.06E-02	2.02E-06
4-Amino-2,6-DNT	1.28E+02	1.00E+00	1.28E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	1.66E+00	1.00E+00	1.66E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	1.78E+01	1.00E+00	1.78E+01	1.00E+00	1.00E+00	1.06E-03	5.96E-05	1.37E-01	7.68E-03	7.74E-03	0.00E+00	0.00E+00	7.74E-03	1.45E-06
Inorganics														
Aluminum	1.39E+01	1.00E+00	1.39E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	9.03E-01	1.00E+00	9.03E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	3.15E+02	1.00E+00	3.15E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	1.92E+03	1.00E+00	1.92E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	3.79E+02	1.00E+00	3.79E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.91E+04	1.00E+00	1.91E+04	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**7.62E-04**		**6.76E-02**	**6.84E-02**		**0.00E+00**	**6.84E-02**	

Body Weight (kg)	1.132
Water intake (L/d)	0.11
Food intake (kg(dw)/d)	0.096
Soil intake (kg/d)	0.006
Plant intake (kg(dw)/d) – 100% of diet	0.096

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Insectivorous mammal: **Short-tailed shrew *(Blarina brevicauda)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	3.97E+00	1.00E+00	3.97E+00	1.00E+00	1.00E+00	2.66E-02	6.69E-03	1.07E-02	2.69E-03	9.38E-03	0.00E+00	0.00E+00	9.38E-03	1.26E-07
4-Amino-2,6-DNT	3.37E+02	1.00E+00	3.37E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	4.37E+00	1.00E+00	4.37E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	4.67E+01	1.00E+00	4.67E+01	1.00E+00	1.00E+00	9.96E-02	2.13E-03	1.07E-02	2.28E-04	2.36E-03	0.00E+00	0.00E+00	2.36E-03	1.78E-07
Inorganics														
Aluminum	3.67E+01	1.00E+00	3.67E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	2.38E+00	1.00E+00	2.38E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	8.29E+02	1.00E+00	8.29E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	5.04E+03	1.00E+00	5.04E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	9.97E+02	1.00E+00	9.97E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	5.03E+04	1.00E+00	5.03E+04	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**8.82E-03**		**2.92E-03**	**1.17E-02**		**0.00E+00**	**1.17E-02**	

Body Weight (kg)	0.015
Water intake (L/d)	0.0023
Food intake (kg(dw)/d)	0.008
Soil intake (kg/d)	0.00083
Invertebrate intake (kg(dw)/d)–100% of diet	0.008

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Herbivorous Mammal: **White-tailed deer *(Odocoileus virginianus)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics													
1,3-DNB	6.15E-01	1.00E+00	6.15E-01	1.00E-02	1.00E-02	1.31E-06	2.13E-06	8.39E-04	1.37E-03	1.37E-03	0.00E+00	0.00E+00	1.37E-03
4-Amino-2,6-DNT	5.22E+01	1.00E+00	5.22E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	6.77E-01	1.00E+00	6.77E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	7.24E+00	1.00E+00	7.24E+00	1.00E-02	1.00E-02	1.31E-06	1.81E-07	4.75E-03	6.57E-04	6.57E-04	0.00E+00	0.00E+00	6.57E-04
Inorganics													
Aluminum	5.68E+00	1.00E+00	5.68E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	3.68E-01	1.00E+00	3.68E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.28E+02	1.00E+00	1.28E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	7.80E+02	1.00E+00	7.80E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	1.54E+02	1.00E+00	1.54E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	7.79E+03	1.00E+00	7.79E+03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**2.32E-06**		**2.02E-03**	**2.02E-03**		**0.00E+00**	**2.02E-03**

Body Weight (kg)	61
Water intake (L/d)	4
Food intake (kg(dw)/d)	2
Soil intake (kg/d)	0.04
Plant intake (kg(dw)/d) -- 100% of diet	2

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Insectivorous Bird: **Marsh wren *(Cistothorus palustris)***

Chemical Name	LOAEL	Uncertainty Factor	Adjusted LOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	4.20E+00	1.00E+00	4.20E+00	1.00E+00	1.00E+00	3.80E-03	9.05E-04	1.90E-02	4.52E-03	5.43E-03	0.00E+00	0.00E+00	5.43E-03	4.68E-08
4-Amino-2,6-DNT	1.78E+01	1.00E+00	1.78E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	4.20E+00	1.00E+00	4.20E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	4.20E+00	1.00E+00	4.20E+00	1.00E+00	1.00E+00	3.80E-03	9.05E-04	1.90E-02	4.52E-03	5.43E-03	0.00E+00	0.00E+00	5.43E-03	2.24E-08
Inorganics														
Aluminum	1.10E+03	1.00E+00	1.10E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	0.00E+00	1.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.50E+02	1.00E+00	2.50E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	7.50E+02	1.00E+00	7.50E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	9.77E+03	1.00E+00	9.77E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	5.00E+03	1.00E+00	5.00E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**1.81E-03**		**9.05E-03**	**1.09E-02**		**0.00E+00**	**1.09E-02**	

Body Weight (kg)	0.01
Water intake (L/d)	0.0027
Food intake (kg(dw)/d)	0.0095
Soil intake (kg/d)	0.00019
Plant intake (kg(dw)/d) -- 0% of diet	0
Invertebrate intake (kg(dw)/d) -- 100% of die	0.0095

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Chemical Data

Chemical Name	Surface Soil Conc. (mg/kg)	Total Soil Conc. (mg/kg)	Water Conc. (mg/L)	log Kow (organics)	Soil-to-Plant TF	Shallow-rooted Plant Conc. (mg/kgdw)	Deep-rooted Plant Conc. (mg/kgdw)	Soil-to-Invert. BAF	Invert. Conc. (mg/kgdw)	Food-to-Muscle TF
Organics										
1,3-DNB	1.25E-01	1.25E-01		1.49E+00	5.33E+00	6.66E-01	6.66E-01	1.00E-01	1.25E-02	6.37E-07
4-Amino-2,6-DNT				2.00E+00	2.70E+00	0.00E+00	0.00E+00	1.00E-01	0.00E+00	2.14E-06
Nitrobenzene				1.87E+00	3.21E+00	0.00E+00	0.00E+00	1.00E-01	0.00E+00	1.57E-06
1,3,5-TNB	1.25E-01	1.25E-01		1.18E+00	8.05E+00	1.01E+00	1.01E+00	1.00E-01	1.25E-02	3.05E-07
Inorganics										
Aluminum				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Antimony				---	5.60E-04	0.00E+00	0.00E+00	1.00E+00	0.00E+00	4.00E-05
Iron				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Magnesium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02
Manganese				---	NA	0.00E+00	0.00E+00	NA	0.00E+00	NA
Potassium				---	7.80E-01	0.00E+00	0.00E+00	1.00E+00	0.00E+00	2.00E-02

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Toxicity Data

Chemical Name	Mammals NOAEL (mg/kg/d)	Mammals Test Species	Mammals Body Wt. (kg)	Birds NOAEL (mg/kg/d)	Birds Test Species	Birds Body Wt. (kg)
Organics						
1,3-DNB	1.13E-01	rat	0.35	4.20E-01	red winged black bird	0.077
4-Amino-2,6-DNT	9.59E+00	rat	0.35	7.00E-01	Bobwhite quail	0.19
Nitrobenzene	2.30E-01	rat	0.35	4.20E-01	red winged black bird	0.077
1,3,5-TNB	2.68E+00	rat	0.35	4.20E-01	red winged black bird	0.077
Inorganics						
Aluminum	1.93E+00	mouse	0.03	1.10E+02	ringed dove	0.155
Antimony	1.25E-01	mouse	0.03	—	—	—
Iron	2.60E+01	rabbit	3.8	5.00E+01	poultry	1.6
Magnesium	1.58E+02	rabbit	3.8	1.50E+02	poultry	1.6
Manganese	8.80E+01	rat	0.35	9.77E+02	Jap. Quail	0.072
Potassium	1.58E+03	rabbit	3.8	1.00E+03	poultry	1.6

Plum Brook Ordnance Site
Pentolite Road Red Water Ponds

Omnivorous Rodent: **Deer mouse *(Peromyscus manicalatus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Plant/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics																
1,3-DNB	2.49E-01	8.00E+00	3.11E-02	1.00E+00	1.00E+00	4.81E-04	1.55E-02	7.69E-02	2.47E+00	9.22E-04	2.96E-02	2.51E+00	0.00E+00	0.00E+00	2.51E+00	5.84E-07
4-Amino-2,6-DNT	2.11E+01	8.00E+00	2.64E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	5.07E-01	8.00E+00	6.34E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	5.91E+00	8.00E+00	7.39E-01	1.00E+00	1.00E+00	4.81E-04	6.52E-04	1.16E-01	1.57E-01	9.22E-04	1.25E-03	1.59E-01	0.00E+00	0.00E+00	1.59E-01	4.20E-07
Inorganics																
Aluminum	2.30E+00	8.00E+00	2.88E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	1.49E-01	8.00E+00	1.86E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.04E+02	8.00E+00	1.30E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	6.32E+02	8.00E+00	7.91E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	1.94E+02	8.00E+00	2.43E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	6.32E+03	8.00E+00	7.90E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							1.61E-02		2.63E+00		3.09E-02	2.67E+00		0.00E+00	2.67E+00	

Body Weight (kg)	0.0148
Water intake (L/d)	0.0022
Food intake (kg(dw)/d)	0.0028
Soil intake (kg/d)	0.000057
Plant intake (kg(dw)/d) – 61% of diet	0.001708
Invertebrate intake (kg(dw)/d) – 39% of diet	0.001092

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Opportunistic Omnivore: **Raccoon *(Procyon lotor)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Mouse Intake (mg/kg-d)	Mouse Intake Hazard Quotient	Total Intake Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics																	
1,3-DNB	5.78E-02	8.00E+00	7.23E-03	1.00E+00	1.00E+00	2.94E-04	4.07E-02	1.43E-02	1.97E+00	1.91E-04	2.64E-02	1.49E-09	2.06E-07	2.04E+00	0.00E+00	0.00E+00	2.04E+00
4-Amino-2,6-DNT	4.91E+00	8.00E+00	6.14E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	1.18E-01	8.00E+00	1.47E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	1.37E+00	8.00E+00	1.71E-01	1.00E+00	1.00E+00	2.94E-04	1.72E-03	2.16E-02	1.26E-01	1.91E-04	1.11E-03	1.07E-09	6.24E-09	1.29E-01	0.00E+00	0.00E+00	1.29E-01
Inorganics																	
Aluminum	5.34E-01	8.00E+00	6.68E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	3.46E-02	8.00E+00	4.33E-03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.42E+01	8.00E+00	3.02E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	1.47E+02	8.00E+00	1.83E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	4.50E+01	8.00E+00	5.63E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.47E+03	8.00E+00	1.83E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**4.24E-02**		**2.10E+00**		**2.76E-02**		**2.12E-07**	**2.17E+00**		**0.00E+00**	**2.17E+00**

Body Weight (kg)	5.1
Water Intake (L/d)	0.43
Food Intake (kg(dw)/d)	0.26
Soil Intake (kg/d)	0.012
Mouse Intake (kg(dw)/d) -- 5 % of diet	0.013
Plant Intake (kg(dw)/d) -- 42% of diet	0.1092
Invertebrate intake (kg(dw)/d) -- 30% of diet	0.078

Plum Brook Or. .ice Works
Pentolite Road Red Water Ponds

Herbivorous Rodent: **Eastern Cottontail *(Sylvilagus floridanus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	1.51E-01	8.00E+00	1.89E-02	1.00E+00	1.00E+00	6.63E-04	3.51E-02	5.65E-02	3.00E+00	3.03E+00	0.00E+00	0.00E+00	3.03E+00	1.26E-06
4-Amino-2,6-DNT	1.28E+01	8.00E+00	1.60E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	3.07E-01	8.00E+00	3.84E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	3.58E+00	8.00E+00	4.47E-01	1.00E+00	1.00E+00	6.63E-04	1.48E-03	8.54E-02	1.91E-01	1.92E-01	0.00E+00	0.00E+00	1.92E-01	9.09E-07
Inorganics														
Aluminum	1.39E+00	8.00E+00	1.74E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	9.03E-02	8.00E+00	1.13E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	6.30E+01	4.00E+00	1.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	3.83E+02	4.00E+00	9.58E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	1.18E+02	8.00E+00	1.47E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	3.83E+03	4.00E+00	9.57E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**3.66E-02**		**3.19E+00**	**3.22E+00**		**0.00E+00**	**3.22E+00**	

Body Weight (kg)	1.132
Water intake (L/d)	0.11
Food intake (kg(dw)/d)	0.096
Soil intake (kg/d)	0.006
Plant intake (kg(dw)/d) -- 100% of diet	0.096

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Insectivorous mammal: **Short-tailed shrew *(Blarina brevicauda)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	3.97E-01	8.00E+00	4.96E-02	1.00E+00	1.00E+00	6.92E-03	1.39E-01	6.67E-03	1.34E-01	2.74E-01	0.00E+00	0.00E+00	2.74E-01	4.59E-08
4-Amino-2,6-DNT	3.37E+01	8.00E+00	4.21E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	8.08E-01	8.00E+00	1.01E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	9.41E+00	8.00E+00	1.18E+00	1.00E+00	1.00E+00	6.92E-03	5.88E-03	6.67E-03	5.67E-03	1.15E-02	0.00E+00	0.00E+00	1.15E-02	2.20E-08
Inorganics														
Aluminum	3.67E+00	8.00E+00	4.58E-01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	2.38E-01	8.00E+00	2.97E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	1.66E+02	8.00E+00	2.07E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	1.01E+03	8.00E+00	1.26E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	3.09E+02	8.00E+00	3.86E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.01E+04	8.00E+00	1.26E+03	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**1.45E-01**		**1.40E-01**	**2.85E-01**		**0.00E+00**	**2.85E-01**	

Body Weight (kg)	0.015
Water intake (L/d)	0.0023
Food intake (kg(dw)/d)	0.008
Soil intake (kg/d)	0.00083
Invertebrate intake (kg(dw)/d)—100% of diet	0.008

Plum Brook Or ice Works
Pentolite Road Red Water Ponds

Herbivorous Mammal: **White-tailed deer *(Odocoileus virginianus)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Plant Intake (mg/kg-d)	Plant Intake Hazard Quotient	Soil/Plant Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index
Organics													
1,3-DNB	6.15E-02	8.00E+00	7.68E-03	1.00E-02	1.00E-02	8.20E-07	1.07E-04	2.18E-04	2.84E-02	2.85E-02	0.00E+00	0.00E+00	2.85E-02
4-Amino-2,6-DNT	5.22E+00	8.00E+00	6.52E-01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	1.25E-01	8.00E+00	1.56E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	1.46E+00	8.00E+00	1.82E-01	1.00E-02	1.00E-02	8.20E-07	4.50E-06	3.30E-04	1.81E-03	1.82E-03	0.00E+00	0.00E+00	1.82E-03
Inorganics													
Aluminum	5.68E-01	8.00E+00	7.10E-02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	3.68E-02	8.00E+00	4.60E-03	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	2.57E+01	8.00E+00	3.21E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	1.56E+02	8.00E+00	1.95E+01	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	4.79E+01	8.00E+00	5.98E+00	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.56E+03	8.00E+00	1.95E+02	1.00E-02	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**1.11E-04**		**3.02E-02**	**3.04E-02**		**0.00E+00**	**3.04E-02**

Body Weight (kg)	61
Water intake (L/d)	4
Food intake (kg(dw)/d)	2
Soil intake (kg/d)	0.04
Plant intake (kg(dw)/d) – 100% of diet	2

Plum Brook Ordnance Works
Pentolite Road Red Water Ponds

Insectivorous Bird: **Marsh wren *(Cistothorus palustris)***

Chemical Name	NOAEL	Uncertainty Factor	Adjusted NOAEL	Foraging Factor (soil)	Foraging Factor (sw)	Soil Intake (mg/kg-d)	Soil Intake Hazard Quotient	Invert. Intake (mg/kg-d)	Invert. Intake Hazard Quotient	Soil/Invert. Hazard Quotient	Water Intake (mg/kg-d)	Water Hazard Quotient	Overall Hazard Index	Tissue Conc. mg/kg(dw)
Organics														
1,3-DNB	4.20E-01	8.00E+00	5.25E-02	1.00E+00	1.00E+00	2.38E-03	4.52E-02	1.19E-02	2.26E-01	2.71E-01	0.00E+00	0.00E+00	2.71E-01	2.93E-08
4-Amino-2,6-DNT	7.00E-01	8.00E+00	8.75E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrobenzene	4.20E-01	8.00E+00	5.25E-02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,3,5-TNB	4.20E-01	8.00E+00	5.25E-02	1.00E+00	1.00E+00	2.38E-03	4.52E-02	1.19E-02	2.26E-01	2.71E-01	0.00E+00	0.00E+00	2.71E-01	1.40E-08
Inorganics														
Aluminum	1.10E+02	8.00E+00	1.38E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Antimony	0.00E+00	8.00E+00	0.00E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iron	5.00E+01	8.00E+00	6.25E+00	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Magnesium	1.50E+02	8.00E+00	1.88E+01	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese	9.77E+02	8.00E+00	1.22E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potassium	1.00E+03	8.00E+00	1.25E+02	1.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL							**9.05E-02**		**4.52E-01**	**5.43E-01**		**0.00E+00**	**5.43E-01**	

Body Weight (kg)	0.01
Water intake (L/d)	0.0027
Food intake (kg(dw)/d)	0.0095
Soil intake (kg/d)	0.00019
Plant intake (kg(dw)/d) – 0% of diet	0
Invertebrate intake (kg(dw)/d) – 100% of die	0.0095