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May 14, 2013

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Subject: ***Submittal of the Final Addendum to the Red Water Pond Areas Focused Feasibility Study for Soil Former Plum Brook Ordnance Works, Sandusky, Ohio Contract No. W912QR-08-D-0013: Shaw Project Number 132458***

Dear Ms. Coleman:

In accordance with the requirements of Delivery Order No. DX03 of Contract No. W912QR-08-D-0013 awarded to Shaw Environmental & Infrastructure, Inc., a CB&I company, we are pleased to submit the Final Addendum to the Red Water Pond Areas Focused Feasibility Study for Soil at the Former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio. This report was prepared consistent with other PBOW feasibility studies, U.S. Environmental Protection Agency guidance, and communications with the U.S. Army Corps of Engineers regarding the scope and format of this report. This final version incorporates responses to comments received on drafts of this document.

Enclosed for your records are four copies of this report. Copies have also been sent to those on the distribution list as indicated.

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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G05OH001820_04.09_1003_a

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Client Name: U.S. Army Engineer District, Nashville; CELRN-EC-E

Project Description: Red Water Pond Area Focused Feasibility Study Addendum
Former Plum Brook Ordnance Works, Sandusky, Ohio

Contract No. W912QR-08-D-0013 Delivery Order No. DX03

Project No. 132458 Task/Phase Number: 14000000

Document Type	Identify specific section or segment covered by this checkprint	**Document Origin**
☐ Technical / Cost Proposal		X Originator Developed
☐ RFP		☐ Edited Standard
☐ Contract / Subcontract		☐ Client Furnished
☐ Work Plans		
X Report	Feasibility Study Report Addendum	**Document Status**
☐ Risk Assessment / Evaluation		☐ Preliminary
☐ Specifications & Plans		☐ Internal Draft
☐ Design Calculations		☐ Draft
☐ Tables		☐ Draft Final
☐ Drawings / Figures		X Final
☐ Other:		☐ Other:

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Final

Addendum for Red Water Pond Areas Focused Feasibility Study for Soil
FUDS Project No. G05OH001820
Former Plum Brook Ordnance Works
Sandusky, Ohio

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May 2013

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List of Acronyms

ADNT	aminodinitrotoluene
ARAR	applicable or relevant and appropriate requirement
ATS	alternative treatment standard
BCY	bank cubic yard
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
^{14}C	carbon-14
C/N	carbon to nitrogen
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
CY	cubic yard
°C	degrees Celsius
DAT	diaminotoluene
DNB	dinitrobenzene
DNT	dinitrotoluene
DOD	U.S. Department of Defense
EC_{50}	half maximal effective concentration
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
FFS	focused feasibility study
FS	feasibility study
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
IT	IT Corporation
LCY	loose cubic yard
LDR	land disposal restriction
McTech	McTech Corporation
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mM	millimoles per liter
^{15}N	nitrogen-15
NAC	nitroaromatic compound
NaOH	sodium hydroxide

List of Acronyms *(Continued)*

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NTCRA	non-time-critical removal action
O&M	operation and maintenance
OH	hydroxide ion
PBOW	Plum Brook Ordnance Works
PPE	personal protective equipment
PRRWP	Pentolite Road Red Water Pond
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RG	remedial goal
RI	remedial investigation
RSL	regional screening level
Shaw	Shaw Environmental and Infrastructure, Inc.
SLERA	screening-level ecological risk assessment
TAT	triaminotoluene
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TDL	Technology Development Laboratory
TNB	trinitrobenzene
TNT	trinitrotoluene
TNTB	TNT Area B
TNTC	TNT Area C
TSDF	treatment, storage, and disposal facility
TTI	Tetra Tech, Inc.
UHC	underlying hazardous constituent
USACE	U.S. Army Corps of Engineers
UTS	universal treatment standard
VAAP	Volunteer Army Ammunition Plant

Executive Summary

This feasibility study addendum is a supplement and partial revision to the Red Water Pond Areas focused feasibility study (FFS) for soil that was finalized in December 2002. This addendum addresses changes to the FFS for the Pentolite Road Red Water Pond (PRRWP) Area, located at the former Plum Brook Ordnance Works (PBOW) in Sandusky, Ohio. The U.S. Army Corps of Engineers contracted Shaw Environmental and Infrastructure, Inc. (Shaw) (a CB&I company), to conduct this FFS addendum under Contract Number W912QR-08-D-0013. This addendum was prepared for the PRRWP Area only. This addendum does not change the evaluation of the West Area Red Water Pond soil in the 2002 FFS.

The feasibility study addendum has the following objectives:

- Revise remedial action objectives, chemicals of concern (COC), remedial goals (RG), remedial area and volume estimates, and applicable or relevant and appropriate requirements (ARAR) for remedial action.
- Revise the technology screening for chemical stabilization and windrow composting and add a technology evaluation for alkaline hydrolysis.
- Revise the development and detailed analysis of remedial alternatives.
- Revise the cost tables.
- Revise the comparative analysis of remedial alternatives.
- Update the references.
- Present the final PRRWP Area site delineation report (replaces and rescinds the remedial goal option calculation for trinitrotoluene [TNT]) presented in the final FFS.
- Present a comparison of delineation sample results to RGs.

This information is presented as revised text, tables, figures and appendices of the final FFS. As such, these sections and tables are numbered according to their placement in the FFS where possible. The FFS addendum includes new material and sections not presented in the final FFS, which has caused some of the sections to be renumbered.

This addendum is not intended as a stand-alone document. Please refer to the final FFS for background information on PBOW and the PRRWP Area, including site description and history. The remedial action objective for the PRRWP Area is:

- Prevention of human exposure via direct contact (i.e., incidental ingestion and dermal contact) to site soil containing the COCs at concentrations that exceed the RGs for PRRWP Area soil, which were developed assuming unrestricted land use.

The COCs and RGs for soil are listed in the following table.

Chemical of Concern	Remedial Goal (mg/kg)
1,3-Dinitrobenzene	6.1
2-Amino-4,6-dinitrotoluene	15
4-Amino-2,6-dinitrotoluene	15
Combined aminodinitrotoluenes	30
2,4-Dinitrotoluene	5.6
2,6-Dinitrotoluene	1.6
Combined dinitrotoluenes	7.2
1,3,5-Trinitrobenzene	220
2,4,6-Trinitrotoluene	36

mg/kg – Milligrams per kilogram.

The following process options and technologies were revised or added to the technology screening:

- Chemical stabilization
- Windrow composting
- Alkaline hydrolysis.

Four remedial alternatives were developed and evaluated based on the revised technology screening. The remedial costs account for changes in volumes associated with treatment. The four remedial alternatives are as follows:

- ***Alternative 1 – No Further Action.***

- ***Alternative 2 – Excavation and Off-Site Disposal.*** Excavation of 21,146 bank cubic yards (BCY) of contaminated soil. Off-site treatment and/or disposal of 7,331 loose cubic yards (LCY) of soil that is a hazardous waste due to elevated concentrations of 2,4-dinitrotoluene (DNT) at an approved hazardous waste disposal facility. Off-site disposal of 20,160 LCY of untreated nonhazardous soil at an approved solid waste landfill.

- ***Alternative 3 – Excavation, Windrow Composting, and Off-Site Disposal.*** Excavation of 21,146 BCY of contaminated soil. Windrow composting of 7,331 LCY of soil that is a hazardous waste due to elevated concentrations of 2,4-DNT. Off-site

disposal of the composted soil and 20,160 LCY of untreated nonhazardous soil in an approved solid waste landfill.

- ***Alternative 4 - Excavation, Alkaline Hydrolysis, and Off-Site Disposal.*** Excavation of 21,146 BCY of contaminated soil. Alkaline hydrolysis of 7,331 LCY of soil that is a hazardous waste due to elevated concentrations of 2,4-DNT. Off-site disposal of the treated soil and 20,160 LCY of untreated nonhazardous soil in an approved solid waste landfill.

The remedial alternatives were evaluated with respect to the seven threshold and balancing criteria specified by the Comprehensive Environmental Response, Compensation and Liability Act. The threshold criteria are protection of human health and the environment and compliance with ARARs. The balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility and volume of contamination; short-term effectiveness; implementability; and cost. The modifying criteria of state and community acceptance will be evaluated later in a decision document.

Each of the alternatives, with the exception of Alternative 1, would meet the threshold criteria of protection of human health and the environment and compliance with ARARs. Alternatives 2 through 4 protect human health and the environment by removing or treating soil with concentrations of COCs above RGs. This action would lower the human health and ecological risks associated with exposure to contaminated soil and protect groundwater resources by removing a potential source of groundwater contamination. Alternative 1 is not protective because soil with concentrations of COCs above RGs would be left in place.

With the exception of Alternative 1, the remaining alternatives are similar with respect to the evaluation of the balancing criteria, although there are some differences. Alternatives 3 and 4 would employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances. Approximately 25 percent of the contaminated soil that is excavated from the site (20 percent of all soil excavated within the remedial area) would be treated under Alternatives 3 and 4 to reduce the leachable concentration of 2,4-DNT to make the soil non-hazardous and comply with the land disposal restrictions (LDR). The soil treated on site would be disposed off site as a nonhazardous waste. Alternative 2 is different in that it would not involve any on-site treatment. The soil that is treated on site under Alternatives 3 and 4 would be disposed off site as a hazardous waste and any treatment required to comply would LDRs would occur at the off-site disposal facility. Alternatives 2, 3 and 4 would manage nonhazardous soil in the same way, disposing the soil in an off-site nonhazardous disposal facility.

Alternatives 3 and 4 use treatment technologies that biologically or chemically convert or transform COCs into less toxic constituents. Windrow composting (Alternative 3) and alkaline hydrolysis (Alternative 4) have been implemented previously at PBOW to treat soil contaminated with nitroaromatic explosive compounds.

The total present value cost (including 25 percent contingency) for each of the four remedial alternatives is provided in the following table. Alternative 4 has the lowest cost of the alternatives that involve remedial action.

Alternative 1	Alternative 2	Alternative 3	Alternative 4
$0	$6.2 million	$6.4 million	$5.5 million

1.0 Introduction

This report is a feasibility study (FS) addendum to the Final Red Water Ponds Focused Feasibility Study (FFS) for Soil at Plum Brook Ordnance Works (PBOW) (IT Corporation [IT], 2002)]. The original FFS was based on a previous understanding that soil contamination at the Pentolite Road Red Water Pond (PRRWP) Area was limited to a relatively small area. During the non-time-critical removal action (NTCRA) (McTech Corporation [McTech], 2009), additional soil contamination was discovered, resulting in a greatly increased estimated volume of soil contamination. This FS addendum summarizes the NTCRA and post-removal action investigation at the PRRWP Area, recalculates the estimated volume of soil requiring remedial action, updates the screening of remedial technologies, and presents a revised evaluation of remedial alternatives to address soil contamination.

Only sections of the text and the associated tables, figures, and appendices that have been revised from those presented in the original FFS are presented in this FS addendum. In this current chapter, only Section 1.7 has been added; Sections 1.1 through 1.6 have not been revised.

Chapter 2.0 identifies the remedial action objectives (RAO), chemicals of concern (COC), and remedial goals (RG); estimates the area and volume of contaminated soil; and identifies applicable or relevant and appropriate requirements (ARAR) for remedial action. Chapter 3.0 screens two remedial technologies, composting and alkaline hydrolysis, for effectiveness, implementability, and cost. The composting technology section updates the screening presented in the FFS (IT, 2002) with some new information. The alkaline hydrolysis technology section is new. This technology as it is currently implemented had not yet been developed at the time the FFS was completed. Chapter 4.0 significantly revises the development and detailed analysis of remedial technologies presented in the final FFS. Chapter 5.0 revises the comparative analysis of remedial alternatives, and Chapter 6.0 presents references used in the FS addendum that were not presented in the FFS.

This report modifies and adds to the appendices presented in the final FFS. Appendix A of the final FFS is rescinded because the evaluation of ARARs has been significantly modified and is now presented in the FS addendum text and tables. Appendix C of the FFS (remedial goal option calculation for trinitrotoluene [TNT]) is rescinded and has been replaced by the PRRWP Area site delineation report (Shaw Environmental & Infrastructure, Inc. [Shaw], [a CB&I company] 2013). Appendix D is new and describes the derivation of exposure point concentrations (EPC)

used in the identification of COCs. Appendix E is new and presents the analytical results of all delineation samples (McTech, 2009; Shaw, 2013), and provides a comparison to RGs.

1.7 Non-Time-Critical Removal Action and Post-Non-Time-Critical Removal Action Soil Delineation

An action memorandum for an NTCRA for PRRWP Area soils was presented to the public in September 2002 (U.S. Army Corps of Engineers [USACE], 2003) to address contamination identified during the remedial investigation (RI) process (IT, 2000). The NTCRA, which commenced in January 2003, eventually included excavation of TNT-contaminated soil, windrow composting, and backfilling of the excavation with clean soil and composted material that met the TNT cleanup criterion of 13.8 milligrams per kilogram (mg/kg) (USACE, 2003). An initial soil volume of 118 cubic yards (CY) (i.e., approximately 20 feet by 20 feet by 8 feet deep) was excavated during the NTCRA. This 20-foot-by-20-foot area was completed based on the area described in the action memorandum. A dark seam of impacted soil was observed along the walls of this initial excavation. This newly discovered dark seam was sampled and analyzed for nitroaromatics. Unexpectedly high concentrations of TNT (up to 1,440 mg/kg) and other nitroaromatics were reported in this material, prompting the need for additional excavation to meet the NTCRA TNT cleanup level. The areal extent of contaminated soil for the NTCRA was identified through the use of exploratory test pits, the collection of soil samples from these pits, and a comparison of the analytical results from these samples to the TNT cleanup criterion of 13.8 mg/kg (McTech, 2009). Excavation floor samples were collected as appropriate to determine the vertical extent of contamination.

Test pits were initially dug radially from the previous excavation walls, approximately 10 feet from the initial 20-foot-by-20-foot excavation to a depth of approximately 8 feet. The analytical results of the samples from each of these test pits yielded TNT concentrations that exceeded the cleanup criterion. Therefore, successive test pits were dug another 10 to 20 feet outward from the previous test pits and radially from the initial excavation, until the TNT concentration from samples collected along the outside wall of each test pit was equal to or less than the 13.8 mg/kg cleanup criterion. Once the TNT cleanup criterion was met along the outside boundary represented by these test pits, which were completed in June 2004, the delineation of the extent of contamination for purposes of the NTCRA was regarded as complete. This area identified by the perimeter test pits was then excavated in 2007. Composite confirmation samples from the soil surface to the bottom of the excavation were collected approximately every 30 feet along the perimeter wall of the excavation and analyzed for nitroaromatics. The TNT concentration of each confirmation sample was less than the NTCRA cleanup criterion (McTech, 2009). The extent of the NTCRA excavation is shown on Figure 1-3.

Prior to completing the PRRWP Area NTCRA excavation, USACE conducted field-scale and laboratory-scale treatability studies to determine the best approach to address the contaminated material. A composting action was selected and begun in 2007 and completed in March 2009. The project was returned to the FS phase at the end of the NTCRA.

After completion of the NTCRA, the analytical results of soil samples collected from the walls of the NTCRA excavation were reviewed, as discussed in the site delineation report (Shaw, 2013), which is included as Appendix C. During this review, it was discovered that concentrations of non-TNT nitroaromatics were higher than expected based on a comparison to the analytical results of the RI samples that were used in the PRRWP Area baseline human health risk assessment (BHHRA). The analytical results of soil samples collected from along the NTCRA wall were compared to U.S. Environmental Protection Agency (EPA) (2004a) Region 9 preliminary remediation goals as a screening method to determine whether the concentrations and the associated noncancer hazard index (HI) and incremental lifetime cancer risks (ILCR) were potentially at unacceptably high levels (i.e., HI>1; ILCR>1E-5) assuming future residential land use. Based on this evaluation, it was found that the HI values associated with the soil samples collected from the perimeter of the excavation wall exceeded 1, with an average HI value of 2. Therefore, USACE deemed further delineation of this contamination beyond the NTCRA excavation necessary. Initial post-NTCRA delineation sampling was conducted by McTech using test pits on a grid pattern in May and June 2009. This included an initial step-out of approximately 30 feet radially from the perimeter of the NTCRA excavation. Additional samples were collected by McTech (2009) from test pits excavated at distances of approximately 60 feet and 90 feet from the perimeter of the NTCRA wall, several of which were submitted for laboratory analysis. An evaluation of these post-NTCRA test pit soil samples determined that data gaps still existed and that the extent of the PRRWP Area soil contamination was not adequately delineated.

Shaw continued to delineate the extent of PRRWP Area contamination as described in the site delineation report (Appendix C) using the grid pattern set up by McTech from July 2009 through November 2009. Additional phased sampling was performed in June 2010 and November 2010. This delineation was performed using a combination of test pit and direct-push soil sampling and analysis. Both test kit sampling and laboratory analysis were used. Cancer risks and noncancer hazards were preliminarily estimated by comparing detected concentrations of nitroaromatics in PRRWP Area delineation soil samples using risk-based delineation levels (described in Appendix C) to estimate ILCRs and HIs associated with individual sample results. These comparisons were not intended to represent an estimate of potential risks to any specific receptor

but were used as a tool to help guide delineation as described in the site delineation report (Appendix C).

2.0 Identification of Remedial Action Objectives at the Pentolite Road Red Water Pond Area

2.1 Introduction

This chapter presents the RAOs, COCs, and RGs for cleanup of contaminated soil that remains at the PRRWP Area after completion of the NTCRA. This chapter also includes an estimate of the remaining area and volume of contaminated soil at the PRRWP Area and ARARs that must be complied with during remedial activities. As described in Sections 1.5 and 1.6 of the Red Water Pond Areas FFS (IT, 2002), no unacceptable U.S. Department of Defense (DOD)-related risks were identified for the West Area Red Water Ponds media; therefore, RAOs and RGs were not developed for the West Area Red Water Ponds.

Section 2.2 presents the RAOs. Section 2.3 identifies the COCs and discusses the basis for their selection. Section 2.4 identifies the RGs and describes their derivation and implications for reduction in potential ecological hazards. Section 2.5 presents estimates of the area and volume of contaminated soil. ARARs associated with potential remediation activities are identified in Section 2.6.

2.2 Remedial Action Objectives

RAOs are cleanup objectives that are developed during the FFS and finalized in the decision document to protect human health and the environment. They consist of medium-specific goals for protecting human health and the environment. RAOs provide the basis for the identification, detailed analysis, and selection of remedial alternatives.

RAOs developed for the protection of human health and the environment specify the following:

- COCs to be addressed
- Relevant exposure routes and receptors
- Chemical concentration limits specific to COCs, environmental media, and specific locations at the site, referred to as RGs.

The RAO for the PRRWP Area is:

- Prevention of human exposure via direct contact (i.e., incidental ingestion and dermal contact) to site soil containing the COCs (Section 2.3) at concentrations that exceed the RGs for PRRWP Area soil, which were developed assuming unrestricted land use (Section 2.4).

2.3 Chemicals of Concern

COCs are typically identified in the FS based on the results of the risk assessments. For human health risks, DOD-related chemicals other than lead (which is not applicable to the PRRWP Area) are selected as COCs at PBOW sites based on the criteria presented in the following bullets. These criteria are consistent with those used for other PBOW site FSs (e.g., IT [2000] and Shaw [2003; 2006; 2008; 2011]):

- Significant chemical-specific contribution to an overall site-related human health ILCR that exceeds 1E-5. Significant contribution is defined as a chemical-specific ILCR of 1E-6 or greater.

- Significant chemical-specific contribution to an overall site-related human health HI that exceeds a value of 1. Significant contribution is defined as a chemical-specific HI of 0.1 or greater.

The characterization and delineation of DOD-related soil contaminants in the PRRWP Area for this FFS rely on results from samples that have been collected since completion of the BHHRA. As a result, the BHHRA results are not adequate for the identification of COCs. No formal human health risk assessment has been performed based on the post-NTCRA samples, which were collected to delineate the residual contamination.

The post-NTCRA samples were used to identify COCs by deriving EPCs as described in Appendix D. EPCs are calculated as representative chemical-specific concentrations over a given area to which a receptor may be exposed (EPA, 1989). The EPCs were then compared to November 2012 regional screening levels (RSL) for residential soil (EPA, 2012a) to identify the COCs using the ILCR and HI criteria listed in the above bullets (Appendix D).

Based on a comparison of the EPCs to the RSL values, the following chemicals are identified as COCs:

- 2,4-Dinitrotoluene (DNT)
- 2,6-DNT
- 1,3-Dinitrobenzene (DNB)
- TNT
- Aminodinitrotoluenes (ADNT) (combined isomers)
- 1,3,5-Trinitrobenzene (TNB).

2.4 Remedial Goals

RGs are selected to address human health concerns and may be based on chemical- and medium-specific ARARs, "to be considered" (TBC) criteria, and risk-based criteria. These terms are briefly described below:

- Chemical-specific ARARs – Enforceable requirements for specific chemical concentrations.
- TBCs – Nonenforceable guidance or advisories that can assist in setting risk-based standards.
- Risk-based criteria – Risk-based criteria derived using exposure and toxicity assessment methodology. These criteria provide important standards relating contaminant concentrations to specific risk levels. Risk-based criteria are chemical-specific, receptor-specific, medium-specific concentrations.

RGs were developed for each COC in PRRWP Area soil. The derivation of RGs is described in Section 2.4.1.

2.4.1 Development of Remedial Goals

The first step of RG development was to perform a comprehensive search for any chemical-specific ARARs for COCs in soil. No chemical-specific ARARs were found for any of the PRRWP Area COCs. Therefore, the PRRWP Area RGs were derived from risk-based criteria. Most of the property surrounding the former PBOW facility is rural residential, and other PBOW sites have been remediated to meet residential criteria. Therefore, the risk-based criteria selected for use in deriving RGs are based on residential land use.

The risk-based RG values are typically back-calculated from the BHHRA, which in the case of the PRRWP Area (IT, 2000) is more than 10 years old. Since that time, EPA exposure guidance has changed, especially with regard to the dermal pathway (e.g., EPA [2004b]), and some of the toxicological values have also been revised. Therefore, the PRRWP Area RGs have been calculated based on the current November 2012 resident soil RSLs (EPA, 2012a). The paragraphs that follow describe the derivation of risk-based RGs for PRRWP Area soil.

With respect to risk-based criteria, both cancer and noncancer effects must be considered in the derivation of RGs. The DNT isomers and TNT are regarded as carcinogenic and have EPA-verified cancer slope factors; the three other COCs (1,3-DNB, ADNTs, and 1,3,5-TNB) are not known to be carcinogenic (EPA, 2012a,b). EPA-verified noncancer reference doses (RfD) exist for TNT, 2,4-DNT, 1,3-DNB, and 1,3,5-TNB (EPA, 2013). A provisional RfD exists for

2,6-DNT (EPA, 2004c). Consistent with current EPA practice (EPA, 2012b), the verified RfD for 2,4-DNT is also used as the surrogate RfD value for the ADNTs.

The RGs were derived based on a cumulative target cancer risk level of 1E-5 and a cumulative HI of 1. An HI of 1 represents a level of exposure at which adverse health effects are unlikely for all receptors. The ILCR of 1E-5 represents the logarithmic midpoint of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (EPA, 1990) acceptable cancer risk range (1E-6 to 1E-4) and is the cancer risk goal used for other PBOW sites. It is noted that the State of Ohio recognizes a risk-based cleanup goal of 1E-5, whereas the Army recognizes the NCP acceptable range with a cancer risk "trigger level" of 1E-4, which is the upper end of the NCP acceptable range.

With few exceptions, the cancer risks associated with all carcinogens are regarded as additive. Therefore, the ILCR goal for PBOW (1E-5) is apportioned to the various carcinogenic COCs to account for their additivity. Noncancer effects are generally assumed to be additive only if they affect the same target organ. The critical effect target organ for each COC is listed in parentheses below:

- 2,4-DNT (target organs: biliary tract, erythrocyte, nervous system)
- 2,6-DNT (target organs: liver, erythrocyte, nervous system)
- 1,3-DNB (target organ: spleen)
- TNT (target organ: liver)
- ADNTs (target organs [assumed same as 2,4-DNT]: biliary tract, erythrocyte, nervous system)
- 1,3,5-TNB (target organs: spleen, erythrocyte).

From the above list, 2,6-DNT and TNT have the liver as a common target organ and are thus regarded as additive. Due to the similarity between the two DNT isomers (i.e., 2,4-DNT and 2,6-DNT) and the general relatedness of the biliary tract to the liver, 2,4-DNT and the ADNTs (which use the 2,4-DNT RfD as a surrogate) are also regarded as additive with these compounds for purposes of RG derivation. 1,3,5-DNB has a common target organ with 1,3-DNB (i.e., spleen) and is also additive with the erythrocyte effects of the DNTs and ADNTs.

The cancer-based RSL for the DNT isomers in residential soil (0.72 mg/kg) is an order of magnitude less than the non-cancer-based RSL (corrected to a hazard quotient [HQ] of 0.1) for

2,4-DNT (6.1 mg/kg) or 2,6-DNT (12 mg/kg). Therefore, cancer effects are clearly the risk-driving effects for 2,4-DNT and 2,6-DNT. The cancer-based residential soil RSL for TNT is 19 mg/kg, which is approximately five times greater than the non-cancer-based RSL (corrected to an HQ of 0.1) for TNT (3.6 mg/kg). Therefore, the noncancer effects of TNT are dominant as compared to the cancer effects. The result of these observations is that the RG for the DNT isomers is derived based chiefly on cancer effects, whereas the RG for TNT is based chiefly on noncancer effects. However, the additive cancer effects of TNT and the additive noncancer effects of the DNT isomers are considered in deriving the respective RGs such that the overall ILCR goal of 1E-5 and the overall HI goal of 1 are not exceeded (rounded to one significant figure).

Table 2-1 shows the RG for each COC and the associated HQ and ILCR, as applicable. The RG for total DNTs is 7.2 mg/kg; shown separately in Table 2-1 are 5.6 mg/kg for 2,4-DNT and 1.6 mg/kg for 2,6-DNT. The ILCR associated with these RGs is 1E-5. An RG of 36 mg/kg, which equals the non-cancer-based residential soil RSL at an HQ of 1, was selected for TNT. The ILCR for TNT at 36 mg/kg is 1.9E-6. Thus, if the DNT isomers and TNT are present at exactly the RG values, the associated ILCR is 1E-5 (1.19E-5 prior to rounding), which equals the Ohio Environmental Protection Agency cancer risk goal and the logarithmic midpoint of the EPA (1990) acceptable risk range.

The RGs for COCs other than the DNT isomers were selected based on noncancer RSL values. As mentioned, noncancer HI values were mostly driven by 1,3-DNT; therefore, the residential soil RSL of 6.1 mg/kg, equal to an HQ of 1, was selected as the RG for 1,3-DNB. 1,3,5-TNB is the only other COC with a critical effect (i.e., spleen) that is regarded as additive with those of 1,3-DNB. Other than 1,3-DNB and 1,3,5-TNB, the noncancer effects of each COC are regarded as additive with the liver effects of TNT.

A value equal to 0.1 times the RSL was selected as the RG for the ADNTs and 1,3,5-TNB. Although the RGs for the DNT isomers were derived based on cancer effects, the noncancer contributions of these values are also considered with respect to potential additive noncancer liver effects. At the respective (cancer-based) RG levels, the HQ of 2,4-DNT is 0.05 and the HQ of 2,6-DNT is 0.03. Thus, at the respective RG levels, the combined HI value for liver effects (associated with TNT, DNTs, and ADNTs) is 1 (1.18 prior to rounding). The HI of the spleen effects at the RGs for 1,3-DNB and 1,3,5-TNB is 1 (1.1 prior to rounding). These HI values equal the PBOW noncancer hazard goal.

2.4.2 Implications of Remedial Goals for Ecological Receptors

The PRRWP Area baseline ecological risk assessment (BERA) concluded that PRRWP Area soil does not present unacceptable risks and that remedial action based on the ecological risk assessments is not recommended (IT, 2001). The BERA was conducted as a supplement to the screening-level ecological risk assessment (SLERA) (IT, 2000). The results of the ecological risk assessments are based on soil concentrations that are much lower than those encountered in some of the post-NTCRA soil samples. Therefore, this section revisits the ecological considerations of the PRRWP Area in light of more recent, post-NTCRA analytical data, current site conditions, and the implications to ecological receptors of remediation to human health-based RGs. The SLERA and BERA evaluated an approximately 20-acre PRRWP Area study site. The BERA found this site is unlikely to represent a potential for any adverse ecological effects. The subsequent discovery of contaminated soil as described in this FS appears to be limited to an area of less than 3 acres. This contamination is unlikely to adversely affect ecological receptors based on the following observations:

- Most of this contaminated soil appears to be at a depth of 3 feet or greater.
- The water table is within 3 feet of the surface during the wet season, which effectively limits contact by burrowing with the contaminated soil.
- The areal extent of contaminated soil is too limited to adversely affect any ecological populations even if exposure to the most highly contaminated soil were to occur.

In summary, no remediation is necessary to protect ecological receptors at the PRRWP Area because of negligible to minimal exposure and extent of contamination. Further, cleanup of the site to human health-based RGs will not adversely affect ecological receptor populations and may further limit exposure by ecological receptor populations.

2.5 Area and Volume Estimates of Contaminated Media

Soil is the only environmental medium that requires remedial action at the PRRWP Area. Figure 2-1 depicts the estimated area that requires remedial action. The remedial area essentially circumscribes the sample locations where RGs were exceeded, with professional judgment used for those specific areas where the magnitude of the exceedance was marginal. Analytical results for all delineation samples are provided in the Appendix E tables, with RG exceedances indicated. The general magnitude of the nitroaromatics concentrations in the delineation samples is further discussed and presented in Appendix C.

RGs (Section 2.4) will be used to evaluate post-excavation confirmation samples to determine if additional soil removal is required. The RGs will be compared to average residual soil

concentrations to determine if remedial action is complete. The RGs will not be used as not-to-exceed values.

The remedial area shown on Figure 2-1 is estimated to be 95,157 square feet. This value excludes the previously remediated NTCRA Area. Assuming an excavation depth of 8 feet, this area represents a volume of approximately 28,195 bank cubic yards (BCY). During the NTCRA test pit and removal excavation, competent shale and/or groundwater were encountered at an average depth of approximately 8 feet. Soil excavation will stop at the top of the water table if groundwater is encountered between 0 and 8 feet deep.

Chemical composition statistics for the soil within the remedial area are presented in Table 2-2. The table presents the median, average, and maximum concentrations of each COC and compares these values to the RGs. Table 2-2 shows that the median concentrations of the COCs are significantly below the average. For example, the median and average 2,4-DNT concentrations are 18 and 1,277 mg/kg, respectively. 2,4-DNT is the only COC with a median concentration above the RG. Figure 2-2 shows that the soil analytical data for 2,4-DNT within the remedial area is left-skewed. Of the 61 analytical results for 2,4-DNT, 54 percent of the soil samples have concentrations less than 20 mg/kg, but only 15 percent of the samples have a 2,4-DNT concentration greater than 1,000 mg/kg.

The site delineation report (Appendix C) states that the soil north and west of the NTCRA excavation may have become contaminated through the subsurface transport of wastewater through drain tile, the advective transport of groundwater, or a combination of these mechanisms. This suggests that the upper layer of soil in the remedial area may be uncontaminated. The report recommends that the volume of soil requiring treatment or off-site disposal may be minimized by segregating clean from contaminated soil in the remedial area. Most of the soil samples collected during 2009 and 2010 to delineate the post-NTCRA remedial area were composited over the first 10 feet below ground surface, and the data cannot be used to vertically profile contamination within this zone. However, three samples (PRWP-SO011, PRWP-SO012, and PRWP-SO013) were collected in the upper 3 feet of the soil horizon, and the cancer risk and noncancer hazard posed by COCs in these samples were within acceptable levels. The data support the recommendation in the site characterization report to segregate the top 3 feet of soil during excavation because this soil may not require treatment before backfilling in the excavation area. It may also be appropriate to consider excavating and segregating the soil below 3 feet deep into convenient vertical intervals for waste characterization and management in case contamination is present primarily within a specific depth interval. This could reduce the volume of soil requiring treatment and/or off-site disposal.

For cost-estimating purposes in this document, it is assumed that the concentrations of COCs in the top 2 feet of excavated soil (7,049 BCY) are below RGs and that this soil can be backfill into the excavation after the evaluation of confirmation samples. The remaining 21,146 BCY of the 28,195 BCY excavated from the site will require remedial action.

2.6 ARARs Associated with Potential Remediation Activities

ARARs are defined in the NCP (EPA, 1990) as follows:

- "Applicable requirements" means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Only those state standards that are identified by a state in a timely manner and are more stringent than federal requirements may be applicable.

- "Relevant and appropriate requirements" means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by a state in a timely manner and are more stringent than federal requirements may be applicable.

There is more discretion in the determination of relevant and appropriate requirements. It is possible that only a specific part or parts of a requirement will be considered relevant and appropriate in a given case. When the analysis results in a determination that a requirement is both relevant and appropriate, compliance with that requirement is mandatory to the same extent as for applicable requirements.

ARARs can be separated into three categories: chemical-specific, action-specific, and location-specific. Table 2-3 presents the ARARs for remedial action at the PRRWP Area. For each ARAR, the table lists the applicable regulatory authority, the medium of interest, the regulatory citation, if the requirement is directly applicable or relevant and appropriate, a brief summary of the requirement, and the action that is necessary to comply with the regulation.

There are no chemical-specific ARARs for COCs in soil at the PRRWP Area.

No location-specific ARARs were identified for remedial action at the PRRWP Area because areas of special significance (e.g., wetlands; sites containing cultural resources; or habitats of endangered, threatened, or rare species) do not exist within the proposed remedial area.

Several action-specific ARARs were identified for remedial actions under consideration. These include the land disposal restriction (LDR) alternative treatment standards (ATS) for contaminated soil and the federal regulations for the use of staging piles. The action-specific ARARs are discussed in more detail in the following sections.

2.6.1 Land Disposal Restrictions

LDRs are applicable in the event that the excavated material is a hazardous waste (40 Code of Federal Regulations [CFR] 268.49) and on-site land disposal is a component of the remedial alternative. For hazardous wastes, the concentrations of underlying hazardous constituents (UHC) must be characterized to determine if the waste will require treatment prior to land disposal. Typically, the concentrations of UHCs in hazardous waste must not exceed the universal treatment standards (UTS) for the material to be land disposed without treatment. However, contaminated soil is a special case under the LDRs. ATSs have been created for contaminated soil because EPA acknowledges that soil is a more difficult matrix to treat than the process wastes that the UTSs were originally created to address. The ATSs for contaminated soil allow the concentrations of UHCs to be up to 10 times the UTS before treatment is required prior to land disposal. Nonmetal UHCs in contaminated soil that exceed the ATS must be treated to achieve a 90 percent reduction in concentration, capped at 10 times the UTSs. For soil contaminated with metals, treatment must achieve a 90 percent reduction in leachable constituent concentrations, measured in toxicity characteristic leaching procedure (TCLP) extract from the treated soil, capped at 10 times the UTS.

Table 2-4 compares the maximum detected concentration of each COC and other potential UHCs at the PRRWP Area to the ATS for contaminated soil. This comparison is used to determine if excavated material may require treatment to meet LDRs prior to land disposal. The minimum ATS for UHCs equals 10 times the UTS. The UTSs for nonmetals are based on the total concentration in soil, while the UTSs for metals are based on the concentration in the TCLP extract. Note that all of the PRRWP Area COCs are nonmetals. As shown in Table 2-4, the maximum detected concentrations of 2,4-DNT and 2,6-DNT are greater than the applicable ATS, indicating that treatment may be required for some material excavated at the PRRWP Area to comply with the LDRs. The LDRs do not apply to soil that is classified as nonhazardous based

on TCLP test results. Figure 2-2 shows that only 9 of the 61 soil samples (15 percent) exceed the minimum ATS of 1,400 mg/kg for 2,4-DNT.

2.6.2 Staging Pile Regulations

A staging pile is an accumulation of a solid, nonflowing hazardous remediation waste that is not in a containment building and is used only during remedial operations for temporary storage at a facility. Staging piles are routinely used to temporarily store remediation waste on site while the excavated soil is characterized and other arrangements are made for disposal. A staging pile is not required if excavated soil is directly loaded onto trucks for disposal. Staging piles may be used during cleanup of the PRRWP Area to store excavated soil prior to treatment and/or off-site disposal and treated soil prior to off-site disposal or placement back on site. Staging piles must meet design requirements to prevent or minimize releases of hazardous wastes, hazardous constituents, and cross-media transfers to the environment. Techniques used to comply with the design requirements include liners, covers, and run-on/off controls. Hazardous remediation wastes cannot be left in a staging pile longer than 2 years. A staging pile located in a previously contaminated area must be closed within 180 days after the operating period expires.

2.7 Characterization of Excavated Soil for Disposal

Contaminated soil becomes waste material when it is excavated. Excavated soil can be a hazardous waste due to the characteristic of toxicity, reactivity, ignitability, or corrosivity. The Army considers all soil containing 10 percent or more (≥100,000 mg/kg) of a secondary explosive (e.g., TNT, RDX, HMX) or mixture of secondary explosives to be reactive or ignitable (EPA, 2002a; USACE, 2007). The maximum TNT concentration in soil does not exceed the 10 percent level, so excavated soil at the PRRWP Area would not be a reactive or ignitable characteristic hazardous waste. The corrosivity test does not apply to solids, so contaminated soil from the PRRWP Area cannot be a corrosive characteristic hazardous waste. The toxicity characteristic of excavated soil is determined by the results of the TCLP test. The TCLP test involves the extraction of a soil sample with an acidic solution followed by analysis of the extracted solution for chemicals on the TCLP list. Excavated soil with a TCLP leachate concentration that exceeds a TCLP regulatory limit exhibits the characteristic of toxicity and would be classified as a characteristic hazardous waste.

For cost-estimating purposes in this document, it is assumed that 25 percent of the contaminated soil (20 percent of excavated soil) within the remedial area, or 5,639 BCY (7,331 loose cubic yards [LCY]), is hazardous for 2,4-DNT. This percentage was recommended by the USACE-Huntington District after considering the characterization of soil excavated during the NTCRA.

3.0 Screening of Remedial Action Technologies

(Note: Sections 3.0 through 3.3.3.4 and 3.3.5 through 3.3.5.4 have not been revised from the FFS.)

3.3.4 Ex Situ Solidification/Stabilization

3.3.4.1 Effectiveness

Chemical stabilization could be effective in immobilizing COCs in soil, depending on the concentrations of COCs in the soil requiring treatment. Contaminated soil would be excavated and then mixed with stabilizing agents in a batch mixer or pug mill. Alternatively, some stabilization chemicals are sprayed on excavated soils and mixed using heavy equipment such as an excavator. Previous Army studies on the use of solidification/stabilization on nitroaromatic compound (NAC)-contaminated soil demonstrated that the addition of activated carbon to the stabilization mixture may be required to effectively immobilize organic compounds such as TNT (Channell et al., 1996).

Ex situ chemical stabilization has been used previously at PBOW to immobilize lead in soil to pass the TCLP test and comply with LDR ATSs for contaminated soil. Lead is typically stabilized by the addition of phosphate chemicals, as described in Section 3.2.4.1. However, lead is not a COC in PRRWP Area soil.

Stabilization does not transform or remove the COCs from soil; it only hinders their environmental transport. Therefore, stabilization should be combined with other waste management options like off-site disposal in a nonhazardous waste landfill or capping of the stabilized soil.

3.3.4.2 Implementability

This process is technically implementable at this site. The technology is mature, and equipment and personnel are readily available. However, the technology may not comply with the LDR ATSs for contaminated soil. 2,4-DNT and 2,6-DNT are the only soil constituents that will require treatment to comply with the LDRs. The treatment standards for 2,4-DNT and 2,6-DNT are expressed in units of total (not leachable) concentration. Solidification/stabilization does not destroy but only immobilizes the contaminants within the treated material. Therefore, off-site disposal of treated soil might be prohibited because the stabilized soil may not comply with the LDR requirements for these constituents.

3.3.4.3 Cost

The cost associated with ex situ stabilization is moderate and depends on the amount of excavated material requiring treatment, the amount of stabilizing agents required, and labor costs associated with the implementation.

3.3.4.4 Summary

The applicability of ex situ solidification/stabilization for the treatment of DNTs is questionable because the treated soil may not comply with LDR treatment standards. For this reason, chemical stabilization will not be retained for alternative development in Chapter 4.0.

3.3.6 Windrow Composting

3.3.6.1 Effectiveness

Windrow composting has been used in the past to treat a variety of organic contaminants, including NACs, polynuclear aromatic hydrocarbons, and pesticides. In particular, windrow composting has been used at several sites to effectively treat nitroaromatic-contaminated soil that has been impacted by the production or handling of TNT-based munitions. The technology has been implemented on a full-scale basis to treat TNT-contaminated soil at PBOW, as well as other facilities, including Umatilla Depot in Hermiston, Oregon; the Naval Surface Warfare Center in Crane, Indiana; the Joliet Army Ammunition Plant in Elwood, Illinois; the Pueblo Chemical Depot in Pueblo, Colorado; the Hawthorne Army Depot in Hawthorne, Nevada; and the U.S. Naval Submarine Base in Bangor, Washington (Woodhull and Jerger, 2000; EPA, 2002b). DNT-contaminated soils were also treated during composting operations at the Pueblo Chemical Depot and the Joliet Army Ammunition Plant (Woodhull and Jerger, 2000).

Composting can be distinguished from other types of bioremediation processes by the use of bulking agents, such as wood chips and straw, to increase the porosity of the soil. Manure, yard wastes, and wood processing wastes are often added to increase the amount of nutrients and readily degradable organic matter. Occasionally, other easily degradable carbon sources (e.g., molasses, acetate, glucose) are added to sustain microorganisms capable of degrading hazardous constituents. Inorganic fertilizers may be added to supplement available nutrients (EPA, 1996).

Composting utilizes solid-, liquid- and gas-phase processes. The solid phase provides physical support for biofilm growth, a source of organic and inorganic nutrients, a sink for metabolic products, and thermal insulation. The liquid phase provides a matrix for the interchange of gases, nutrients, and metabolic products. The gas phase delivers oxygen and provides a sink for gaseous

metabolic products, such as carbon dioxide and ammonia. The gas phase also serves as the primary heat sink, through evaporative cooling (EPA, 1996).

The composting process is mediated by microbial populations that are classified as either mesophiles or thermophiles. Mesophilic microbes are those with an optimum temperature range of 25 to 40 degrees Celsius (^{o}C). Thermophiles have an optimum temperature range of 40 to 60°C. Significant degradation of TNT has been reported within both temperature regimes, although slightly higher removals have been demonstrated under thermophilic conditions (Williams et al., 1992).

Composting can biologically degrade organic contaminants via aerobic, anaerobic, or a combination of anaerobic and aerobic processes. Research on TNT degradation using composting has shown that a combined anaerobic/aerobic process is most effective in detoxifying TNT-contaminated soil. The first step in the biological degradation of TNT involves the reduction of one of the three aromatic nitro groups to an amino group through nitroso and hydroxylamino intermediates. Figure 3-1 shows the specific case of the reduction of an aromatic nitro group during the fermentation of glucose (Daun et al., 1998).

The sequential reduction of all three nitro groups, converting TNT to 2,4,6-triaminotoluene (TAT), can only be achieved under strict anaerobic conditions (Preuss et al., 1993). Figure 3-2 depicts the transformation processes that are involved in degradation of TNT in an anaerobic/aerobic composting system (Bruns-Nagel et al., 2000). Studies have shown that, in addition to the transformation of TNT to TAT, degradation of TNT may proceed through the condensation of ADNTs to azoxy-tetranitrotoluenes (Achtnich et al., 1999).

Significant mineralization of TNT via composting has not been demonstrated. This may be explained by the rareness of polynitroaromatic compounds in nature and the resistance of the highly oxidized trinitro-substituted aromatic ring to oxidative microbial attack (Rieger and Knackmuss, 1995). However, TNT degradation and transformation products can be stabilized through interaction with organic and inorganic soil components. The reduction of TNT in the presence of clay and humic substances has been shown to significantly increase the removal rate of nitroaromatics from soil. The TNT metabolites hydroxyamino-dinitrotoluenes and TAT strongly bind to clay minerals and humic substances (Daun et al., 1998).

Three different types of interactions between TNT metabolites and soil are possible: physical sorption, sequestration, and covalent binding to soil organic matter. Only if TNT and its metabolites are bound through covalent linkages are they considered to be an integral part of the

humus. When bound to humic materials in this manner, they are not considered to represent a potential future threat to the environment.

Composting studies using carbon-14 (^{14}C) ring-labeled TNT have demonstrated significant binding of TNT transformation products to the humic substances (fulvic acid, humic acid, and humin) present in compost (Achtnich et al., 1999; Drzyzga et al., 1998; Bollag et al., 2002). The studies reported that the immobilized (unextractable) fraction of the ^{14}C-TNT ranged from 82 to 84 percent. All three studies used a combination anaerobic/aerobic treatment approach.

The nature of the bonding mechanism between TNT metabolites and the humic materials in the compost has been investigated using nitrogen-15 (^{15}N)-nuclear magnetic resonance spectroscopy of ^{15}N-labeled TNT (Achtnich et al., 1999; Bruns-Nagel et al., 2000; Bollag et al., 2002). These studies found significant evidence of covalently bound ^{15}N. The Bruns-Nagel study found that the major portion (55 percent) of the ^{15}N was strongly bound to the humic fraction of the soil: 23 percent as heterocyclic structures, 15 percent covalently bonded, 15 percent as amino functional groups, and 2 percent as nitro functional groups.

The recent research has demonstrated that, after incorporation of the partially or fully reduced TNT into humic materials, the pollutant is practically indistinguishable from the soil organic matter. Further, it can be assumed that mineralization of the bound residue would occur at a rate similar to that of the mineralization of the natural humus. Even if some covalently bound molecules are subsequently released and become bioavailable, this process should not occur to an extent that would cause toxic effects (Bollag et al., 2002).

DNT-contaminated soil can be treated via both aerobic and anaerobic pathways. Under anaerobic conditions, DNTs are sequentially transformed to nitrosonitrotoluenes, aminonitrotoluenes, and diaminotoluenes (DAT) (McCormick et al., 1976; Liu et al., 1984; Yang et al., 2008). Nitrosonitrotoluenes are short-lived reaction intermediates and are not typically detected in treated soil (Liu et al., 1984). Complete mineralization of DNT to carbon dioxide does not proceed to any significant degree under anaerobic conditions. One study found that less than 1 percent of the initial mass of 2,4- and 2,6-DNT in contaminated sediment treated under lactate-amended anaerobic conditions was converted to carbon dioxide (Yang et al., 2008). The same study determined that aminonitrotoluenes and DATs are mostly reversibly bound to sediment under anaerobic conditions, with 74 to 89 percent of the mass of these constituents initially bound to sediment available for desorption by water (Yang et al., 2008). Under aerobic conditions, 2,4-DAT was found to readily transform to reaction products tentatively identified as hydroxylamino-aminotoluene, dihydroxylaminotoluene, azo- and hydrazo-dimers of 2,4-DAT,

and a hydrazo-trimer of 2,4-DAT (Yang et al., 2008). Figure 3-3 presents a proposed pathway for the oxidative coupling reactions of 2,4-DAT. DAT aerobic reaction products irreversibly bind to sediment. Over 70 percent of the carbon present as 2,4-DNT at the start of anaerobic biodegradation tests was immobilized on sediment during subsequent sorption tests conducted under aerobic conditions (Yang et al., 2008).

Significant mineralization of 2,4- and 2,6-DNT occurs during aerobic degradation with no production of aminonitrotoluenes. One study found that nearly 60 percent of radiolabeled DNT was recovered as carbon dioxide during aerobic treatment of soil slurries (Nishino et al., 1999). Figure 3-4 presents the aerobic degradation pathway for 2,4- and 2,6-DNT (Ju and Parales, 2010). A number of bacterial strains have been identified that aerobically degrade 2,4- and 2,6-DNT, and some strains can utilize DNTs as their sole source of carbon, nitrogen, and energy (Nishino et al, 2000).

Performance data for the composting of DNT-contaminated soil are very limited. A pilot-scale composting operation at Pueblo Chemical Depot reduced DNT in soil from 10 mg/kg to below 0.2 mg/kg in 15 days (Woodhull and Jerger, 2000). Although DNT-contaminated soils were also reportedly composted at Joliet Army Ammunition Plant and Tooele Army Depot (EPA, 2002b), performance data are not available for these operations (Woodhull and Jerger, 2000). DNT has been successfully treated using aerobic-only (Zhang et al., 2001) and aerobic/anoxic cycling (Manning et al., 1996) bioslurry processes, but the bioslurry technology has not gained commercial acceptance because treatment costs are higher than composting. Composting unit treatment costs for explosives-contaminated soil have been estimated to range from $133-$225/ton in comparison to $162-$309/ton for treatment in bioslurry reactors (Woodhull and Jerger, 2000; EPA, 2002b).

Critical process parameters that impact the effectiveness of a composting process include porosity of the compost material, free air space, moisture content, particle size, temperature, carbon-to-nitrogen (C/N) ratio, and pH. Bulking agents are typically added to the contaminated soil to increase the porosity of the composted material. Adequate porosity is needed to provide a conduit for air, water, and nutrients throughout the compost as well as to afford space for the growth of microbial communities. Compost bulk density typically ranges from 0.5 to 0.7 tons per cubic yard. Free air space is the portion of the porosity occupied by gas. Free air space is necessary for the maintenance of aerobic conditions within the compost. The gas/liquid ratio within the void space has a profound impact on the efficiency of the treatment process (Ro et al., 1998).

Proper moisture content is required for nutrient transport and maintenance of the microbial communities. Constructing a compost shelter or covering the piles with a water-impermeable fabric would prevent infiltrating rainfall from creating excessive moisture conditions within the compost. Adequate moisture levels can be maintained by periodically adding water to the compost to replace losses from evaporation. The recommended moisture content for composting is between 40 and 65 percent of saturation (USACE, 2002). The moisture content of the compost should be checked two to three times per week during treatment. The water usage in windrow composting is typically 1 gallon per CY of compost per day.

Particle size is important because it affects the surface area available for microbial activity as well as the pore space available for oxygen and nutrient transport. A particle size from 1.3 to 5 centimeters is reported in the scientific literature to be optimum for composting (Forster and Wase, 1987). USACE specifications recommend a particle size range of 2 to 10 centimeters (USACE, 2002). Larger particles reduce the surface area for microbial growth and may cause contaminants to become occluded such that they are not accessible for degradation. Wet clays, for example, can be difficult to mix with amendments, and lumping can result. Lumping limits oxygen transfer rates and contaminant availability, resulting in incomplete treatment. Excavated soil is typically screened prior to mixing with amendments to remove large objects, and a shredder or crusher may be used to reduce the size of oversize material to facilitate treatment. Excavated material is typically screened down to 2 inches. Material between 2 and 6 inches can be crushed for treatment. Material larger than 6 inches is normally stockpiled for disposal. TNT is sometimes found in contaminated soil as nodules that can be difficult to treat via composting. Researchers at the Idaho National Engineering and Environmental Laboratory have used acetone to dissolve chunks of TNT (Radtke et al., 2000). The resulting acetone/TNT slurry is then added back to the compost pile. The acetone is biodegradable and provides an additional carbon source for microbial growth.

The type of temperature control employed depends on the composting process used. The compost temperature in static piles and in-vessel composting is controlled by adjusting airflow through the compost. Compost temperature during windrow composting is controlled by the frequency of windrow turning and by minimizing the impact of climatic effects through sheltering or covering the compost. USACE specifications recommend that the compost temperature be maintained between 54 and 60°C for optimum treatment efficiency. Microbial activity is substantially reduced at temperatures above 71°C. Temperature control is particularly important in locations such as northern Ohio, where the impact of winter temperatures on the effectiveness of composting operations must be considered. Low ambient temperatures will impact the process if the amendments and/or soil become frozen prior to blending. The initial

self-heating phase may be longer or may not occur if one or more of the components is at or near freezing. This problem can be overcome by staging amendments in large piles during cold weather or by using engineering controls such as a small heated amendment staging area to heat a 1- to 2-day supply of amendments prior to mixing. The temperature of the windrows should be monitored on a daily basis.

Compost microorganisms require adequate levels of carbon sources and other nutrients, including nitrogen, phosphorus, sulfur, and other trace minerals. Among these, carbon and nitrogen are usually the limiting substrates. Optimal C/N ratios for different composting materials are reported to range from 20:1 to 40:1 (USACE, 2002), although a lower C/N ratio (less than 10:1) was effectively used during the composting project at the Naval Surface Warfare Center in Crane, Indiana. If the C/N ratio is too low, nitrogen will be lost as ammonia, which may reach toxic levels and raise the compost pH.

The optimum pH for composting has been reported in the scientific literature to range from 6.0 to 8.5 (Fitzpatrick, 1993). At higher pH, nitrogen will be lost as ammonia, and essential elements such as calcium and magnesium may not be available to microorganisms due to precipitation as insoluble metal hydroxides or carbonates. At lower pH, metals such as aluminum, copper, and zinc may be leached from minerals and may stop the composting process (Ro et al., 1998). USACE specifications recommend that the compost pH be maintained in the range of 5.5 to 9.0 and preferably within 6.5 to 8.5 (USACE, 2002).

Composting has typically been implemented using one of the three following processes: in-vessel composting, static pile composting, and windrow composting. In-vessel composting involves the placement of compost material in a large containment vessel equipped with a temperature-controlled aeration system. In-vessel systems may be equipped with a mechanism that periodically mixes the compost. In static pile composting, the material to be composted is formed into a pile and aerated by blowing air into the pile through perforated pipes. Static piles are not mechanically mixed, and the aeration system is used to control temperature. In windrow composting, the material to be composted is formed into long parallel rows. The rows are watered occasionally and are periodically turned to promote aeration and control temperature using a specialized piece of equipment called a windrow turner. Of the three types of composting processes, windrow composting has proven to be the most cost-effective for soil remediation due to its lower capital and operating costs. Therefore, windrow composting is selected as the representative composting technology for evaluation in the FS.

Windrow composting may not be able to achieve RGs for all COCs in soil at the PRRWP Area. The NACs in soil would be biodegraded or transformed into less toxic products. Although composting has been used effectively to treat NAC-contaminated soil at some other ordnance facilities, a previous implementation of the technology at PBOW TNT Area B (TNTB) would not have attained RGs for all COCs at the PRRWP Area (Table 3-1). Table 3-1 shows that the final concentration of total DNTs (2,4-DNT and 2,6-DNT) in TNTB composted soil taken from three of the four windrows after 6 weeks of treatment exceeded the PRRWP Area RG. A significant portion of the treated soil at PRRWP Area would likely require off-site disposal based on the TNTB results. Composting at TNTB was able to reduce the leachable concentration of 2,4-DNT below the TCLP limit, allowing the treated soil to be disposed off site as a nonhazardous solid waste.

3.3.6.2 Implementability

Composting is technically and administratively implementable at the PRRWP Area. Previous composting work at PBOW was performed without a treatment enclosure to protect the compost from rain and cold temperatures. Equipment, labor, and amendments required for composting are available from local sources, lowering remedial costs. Treated compost would be spread across the site if it attained RGs for all COCs. Alternatively, treated soil that did not attain RGs for all COCs would be transported off site as a nonhazardous waste and used for daily cover at a nearby landfill. Compost does not have the same structural integrity as native soil and is not likely suitable as structural backfill.

3.3.6.3 Cost

The cost for composting the soil would be high. The main factors contributing to the capital cost are significant equipment rental and labor costs incurred over the relatively lengthy remedial duration. Treated soil that complies with RGs for all COCs could be returned to the site. The treated material that does not comply with RGs for all COCs would be managed off site at an approved disposal facility as a nonhazardous waste. The management of treatment residuals is an important cost factor in evaluating the technology because the volume of composted soil after treatment is larger than the initial volume of soil to be treated due to the addition of amendments during the treatment process.

3.3.6.4 Summary

Composting of contaminated soil from the PRRWP Area is a potentially feasible process option for reducing the concentration of NACs to RGs for placement back on site or to concentrations that would render the treated material nonhazardous and facilitate off-site disposal as a

nonhazardous waste. Therefore, the process is retained for further development as a remedial alternative in Chapter 4.0.

3.3.7 Alkaline Hydrolysis

3.3.7.1 Effectiveness

Alkaline hydrolysis involves the addition of an alkaline reagent to increase the pH of contaminated soil, thereby promoting the hydrolysis of NACs to less toxic reaction products. The technology has most commonly been implemented for the treatment of nitroaromatic explosives by adding calcitic lime, composed of calcium hydroxide, to the contaminated soil. More recently, improved treatment results have been achieved using sodium hydroxide (NaOH) (caustic soda) instead of lime as the alkaline reagent.

TNT is susceptible to treatment with alkali because the electronegative nitro groups of TNT reduce the electron density of the aromatic ring and make the molecule subject to nucleophilic attack. The hydroxide ion (OH^-) is a strong nucleophile and has been shown to react with TNT under alkaline conditions. Initiating reactions in alkali include nucleophilic substitutions of the nitro or methyl groups of TNT by OH^-, nucleophilic addition of OH^- at the C3 and C5 carbons and removal of a proton on the methyl group to form a benzylic carbanion (Thorn et al., 2004). Research performed to quantify the TNT-hydroxide reaction rate has identified a multiple step reaction process (Felt et al., 2001; Mills et al., 2003).

The TNT-hydroxide reaction is complex and has the potential to produce numerous undefined reaction products. A resonance-stabilized Meisenheimer complex (Figure 3-5) has been postulated as an intermediate product of alkaline hydrolysis (Hammersley, 1975). It is reported that the molar ratio of OH^- to TNT influences the mix of reaction products (National Research Council, 1999). When TNT is in excess, polymerization reaction products are formed possibly through the formation of an intermediate Janovsky complex (Figure 3-5) (National Research Council, 1999). However, some studies have reported the formation of a polymeric material upon the prolonged treatment of TNT when OH^- is in excess (Felt et al., 2001; Thorn et al., 2004). One study analyzed molecular weight fractions of reaction products generated when an aqueous solution of TNT was treated with potassium hydroxide at a pH of 13 (mole ratio OH^-:TNT > 900). Approximately 40 percent of the reaction products fell within the 1,000 to 6,000 Dalton molecular weight range (molecular weight of TNT = 227 Dalton), indicating that a significant percentage of the final reaction products consists of large molecules that may result from the polymerization of intermediate reaction products (Felt et al., 2001). Characterization of the polymeric precipitate in a second study by ^{13}C and ^{15}N nuclear magnetic resonance suggests

that a complex mixture of products is formed. Nuclear magnetic resonance confirms that carbon functional groups include methyl, methylene, alcohol/ether, phenolic carboxylic acid, ketone, and possibly quinone. Nitrogen is present in the polymeric material as aminohydroquinone, aminoquinone, heterocyclic, imine or azoxy, nitro, and nitrosophenol, among other possibilities (Thorn et al., 2004).

The toxicity of alkaline hydrolysis reaction products is of interest in evaluating the residual risk that would remain after treatment. The toxicity of TNT-hydroxide reaction products is not well defined, although the limited testing that has been done indicates that the reaction products are less toxic than TNT. The acute aquatic toxicity of TNT-contaminated water before and after treatment with NaOH was tested using the standard Microtox® procedure (Hansen et al., 2001). Aqueous solutions of 10 and 100 milligrams per liter (mg/L) TNT were treated with NaOH at concentrations of 0 (untreated control), 2 and 4 millimoles/liter (mM). The Microtox results were reported as half maximal effective concentration (EC_{50}) values, the effective concentration at which 50 percent of the expected fluorescence from the test bacterium (i.e., *Vibrio fischeri*) is inhibited. Higher EC_{50} values indicate relative lower toxicity. The median EC_{50} was increased from approximately 2 percent in the untreated sample to 8 percent in the 100 mg/L TNT sample treated with 4 mM NaOH and 14 percent in the 10 mg/L TNT sample treated with 4mM NaOH (Figure 3-6).

Recent work using NaOH instead of lime to implement alkaline hydrolysis has shown positive results. A laboratory test conducted on NAC-contaminated soil from Volunteer Army Ammunition Plant (VAAP) demonstrated that NaOH treatment achieved RGs at that site for all NAC constituents, including TNT and DNTs. Table 3-2 presents a summary of partial results from this work (Tetra Tech, Inc. [TTI], 2008a). The table presents the results of three treatability tests using varying proportions of NaOH and ferric chloride in soil. The VAAP treatability study results indicate that PRRWP Area soil is likely treatable using alkaline hydrolysis. The average TNT and 2,4-DNT concentrations in PRRWP Area soil are less than the initial soil concentrations tested in the VAAP bench study, and the concentration of total DNTs in the treated soil was below the PRRWP Area RG for total DNTs. Only 8 percent of the soil samples within the PRRWP remedial area have a total DNT concentration greater than the initial concentration of 4,700 mg/kg in the VAAP treatability study. The VAAP treatability tests show that the application of NaOH without catalyst was sufficient to attain RGs for soil at VAAP, although the addition of ferric chloride seemed to increase the removal efficiency of DNTs somewhat (TTI, 2008a).

Nitrite was a principal product of the alkaline hydrolysis reaction with NACs. The addition of 6 ounces of citric acid to 10 pounds of the alkaline hydrolysis-treated soil during a denitrification bench-scale study effectively neutralized the elevated soil pH and provided a carbon source for microbial denitrification of the residual nitrite (Britto et al., 2010). The nitrite concentration in alkaline hydrolysis-treated soil was reduced from 511 mg/kg to nondetect levels within 12 days after application of citric acid.

An alkaline hydrolysis treatability study was completed on PBOW TNT Area C (TNTC) soil by the Shaw Technology Development Laboratory (TDL) in 2009. Table 3-3 presents a summary of the results. DNTs were not detected in the untreated soil sample collected from the site, so the soil was spiked prior to treatment. Several alkaline reagents were tested, and NaOH was found to perform best. The treatability study confirmed that alkaline hydrolysis was most effective at a soil pH above 12.6, as indicated by the previous TTI pilot test (TTI, 2008b). The treatability study found that the TNT concentration could be reduced to the RGs for TNTC within 7 days, but none of the treated samples attained the RG for 2,4-DNT or 2,6-DNT or passed the TCLP test for 2,4-DNT. As shown in Table 3-3, the most effective treatment reduced 2,4-DNT by 97 percent (10,733 to 282 mg/kg) and 2,6-DNT by 32 percent (11,441 to 7,783 mg/kg) within 7 days. The 2,4-DNT concentration in the TCLP leachate from the most effective treatment (0.26 mg/L) was only slightly above the regulatory limit (0.13 mg/L). The LDR regulations require that the concentration of underlying hazardous constituents in soil classified as a hazardous waste be reduced by 90 percent, but no less than 10 times the UTS for land disposal. Alkaline hydrolysis achieved this level of treatment for 2,4-DNT but not for 2,6-DNT in the bench tests.

Additional bench-scale testing of the alkaline hydrolysis process by TTI indicates that DNTs are not readily destroyed unless a pH greater than or equal to 13 is attained in soil during treatment (Britto et al., 2010). Addition of moisture to soil saturation levels was also critical for effective treatment (Britto et al., 2010). The data also bring into question the need for a catalyst, and additional testing was recommended to clarify this issue (Britto et al., 2010). TTI also performed column studies to assess the potential effectiveness of in situ treatment in saturated soil. Thirty pore volumes of a 50-mM NaOH solution applied to an undisturbed soil column from VAAP reduced the concentration of total explosives in the soil column from 5,000 mg/kg to no greater than 50 mg/kg. The 50-mM solution raised the pH of the soil in the column to 12.57 after 72 hours.

Full-scale application of alkaline hydrolysis by TTI at VAAP has shown the technology to be effective. Alkaline hydrolysis was used to treat 112,000 CY of NAC-contaminated soil ex situ. Treated soil achieved the VAAP cleanup level for DNT of 25.4 mg/kg. The 2,4-DNT

concentration in 42 percent of the treated soil was below the 2.6 mg/kg limit that would potentially make the soil a Resource Conservation and Recovery act (RCRA) characteristic hazardous waste (20-times rule). The average 2,4-DNT concentration in the remaining soil was 6.9 mg/kg. Full-scale implementation of alkaline hydrolysis at VAAP demonstrated successful treatment of NAC-contaminated soil within a pH range of 12.3 to 13, with an average treatment pH of 12.5 (Britto et al., 2010). The average treatment duration during full-scale application was 21 days (Britto et al., 2010), longer than the 10 days previously suggested by the results of the VAAP pilot test (TTI, 2008a). Approximately 20 percent of the alkaline hydrolysis-treated soil at VAAP required post-treatment using citric acid to reduce nitrite concentrations during full-scale remediation (Britto et al., 2010). Alkaline hydrolysis-treated soil from the PRRWP Area would not require treatment if the nitrite concentration in soil was less than or equal to the residential soil risk-based concentration of 7,800 mg/kg. Nitrite post-treatment would likely not be required for alkaline hydrolysis-treated soil that is disposed off site at a landfill.

An additional 11,500 cubic meters of NAC-contaminated soil at VAAP were treated in situ using alkaline hydrolysis (TTI, 2010a). NAC-contaminated soil at VAAP was successfully treated in situ at a pH of 12.5 or higher. Effective treatment in situ was found to be less dependent on soil moisture content as previously determined during bench-scale testing. In situ soil moisture content in the range of 16 to 25 percent was found to be adequate for treatment of the clay-like soil at VAAP (Britto et al., 2010).

3.3.7.2 Implementability

Full-scale remediation of TNT-contaminated soil using NaOH has been performed at VAAP (TTI, 2010a) and Iowa Army Ammunition Plant (TTI, 2010b). The technology has also been implemented by the USACE-Huntington District at PBOW at TNTA and TNTC. When the alkaline hydrolysis process using NaOH was scaled up in field tests at VAAP, the treatment chemicals were applied at the rate of 40 pounds of caustic soda and 1 gallon of 30 percent ferric chloride solution per CY of soil (Tetra Tech, 2008b). The Shaw TDL alkaline hydrolysis treatability study found that the optimum amount of alkaline reagent for TNTC soil is 61 pounds of caustic soda per CY of soil. At PBOW, 3 percent weight NaOH was added to contaminated soil. One 55-gallon drum of 50 percent ferric sulfate solution was added to each 250-CY batch of soil (0.22 gallon/CY or 2.63 pounds/CY).

The degree of pH adjustment required after treatment is a significant factor in the cost-effective implementation of alkaline hydrolysis. TTI used citric acid to neutralize soil at VAAP because it is a weak triprotic organic acid that would provide a carbon substrate to promote nitrite reduction as well as neutralize the excess alkali. Common methods of lowering soil pH used in agriculture

include the addition of acid organic matter that is low in calcium and other non-acid cations (e.g., leaf mold from coniferous trees, pine needles, tan bark, pine sawdust, acid peat moss) and inorganic chemicals such as aluminum sulfate, ferrous sulfate, and elemental sulfur (Brady and Weil, 2002). The Shaw TDL alkaline hydrolysis treatability study tested several neutralization reagents to determine which would be the most cost-effective for full-scale application. The study found ferrous sulfate to be the most economical neutralization agent, with the application of 108 pounds of ferrous sulfate required to neutralize 1 CY of alkaline-treated soil.

Soil pH often decreases over time without chemical neutralization due to absorption of carbon dioxide from the air, buffering by soil minerals, reactions with naturally occurring humic or organic acids in the soil, and gradual leaching of the caustic material from the soil (Brooks et al., 2003; Larson et al., 2007). The USACE found that the addition of chemicals to reduce soil pH was not necessary at TNTC because the soil pH decreased naturally over time while the soil was staged on site after treatment.

The pH of alkaline hydrolysis-treated soil at PBOW is reduced to ≤pH 12 prior to off-site disposal at a local municipal landfill. The pH of treated soil is reduced to ≤pH 10 for soil that is been placed back on site. The pH of treated soil may be lowered through chemical addition or the pH may be allowed to decrease naturally with time. Both methods have been used at PBOW. At PBOW, when the volume of soil to be treated has been relatively small, the soil has been stockpiled on site while the pH of the soil slowly decreases over time. Acetic acid has also been added to the soil to reduce pH, but this can be costly depending on the degree of pH adjustment needed. Field experience has shown that about 1.1 and 11.8 gallons of 80 percent acetic acid is needed per CY of soil to reduce the pH of alkaline hydrolysis-treated soil to pH 12 and pH 10, respectively. The chemical cost alone is $70 per ton of soil to reduce soil pH to 10. When compared to an off-site disposal cost of about $52 per ton (including transportation), it is not cost-effective to spend more than $70 per ton to acidify the treated soil to the pH (10) needed to backfill it on site. Staging the soil on site for gradual pH reduction is not practical at PBOW when larger volumes of soil must be treated. There is not available open space around the treatment pad to stockpile treated soil, and staging the soil on the treatment pad prevents additional soil from being treated. For these reasons, the most cost-effective approach at PBOW is often acidification of the treated soil to pH 12 followed by off-site disposal at a local municipal landfill.

3.3.7.3 Cost

Alkaline hydrolysis is typically cost-effective when compared to other treatment technologies that are effective for nitroaromatic explosives, such as composting. Treatment durations are shorter and the volume of treatment residuals is significantly less than composting.

3.3.7.4 Summary

Alkaline hydrolysis of contaminated soil at the PRRWP Area is a potentially feasible process option for attaining RGs in site soil. Therefore, the process is retained for further development as a remedial alternative in Chapter 4.0.

4.0 Development and Detailed Analysis of Remedial Alternatives

The goal of this chapter is to introduce, assess, and communicate the relative costs and benefits of the remedial alternatives selected for careful consideration. The evaluation criteria for this analysis are provided by EPA guidance (EPA, 1988; USACE and EPA, 2000). These criteria are based upon the NCP, Title 40 CFR, Section 300.430 (EPA, 1990). The results of this analysis will be presented in the proposed plan and decision document.

The RI/FS guidance (EPA, 1988) provides nine evaluation criteria for assessing alternatives within the context of a comprehensive FS. These criteria cover regulatory, technical, cost, institutional, and community considerations. Generally, the two threshold criteria are:

- Protection of human health and the environment
- Compliance with ARARs.

The five balancing criteria are:

- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction in toxicity, mobility, and volume
- Technical and administrative implementability
- Alternative cost including capital, operation and maintenance (O&M), and present value costs.

The final two criteria, which often are evaluated subsequent to the initial publication of the FS, are:

- State acceptance
- Community acceptance.

The first seven criteria will be fully evaluated in this FS. The final two criteria will be discussed briefly in the FS. Unofficial public feedback on potential remedial options has already been obtained through preliminary presentations given at the regular public meetings of the PBOW Restoration Advisory Board. The last two criteria will be officially evaluated through working-level discussions with state and federal regulators, as well as through the solicitation of community input from more formal public outreach activities. Once all of the FS criteria have been adequately considered and a remedial alternative is recommended, the proposed remedial action will be presented to the Ohio Environmental Protection Agency and the public in a

proposed plan. The proposed plan will be presented at a public meeting, where comments will be solicited from the public for submittal during a public comment period. At the end of the public comment period, all comments and corresponding responses will be included in the responsiveness summary of the decision document. The decision document will be prepared that, when approved, will be the basis for executing the selected remedial alternative for soil at the PRRWP Area.

4.1 Development of Remedial Alternatives

The following four alternatives were selected for detailed evaluation:

- Alternative 1 – No Further Action
- Alternative 2 – Excavation and Off-Site Treatment/Disposal
- Alternative 3 – Excavation, Windrow Composting, and Off-Site Disposal
- Alternative 4 – Excavation, Alkaline Hydrolysis, and Off-Site Disposal.

4.2 Alternative 1 - No Further Action

4.2.1 Description

A no-action alternative is required by the NCP to be carried forward as a baseline for detailed comparison. In the case of the PRRWP Area, where a removal action has already been implemented, this alternative is no further action. Under this alternative, no further remedial action or monitoring would be conducted for contaminated soil at the site. Thus, this alternative fails to meet the RAO for soil at the PRRWP Area.

4.2.2 Overall Protection of Human Health and the Environment

This alternative would not protect human health or the environment because no further action would be taken to reduce the concentrations of COCs in soil to meet PBOW risk management goals or to prevent current or future receptors from exposure to COCs. The alternative would not protect ecological receptors or prevent the potential migration of soil contaminants to other media.

4.2.3 Compliance with ARARs

There are no chemical-specific ARARs or TBCs for soil. Location- and action-specific ARARs are not applicable to this alternative because no remedial action would be taken. Alternative 1 would leave concentrations of COCs in soil above risk-based RGs that were developed using EPA toxicity data.

4.2.4 Long-Term Effectiveness

This alternative would not result in any permanent reduction of potential risk to human health, ecological receptors, or the environment. No monitoring or periodic review would take place to evaluate future site conditions.

4.2.5 Reduction of Toxicity, Mobility, or Volume

This alternative does not employ any remedial component that would permanently or significantly reduce the toxicity, mobility, or volume of contaminants in soil.

4.2.6 Short-Term Effectiveness

There are no short-term impacts from this alternative because no remedial action would be taken.

4.2.7 Implementability

There are no technical or administrative implementation issues associated with this alternative.

4.2.8 Cost

There is no cost impact associated with this alternative.

4.2.9 State Acceptance

This criterion will be evaluated in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded.

4.2.10 Community Acceptance

This criterion will be evaluated in more detail in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded.

4.3 Alternative 2 – Excavation and Off-Site Treatment/Disposal

4.3.1 Description

Alternative 2 combines excavation and off-site treatment and disposal in order to achieve the RAO for soil at the PRRWP Area. No on-site treatment would be performed under Alternative 2. The proposed approach is to excavate all the areas in which the concentrations of COCs in soil exceed the RGs defined in Chapter 2.0. The total estimated consolidated (in-place) volume of contaminated soil from the PRRWP Area is 21,146 BCY. The soil volume increases as it is excavated, and the volume of unconsolidated material is estimated to be 27,491 LCY (30 percent swell). For cost estimating purposes, the top 2 feet of soil in the remedial area is assumed to be clean (concentrations of COCs below RGs). Additional clean soil would be excavated around the

contaminated area to slope the excavation to comply with federal excavation safety standards. The clean soil would be segregated and used to backfill the excavation.

Soil within the remedial area would be excavated and screened to remove oversize material. The excavated soil would be screened and transported to a staging area for waste characterization and subsequent off-site disposal. Soil adhering to the oversize material would be removed so that the oversize material could be returned to the excavation. Any oversize material not appropriate for use as backfill would be disposed off site along with the rest of the contaminated soil.

Following excavation of the contaminated soil, representative soil samples would be analyzed using the TCLP test. Soil that passes the TCLP tests can be disposed in a nonhazardous waste landfill. For cost estimating purposes in the FS, it is assumed that 20 percent of the soil excavated within the remedial area (7,331 LCY) would fail the TCLP test and be classified as a characteristic hazardous waste (see discussion in Section 2.6.1). The hazardous soil would be transported off site for disposal at a hazardous waste transportation, storage, and disposal facility (TSDF). The TSDF would treat any waste material that did not comply with the LDR treatment standards prior to disposal.

4.3.2 Overall Protection of Human Health and the Environment

Alternative 2 would protect human health by excavating contaminated soil with concentrations of COCs above the RGs. Ecological receptors are unlikely to be impacted under current conditions at the site (Section 2.4.2). The soil removal would also mitigate the migration of soil contaminants to groundwater.

The alternative provides adequate protection against the potential hazards of contaminants in excavated soil by transporting the contaminated soil to a disposal facility designed, constructed, and maintained to permanently manage such waste materials. Once the contaminated soil was excavated, soil classified as hazardous based on TCLP testing would be treated and/or disposed of in a RCRA hazardous waste TSDF.

4.3.3 Compliance with ARARs

The alternative would comply with all ARARs. There are no chemical-specific ARARs or TBCs for soil. There are no location-specific ARARs for this alternative. The remedial alternative would comply with all the action-specific ARARs listed in Table 2-3.

4.3.4 Long-Term Effectiveness

The long-term effectiveness of Alternative 2 is achieved through the removal of contaminated soil with COCs at concentrations above RGs. As previously discussed, the alternative would be effective in protecting potential receptors from direct exposure to COCs in soil. The residual risk associated with soil remaining on site would be acceptable for unrestricted use. The removal of the most highly contaminated soil would also reduce the mass transport of soil contaminants to groundwater.

The alternative would not require the maintenance of any long-term controls at the site to manage residual risk from direct exposure to soil.

4.3.5 Reduction of Toxicity, Mobility, or Volume

Although Alternative 2 would reduce the mass and volume of contaminated media remaining at the site, net reductions in contaminant mass would only be achieved by off-site treatment processes at the TSDF. Some of the excavated soil would require treatment at the TSDF to meet LDRs prior to disposal. On-site remedial activities strictly transfer COCs from one location on site to another off site. As a result**,** Alternative 2 would not comply with the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as their principal element. However, transferring waste material from an uncontrolled disposal site to a managed disposal facility that is designed and constructed to prevent the release of contaminants to the environment would restrict the mobility of COCs in excavated soil.

4.3.6 Short-Term Effectiveness

The implementation of Alternative 2 would not present any significant health threats to the community. The excavation of contaminated soils would be performed within the confines of PBOW at a sufficient distance from the property boundaries that the nearby community should not be affected. Proper decontamination and waste transportation practices would be followed to prevent the spread of contamination when equipment or waste materials leave the site.

Alternative 2 does not present site workers with any unusual health or safety concerns for a remediation project. A hazard evaluation would be performed prior to the commencement of the removal action, and a health and safety plan would be followed during site activities to ensure that risks to workers were minimized. Remediation workers would be provided with the appropriate personal protective equipment (PPE) in accordance with the health and safety plan.

Environmental impacts during remediation would be mitigated primarily through measures designed to ensure that contamination is not spread during remedial activities. This includes measures such as dust controls during excavation, decontamination procedures for equipment and personnel, and storm water runoff and run-on controls.

It is estimated that 15 months would be required to complete remedial activities, from the initiation of work plans to disposal of contaminated soil, backfilling of excavated areas, and completion of a site closeout report. Table 4-1 provides additional detail on the individual work elements involved in the execution of this alternative.

4.3.7 Implementability

This alternative is technically and administratively implementable.

Compliance sampling of the sidewall and bottom areas of the excavation and analysis of the soil samples for COCs would be used to monitor the effectiveness of excavation in removing soil contaminated above RGs.

All CERCLA wastes sent off site for disposal will follow the NCP requirements (40 CFR 300.440) for notification of the EPA Off-Site Coordinator to ensure that the waste disposal facility is acceptable.

The alternative does not preclude additional remedial action for soil if needed.

Alternative 2 does not present any unusual regulatory requirements that would compromise the administrative feasibility of the remedial approach.

4.3.8 Cost

The detailed cost evaluation associated with the implementation of Alternative 2 is presented in Table 4-1. The estimated capital cost for Alternative 2 is $6.2 million. The capital cost includes a 25 percent contingency.

A contingency of 25 percent has been added to the cost estimate to account for uncertainty in the estimated volume of soil requiring remediation and to provide an allowance for cost elements that are not identifiable at the present time. Due to the relatively short time frame over which the remedial alternative would be completed, all costs associated with its implementation are classified as capital costs. Accordingly, there are no O&M costs for this alternative, and the present value cost is equivalent to the capital cost.

4.3.9 State Acceptance

This criterion will be evaluated in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded.

4.3.10 Community Acceptance

This criterion will be evaluated in more detail in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded.

4.4 Alternative 3 – Excavation, Windrow Composting, and Off-Site Disposal

4.4.1 Description

Alternative 3 includes the following components:

- Excavation of contaminated soil within proposed remediation areas
- Windrow composting of soil that would be a hazardous waste due to elevated concentrations of 2,4-DNT
- Off-site disposal of treated and untreated soil as a nonhazardous waste. All soil would be disposed at an approved landfill for CERCLA waste.

Alternative 3 treats only soil that would be a hazardous waste if left untreated because the earlier composting results from TNTB (Table 3-1) show that composting was not able to meet the total DNT RG for approximately 75 percent of the soil that was treated. As a result, on-site placement was not possible for most of the treated soil. Soil within the remedial area at the PRRWP Area appears to be at least as contaminated as TNTB, and better results with composting at PRRWP Area seem unlikely. However, composting was effective at lowering the leachable concentration of 2,4-DNT at TNTB. This allowed the treated soil to be disposed off site as a nonhazardous, rather than a hazardous, waste. Therefore, it may be more cost-effective to compost only the soil at the PRRWP Area that would require off-site disposal as a hazardous waste if not treated.

As with Alternative 2, approximately 21,146 BCY of consolidated (in place volume) soil would be excavated. The soil volume increases as it is excavated, and the volume of unconsolidated material is estimated to be 27,491 LCY (30 percent swell). Following excavation of the contaminated soil, representative soil samples would be analyzed using the TCLP test. For cost estimating purposes in the FS, it is assumed that 20 percent of the contaminated soil excavated within the remedial area (7,331 unconsolidated LCY) would fail the TCLP test and be classified

as a characteristic hazardous waste (see discussion in Section 2.6.1). Under Alternative 3, soil that passed the TCLP tests would be disposed off site without treatment in a nonhazardous waste landfill. The remaining 7,331 LCY of soil assumed to be hazardous would be composted to render the soil nonhazardous for 2,4-DNT and comply with LDR requirements.

The conceptual design of the composting technology was based on previous experience with composting at PBOW. Design factors that significantly influence the cost of the remedial technology (e.g., size of the treatment area, windrow size, composting batch times, type and cost of equipment used, type and cost of operating labor, management of waste residuals) were based on the previous field implementation of the technology. The treatment area previously prepared at PBOW for windrow composting of contaminated soil during the PRRWP Area NTCRA would be used for these composting operations as well. The composting treatment area would be 800 feet long by 260 feet wide and surrounded by an earthen berm to contain storm water runoff. Treatment operations would be conducted in the open. The treatment area is graded and compacted to a 2 percent slope to control storm water. The treatment area is not covered with an artificial surface such as asphalt or concrete. The windrows would be constructed within the treatment area, and stockpiles of amendments would be staged in the area.

Storm water would be pumped from sumps on the lower end of the treatment area to a 260-foot-long by 30-foot-wide by 3-foot-deep contact water retention basin lined with 60-mil plastic. Water in the basin would be applied to the windrows as needed to maintain the moisture content of the compost. Excess water would be trucked off site to an industrial wastewater treatment facility. No on-site treatment of contact water would be required.

The top 2 feet of clean soil within the remedial area and the clean soil from the sloped area around the remedial area would be stockpiled separately and reused when the excavation was backfilled. Contaminated soil within the remedial area would be excavated and screened to remove oversize material and reduce particle size to increase the efficiency of the composting process. Soil adhering to the oversize material would be removed so that the oversize material would be returned to the excavation. Any oversize material not appropriate for use as backfill would be disposed off site at an approved disposal facility. The screened soil would be stockpiled near the excavation site for waste characterization. Hazardous soil would be transported when needed to the on-site composting facility for treatment.

Amendments would be brought to the composting facility as needed so that large amounts of amendments would not be required to be stored on site. This minimizes the cost of amendment storage as well as odor problems associated with manure, as the odor increases with storage

duration. Equipment, labor, and amendments needed to run the composting operation are available locally.

Compost windrow dimensions would be 24 feet wide by 9 feet high by 300 feet long. At least 15 feet would be allowed between windrow for access. It is assumed that four windrows would be constructed and in process at the same time. The compost mixture would consist of 25 percent by volume (85.7 weight percent) contaminated soil, 72 percent by volume (7.6 weight percent) straw, and 3 percent by volume (6.7 weight percent) chicken manure. Each windrow would contain 1,500 CY of compost. Therefore, 1,500 LCY of soil would be in treatment in a batch of four windrows. A treatment cycle for each batch is assumed to require 8 weeks: 1 week for material handling (constructing windrow and moving treated material), 5 weeks for treatment, and 2 weeks for curing and analytical testing. An additional 3 days would be required to transport compost in each windrow to the local municipal landfill before a new windrow could be constructed. There is no available storage space around the treatment pad, so treated soil would remain on the pad until being hauled off site. Based on past experience, the local municipal landfill can accept an average of 200 tons of waste material per day from PBOW. The treatment cycles for windrows would be staggered so that the windrows did not complete the treatment cycle at the same time. Treatment of the 7,331 LCY of soil would require an estimated 46 weeks. The volume of the treated compost would be about 25,559 CY.

Precompliance testing of the compost would consist of sampling the compost immediately after formation and once a week during treatment. One composite sample would be collected from each windrow each week and analyzed using the TNT colorimetric field test.

If the precompliance results indicated that cleanup levels had been achieved, compliance samples would be collected to confirm the results of the precompliance testing. For cost estimating purposes in this FS, it assumed that three composite compliance sample would be collected per windrow. The actual sampling and analytical strategy employed during remediation would be a Project Delivery Team decision.

Treated soil that passed the TCLP test and untreated nonhazardous soil would be disposed off site in a nonhazardous waste landfill.

4.4.2 Overall Protection of Human Health and the Environment

Alternative 3 would protect human health by removing or treating all soil with concentrations of COCs above RGs. Ecological receptors are unlikely to be impacted under current conditions at

the site (Section 2.4.2). Soil removal would also mitigate the migration of soil contaminants to groundwater.

4.4.3 Compliance with ARARs

The alternative would comply with all ARARs. There are no chemical-specific ARARs or TBCs for soil. There are no location-specific ARARs for this alternative. The remedial alternative would comply with all the action-specific ARARs listed in Table 2-3.

4.4.4 Long-Term Effectiveness

The long-term effectiveness of Alternative 3 is achieved through the removal or treatment of soil contaminated with COCs at concentrations above the RGs. As previously discussed, the alternative would be effective in protecting potential receptors from direct exposure to COCs in soil. The residual risk associated with soil remaining on site would be acceptable for unrestricted use. The removal or treatment of the most highly contaminated soil would also reduce the mass transport of soil contaminants to groundwater.

The alternative would not require the maintenance of any long-term controls at the site to manage residual risk from direct exposure to soil.

4.4.5 Reduction of Toxicity, Mobility, or Volume

Alternative 3 would comply with the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as their principal element. The treatment of contaminated soils by windrow composting would reduce the toxicity and mobility of NACs in soil through a combination of biological degradation and immobilization via covalent binding with humic substances in the compost.

Under this alternative, an estimated 7,331 LCY of contaminated soil would be composted.

4.4.6 Short-Term Effectiveness

The implementation of Alternative 3 would not present any significant health threats to the community. The excavation and treatment of contaminated soils would be performed within the confines of PBOW at a sufficient distance from the property boundaries that the nearby community should not be affected. The composting process would be managed to minimize the generation of dust or nuisance odors during remediation. Proper decontamination and waste transportation practices would be followed to prevent the spread of contamination when equipment or waste materials leave the site.

Alternative 3 does not present site workers with any unusual health or safety concerns. A hazard evaluation would be performed prior to the commencement of the removal action, and a health and safety plan would be followed during site activities to ensure that risks to workers were minimized. Remediation workers would be provided with the appropriate PPE in accordance with the health and safety plan.

Environmental impacts during remediation would be mitigated primarily through measures designed to ensure that contamination was not spread during remedial activities. These include measures such as dust controls during excavation and treatment, decontamination procedures for equipment and personnel, and storm water runoff and run-on controls.

It is estimated that 26 months would be required to complete remedial activities under Alternative 3, from the initiation of work plans to backfill of excavated areas, disposal of treatment residuals, and completion of a site closeout report. Table 4-2 provides additional detail on the individual work elements involved in the execution of this alternative.

4.4.7 Implementability

Windrow composting is a reliable technology, as it has been implemented at a number of remediation sites to treat soil contaminated with nitroaromatic explosives, polynuclear aromatic hydrocarbons, and other chemicals such as pesticides. Composting technology has also been widely used in the treatment of agricultural wastes and the management of treatment residuals from municipal wastewater treatment plants. As a result, a number of contractors are experienced in implementing the technology and equipment is readily available. Equipment, personnel, and amendments are available locally for composting.

Compliance sampling of the sidewall and bottom areas of the excavation and analysis of the soil samples for COCs can be used to monitor the effectiveness of excavation in removing soil contaminated above RGs.

The effectiveness of the composting process is easily monitored by periodic sampling and analysis of the compost during and after the treatment process. Colorimetric field analytical methods may be utilized during precompliance testing. Standard fixed-base laboratory analyses would be used for final compliance sampling after treatment was complete for each batch of compost. The composting treatment process could be extended for any composted material that failed compliance testing. Alternatively, batches of composted soil that did not comply with the TCLP criteria for 2,4-DNT could be managed off site as a hazardous waste.

All CERCLA wastes sent off site for disposal will follow the NCP requirements (40 CFR 300.440) for notification of the EPA Off-Site Coordinator to ensure that the waste disposal facility is acceptable.

The alternative does not preclude additional remedial action for soil, if needed.

Alternative 3 does not present any unusual regulatory requirements that would compromise the administrative feasibility of the remedial approach. Landfills receiving treated soil would be approved for disposal of CERCLA waste.

4.4.8 Cost

The detailed cost evaluation for the implementation of Alternative 3 is presented in Table 4-2. The estimated capital cost for Alternative 3 is $6.4 million.

A contingency of 25 percent has been added to the cost estimate to account for uncertainty in the estimated volume of soil requiring remediation and to provide an allowance for cost elements that are not identifiable at the present time. Due to the relatively short time frame over which the remedial alternative would be completed, all costs associated with its implementation are classified as capital costs. Accordingly, there are no O&M costs for this alternative, and the present value cost is equivalent to the capital cost.

4.4.9 State Acceptance

This criterion will be evaluated in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded. The state has accepted this technology for other PBOW sites.

4.4.10 Community Acceptance

This criterion will be evaluated in more detail in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded. The public has accepted this technology for other PBOW sites.

4.5 Alternative 4 – Excavation, Alkaline Hydrolysis, and Off-Site Disposal

4.5.1 Description

Alternative 4 includes the following components:

- Excavation of contaminated soil within proposed remediation areas
- Alkaline hydrolysis of excavated soil that would be a hazardous waste due to elevated concentrations of 2,4-DNT
- On-site disposal of treated soil that attains RGs for all COCs.

Under Alternative 4, treatment is reserved for soil that is hazardous. Nonhazardous soil would be disposed off site untreated. It is cost-effective to treat hazardous soil because alkaline hydrolysis costs approximately $200 per ton, compared to $308 per ton for off site treatment and disposal at a RCRA Subtitle C TSDF. Nonhazardous soil is not treated because the cost of alkaline hydrolysis is significantly higher than the $52 per ton to dispose of nonhazardous soil off site at a municipal landfill.

As with Alternatives 2 and 3, approximately 21,146 BCY of consolidated (in place volume) soil would be excavated. The soil volume increases as it is excavated, and the volume of unconsolidated material is estimated to be 27,491 LCY (30 percent swell). Following excavation of the contaminated soil, representative soil samples would be analyzed using the TCLP test. For cost estimating purposes in the FS, it is assumed that 20 percent of the contaminated soil excavated within the remedial area (7,331 unconsolidated LCY) would fail the TCLP test and be classified as a characteristic hazardous waste (see discussion in Section 2.6.1). Under Alternative 4, soil that passed the TCLP tests would be disposed off site without treatment in a nonhazardous waste landfill. The remaining 7,331 LCY of soil assumed to be hazardous would be treated using alkaline hydrolysis to render the soil nonhazardous for 2,4-DNT and comply with LDR requirements.

The top 2 feet of clean soil within the remedial area and the clean soil from the sloped area around the remedial area would be stockpiled separately and reused when the excavation was backfilled. Contaminated soil within the remedial area would be excavated and screened to remove oversize material and reduce particle size to increase the efficiency of the alkaline hydrolysis processes. Soil adhering to the oversize material would be removed so that the oversize material could be returned to the excavation. Any oversize material not appropriate for use as backfill would be disposed off site at an approved disposal facility. The screened soil would be stockpiled near the excavation site for waste characterization. Hazardous soil would be transported when needed to the on-site treatment facility.

The conceptual design of the alkaline hydrolysis technology was based on the implementation of the technology for soil at TNT Area A (TMG Services, Inc., 2012). The treatment area

previously prepared for windrow composting of contaminated soil from the PRRWP Area during the NTCRA would be used for PRRWP Area alkaline hydrolysis operations. The treatment area would be 800 feet long by 260 feet wide and surrounded by an earthen berm to contain storm water runoff. Treatment operations would be conducted in the open. The treatment area is graded and compacted to a 2 percent slope to control storm water. The treatment area is not covered with an artificial surface such as asphalt or concrete. The treatment cells would be constructed within the treatment area. Storm water would be pumped from sumps on the lower end of the treatment area to a 260-foot-long by 30-foot-wide by 3-foot-deep contact water retention basin that is lined with 60-mil plastic. Water in the basin would be applied to the soil as needed to maintain the moisture content during treatment. Excess water would be transported off site to an industrial wastewater treatment facility. No on-site treatment of contact water would be required.

Alkaline hydrolysis would be implemented by adding caustic soda and ferric sulfate to the excavated soil. NAC-contaminated soil would be treated in 375-LCY batches. The treatment area previously used to compost soil would be used for alkaline hydrolysis treatment. The soil would be arranged in a windrow configuration for treatment with chemicals mixed into the soil using a windrow turner. The remediation field crew could process 13 treatment cells at the same time within the treatment area. A total of 20 batches would be required to complete treatment at the PRRWP Area.

Caustic soda pellets would be added to the soil at a rate of 3 percent on a weight basis to raise the soil pH to 12.5 to 13. Water would be applied to the soil to promote dissolution of the caustic soda. One 55-gallon drum of 50 percent ferric sulfate would be applied to each 375 LCY treatment cell of soil (TMG Services, Inc., 2012). A treatment cycle for each batch is assumed to require 10 weeks: 1 week for material handling (constructing windrow and moving treated material), 7 weeks for treatment and post-treatment acidification (to pH $\leq$12), and 2 weeks for analytical testing. An additional 3 days would be required to transport compost in each windrow to the local municipal landfill before a new windrow could be constructed. There is no available storage space around the treatment pad, so treated soil would remain on the pad until being hauled off site. Based on past experience, the local municipal landfill can accept an average of 200 tons of waste material per day from PBOW. Treatment of the 7,331 LCY of soil would require an estimated 28 weeks.

Nitrite is a major reaction product of alkaline hydrolysis with NACs (Britto et al., 2010). Citric acid was used at VAAP to facilitate microbial denitrification and neutralization of the alkaline hydrolysis-treated soil (Britto et al., 2010). At VAAP, approximately 20 percent of the treated soil required denitrification to comply with the site-specific RG for nitrite (Britto et al., 2010).

The potential need for denitrification of alkaline hydrolysis-treated soil at the PRRWP Area can be evaluated by calculating the maximum theoretical nitrite concentration that would be produced based on the analytical data available for the site. The highest total NAC concentration (51,460 mg/kg) was detected in sample RR-241. An alkaline hydrolysis laboratory treatability study on VAAP soil contaminated with NACs demonstrated that 90 percent of the nitrogen in the NACs was converted into nitrite (Britto et al., 2010). Using this conversion factor, the worst-case nitrite concentration in alkaline hydrolysis-treated soil at the PRRWP Area would be 26,328 mg/kg. The EPA RSL for nitrite in residential soil is 7,800 mg/kg. If this nitrite conversion calculation is performed for soil samples within the remedial area, only 5 samples (RR-239, RR-241, RR-242, RR-244, and RR-246) of the 61 samples (8.2 percent) have a nitrite equivalent concentration greater than the RSL. This is equivalent to about 41 percent of the alkaline hydrolysis-treated soil after adjusting for the percentage of excavated soil within the remedial area that would be treated (8.2 percent / 20 percent = 41percent). Acetic acid was added to the alkaline hydrolysis-treated soil from TNTA to reduce the pH of the soil and provide the dissolved carbon needed for denitrification. For cost estimating purposes in the FS, it is assumed that acetic acid would be applied to the treated soil at the same unit rate as that used for soil from TNTA (1.1 gallon 80 percent acetic acid per LCY soil).

Precompliance (in-process) testing of the alkaline hydrolysis-treated soil involves taking samples for field pH measurements to determine if treatment is uniform throughout the batch. Compliance testing would be performed at the end of the treatment cycle. A composite sample would be collected from each 375-CY batch and analyzed for pH, total NACs, nitrate/nitrite, and TCLP 2,4-DNT. The pH of samples for NAC analysis would be adjusted in the field or at the laboratory to pH≤10 or the background soil pH, whichever is greater, prior to analysis by EPA Method 8330. USACE has found that analytical results for nitroaromatic explosive compounds using EPA Method 8330 may be biased low if the pH of the soil samples are elevated (Larson et al., 2012).

If the precompliance results indicated that cleanup levels had been achieved, compliance samples would be collected to confirm the results of the definitive analyses used for precompliance testing. For cost estimating purposes in this FS, it assumed that one composite compliance sample would be collected per treatment windrow. The actual sampling and analytical strategy employed during remediation would be a Project Delivery Team decision.

4.5.2 Overall Protection of Human Health and the Environment

Alternative 4 would protect human health by excavating contaminated soil with concentrations of COCs above the RGs. Ecological receptors are unlikely to be impacted under current

conditions at the site (Section 2.4.2). The soil removal would also mitigate the migration of soil contaminants to groundwater.

The alternative provides adequate protection against the potential hazards of contaminants in excavated soil through the combination of treatment and waste management technologies. After the contaminated soil was excavated, it would be chemically treated via alkaline hydrolysis to reduce the concentrations of COCs to below RGs. Alkaline hydrolysis-treated soil that met RGs and LDR requirements would be placed back on site.

4.5.3 Compliance with ARARs

The alternative would comply with all ARARs. There are no chemical-specific ARARs or TBCs for soil. There are no location-specific ARARs for this alternative. The remedial alternative would comply with all the action-specific ARARs listed in Table 2-3.

4.5.4 Long-Term Effectiveness

The long-term effectiveness of Alternative 4 is achieved through the removal of soil contaminated with COCs at concentrations above the RGs and treatment of soil to reduce the concentration of COCs to below RGs. As previously discussed, the alternative would be effective in protecting potential receptors from direct exposure to COCs in soil. The residual risk for treated soil that met RGs and was placed back on site would be acceptable for unrestricted use. The removal of the most highly contaminated soil would also reduce the mass transport of soil contaminants to groundwater.

The alternative would not require the maintenance of any long-term controls at the site to manage residual risk from direct exposure to soil.

4.5.5 Reduction of Toxicity, Mobility, or Volume

Alternative 4 would comply with the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as their principal element. The treatment of contaminated soils by alkaline hydrolysis would reduce the toxicity and mobility of NACs in soil.

Under this alternative, an estimated 36,654 CY of alkaline hydrolysis-treated soil would be placed back on site. All of the excavated soil would be treated prior to backfill.

4.5.6 Short-Term Effectiveness

The implementation of Alternative 4 would not present any significant health threats to the community. The excavation and treatment of contaminated soil would be performed within the confines of PBOW at a sufficient distance from the property boundaries that the nearby community should not be affected. The alkaline hydrolysis process would be managed to minimize the generation of dust or nuisance odors during remediation. Proper decontamination and waste transportation practices would be followed to prevent the spread of contamination when equipment or waste materials leave the site.

Alternative 4 involves the storage and handling of very corrosive materials, such as caustic soda and ferric sulfate solution. The material handling processes would be carefully designed to minimize worker contact with corrosive materials. A hazard evaluation would be performed prior to the commencement of the removal action, and a health and safety plan would be followed during site activities to ensure that risks to workers were minimized. Remediation workers would be provided with the appropriate PPE in accordance with the health and safety plan.

Environmental impacts during remediation would be mitigated primarily through measures designed to ensure that contamination was not spread during remedial activities. This includes measures such as dust controls during excavation and treatment, decontamination procedures for equipment and personnel, and storm water runoff and run-on controls. Incompatible hazardous chemicals used in the treatment process would be segregated during storage, and best management practices would be followed to prevent the uncontrolled release of chemicals to the environment.

It is estimated that 34 months would be required to complete remedial activities under Alternative 4, from the initiation of work plans to backfilling of excavated areas and disposal of treatment residuals. Table 4-3 provides additional detail on the individual work elements involved in the execution of this alternative.

4.5.7 Implementability

Alkaline hydrolysis is a relatively new technology applied to NAC-contaminated soil, particularly using caustic soda, but it was successfully implemented at full scale at VAAP, treating 86,000 cubic meters of soil ex situ and 11,500 cubic meters of soil in situ (TTI, 2010c). Equipment and personnel are available locally. The chemical stabilization reagents are available from multiple suppliers.

Compliance sampling of the sidewall and bottom areas of the excavation and analysis of the soil samples for COCs would be used to monitor the effectiveness of excavation in removing soil contaminated above RGs. The effectiveness of the alkaline hydrolysis process is easily monitored in process by taking soil pH measurements using a field pH instrument. Sampling and analysis of the treated soil after caustic soda/ferric sulfide treatment and neutralization would determine final compliance of the treated soil.

All CERCLA wastes sent off site for disposal will follow the NCP requirements (40 CFR 300.440) for notification of the EPA Off-Site Coordinator to ensure that the waste disposal facility is acceptable.

The alternative does not preclude additional remedial action for soil if needed.

Alternative 4 does not present any unusual regulatory requirements that would compromise the administrative feasibility of the remedial approach.

4.5.8 Cost

The detailed cost evaluation for the implementation of Alternative 4 is presented in Table 4-3. The estimated capital cost for Alternative 4 is $5.5 million.

A contingency of 25 percent has been added to the cost estimate to account for uncertainty in the estimated volume of soil requiring remediation and to provide an allowance for cost elements that are not identifiable at the present time. Due to the relatively short time frame over which the remedial alternative would be completed, all costs associated with its implementation are classified as capital costs. Accordingly, there are no O&M costs for this alternative, and the present value cost is equivalent to the capital cost.

4.5.9 State Acceptance

This criterion will be evaluated in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded. The state has accepted this technology for other PBOW sites.

4.5.10 Community Acceptance

This criterion will be evaluated in more detail in the decision document for the remedial action after a public meeting has been conducted and the public comment period has concluded. The public has accepted this technology for other PBOW sites.

5.0 Comparative Analysis of Remedial Alternatives

This chapter provides a comparative analysis of the four alternatives developed in Chapter 4.0. The comparison is based on the evaluation criteria and the overall feasibility of the alternatives in achieving RAOs for contaminated soil. A summary of this comparative analysis is presented in Table 5-1.

5.1 Protection of Human Health and the Environment

All of the alternatives, with the exception of Alternative 1, would permanently treat and/or remove contaminated soil, thereby reducing human health risks to meet the respective cancer and noncancer risk management goals. Ecological receptors are unlikely to be impacted under current conditions at the site (Section 2.4.2). Soil removal actions under Alternatives 2 through 4 would also prevent cross contamination of groundwater and surface water. Alternative 1 does not employ removal, containment, or treatment response actions that would mitigate the impact of source areas on other environmental media.

5.2 Compliance with ARARs

There are no chemical-specific or location-specific ARARs for any of the remedial alternatives. There are no action-specific ARARs for Alternative 1 because no further action would be taken under this alternative. Alternatives 2, 3, and 4 would comply with all action-specific ARARs.

Alternative 1 would leave concentrations of COCs in soil above risk-based RGs that were developed using EPA toxicity data. Alternatives 2, 3, and 4 would comply with the risk-based RGs.

5.3 Long-Term Effectiveness and Permanence

All of the alternatives, with the exception of Alternative 1, would reduce the magnitude of residual risk to meet the respective cancer and noncancer risk management goals. No long-term controls would be required at the site for Alternatives 2 through 4.

5.4 Reduction of the Toxicity, Mobility, or Volume of Contamination

Alternatives 3 and 4 would satisfy the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as their principal element. Alternatives 3 and 4 would treat on site an estimated 7,331 BCY of contaminated soil to reduce the leachable concentration of 2,4-DNT to make the soil nonhazardous and comply with the LDRs. The composting component

of Alternative 3 provides essentially irreversible treatment by coupling biodegradation and transformation processes to reduce the toxicity and mobility of NACs in soil. The alkaline hydrolysis component of Alternative 4 provides irreversible treatment by chemically transforming NACs to less toxic compounds.

Although Alternative 2 would remove contamination from the site, it would not result in any on-site reduction of contaminant mass. The disposal of excavated soil in an appropriate TSDF would minimize the potential for contaminants to leach into the environment. No treatment would occur under Alternative 1, and it would have no effect on the toxicity, volume, or mobility of soil contamination.

5.5 Short-Term Effectiveness

Alternatives 2 through 4 would all provide adequate safeguards for site workers and the community during remediation. All the contaminated soil excavated under Alternatives 2, 3 and 4 would require off-site management. Short-term effectiveness is not relevant to implementation of Alternative 1 because no further action would be taken. No threatened or endangered animal or plant species would be significantly affected or destroyed by remedial actions under Alternatives 2 through 4. Some of the treatment chemicals used in Alternative 4 are hazardous materials. Material handling systems would be designed to protect remediation workers from exposure to corrosive chemicals, and best management practices would be used to prevent the release of hazardous materials to the environment.

Remedial durations for alternatives are presented in Table 5-1 and summarized below:

- Alternative 2 – 15 months
- Alternative 3 – 26 months
- Alternative 4 – 22 months.

5.6 Implementability

All of the technologies in these alternatives are reasonably well developed and have been implemented on a full-scale basis at PBOW. Equipment, technical specialists, and materials are available for all the alternatives. The effectiveness of the alternatives can be monitored by sampling and analysis. Alternatives 2, 3 and 4, which involve disposal of waste off site, would use a landfill approved for that waste. None of the alternatives would preclude additional actions if the technologies were not completely effective.

5.7 Cost

There is no cost associated with Alternative 1. Alternative 4 has the lowest cost of all the alternatives that meet the threshold criteria of protection of human health and the environment and compliance with ARARs. Of Alternatives 2 and 3, the latter has the highest estimated cost.

Remedial costs for alternatives are presented in Table 5-1 and summarized below:

- Alternative 1 – $0
- Alternative 2 – $6.2 million
- Alternative 3 – $6.4 million
- Alternative 4 – $5.5 million.

5.8 State Acceptance

This criterion will be fully evaluated in a decision document for the PRRWP Area after receiving regulatory review comments on the proposed plan.

5.9 Community Acceptance

This criterion will be evaluated in a decision document for the PRRWP Area after the public meeting is held and the public comments are received during the corresponding public comment period.

6.0 References

The following are new references. Please refer to the 2002 FFS for previously used references.

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TABLES

Table 2-1

Remedial Goals for Soil
Pentolite Road Red Water Pond Area
Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

COC	RG (mg/kg)	Basis of RG[a]	RSL nc/c[b] (mg/kg)	HQ of RG	ILCR of RG
1,3-Dinitrobenzene	6.1	noncancer hazard	6.1/NA	1	NA
2-Amino-4,6-dinitrotoluene	15[c]	noncancer hazard	150/NA	0.1	NA
4-Amino-2,6-dinitrotoluene	15[c]	noncancer hazard	150/NA	0.1	NA
Combined aminodinitrotoluenes	30[c]	noncancer hazard	NA/NA	0.2	NA
2,4-Dinitrotoluene	5.6[d]	cancer risk	120/0.72	0.05[e]	8E-6
2,6-Dinitrotoluene	1.6[d]	cancer risk	61/0.72	0.03[e]	2E-6
Combined dinitrotoluenes	7.2[d]	cancer risk	NA/0.72	NA	1E-5
1,3,5-Trinitrobenzene	220	noncancer hazard	2200/NA	0.1	NA
2,4,6-Trinitrotoluene	36	noncancer hazard	36/19	1	2E-6
Total HI/ILCR				**1[f]**	**1E-5[g]**

[a] Refer to Section 2.3.1 of the text for discussion.
[b] RSL values are from U.S. Environmental Protection Agency (EPA), 2011, ***Regional Screening Levels, Supporting Table for Residential Soil***, June, on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_tables/index.htm. The noncancer hazard-based RSL supporting values are set at an HQ of 1, and the cancer risk-based RSL supporting values are set at an ILCR of 1E-6.
[c] RG values of 2-amino-4,6-dinitrotoluene (2-ADNT) and 4-amino-2,6-dinitrotoluene (4-ADNT) may alternatively be added (30 mg/kg combined) as the RG for combined ADNT isomers. Please note that the toxicities of these two compounds are evaluated based on the same chronic reference dose and their other chemical-specific parameters are essentially equal.
[d] RG values of 2,4- and 2,6-dinitrotoluene (DNT) may alternatively be added (7.2 mg/kg combined) as the RG for DNT isomers. Please note that these two compounds are evaluated based on the same cancer slope factor and their other chemical-specific parameters are essentially equal.
[e] RG derived on the basis of carcinogenicity of dinitrotoluene mixture; noncancer effects are *de minimis* (HQ<0.1).
[f] The total HI is rounded to one significant figure and considers additivity of COCs affecting the same target organ. The target organ of TNT is the liver and is assumed to be additive with the noncancer effects of 2,4-DNT (biliary tract), 2,6-DNT (liver), and the aminodinitrotoluene (ADNT) isomers (biliary tract). The noncancer effects of TNT are not additive with those of the other COCs (i.e., 1,3-dinitrobenzene [1,3-DNB] and 1,3,5-trinitrobenzene [1,3,5-TNB]), because the other COCs have different target organs with respect to their critical effects. The maximum HI at the respective RGs for TNT, the DNT isomers, and the ADNT isomers is 1.28 prior to rounding. 1,3-DNB affects the spleen and its effects are regarded as additive with 1,3,5-TNB, which also shares this same target organ. The HI at the respective RGs for 1,3-DNB and 1,3,5-TNB would be 1.1 prior to rounding.
[g] The total ILCR considers the cancer effects of all carcinogenic COCs, which includes the DNT isomers and TNT. The total ILCR at the respective RGs is 1.2E-5 prior to rounding.

COC - Chemical of concern.
HI - Hazard index; sum of HQ values.
HQ - Hazard quotient.
ILCR - Incremental lifetime cancer risk.
mg/kg - Milligrams per kilogram.
NA - Not applicable.
RG - Remedial goal.
RSL - Regional screening level.
nc/c - Noncancer hazard-based value/cancer risk-based value.

Table 2-2

Summary Statistics for Chemicals of Concern in Soil
Inside Remedial Area
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Chemical of Concern	Remedial Goal (mg/kg)	Number of Samples	Number of Detections	Average Conc. (mg/kg)	Minimum Conc. (mg/kg)	1st Quartile Conc. (mg/kg)	Median Conc. (mg/kg)	3rd Quartile Conc. (mg/kg)	Max Conc. (mg/kg)
2,4-Dinitrotoluene	5.6	61	57	1,227	0	11.1	18	85	22,000
2,6-Dinitrotoluene	1.6	61	29	174	0	0.15U	0.85	3.1	3,000
2-Amino-4,6-dinitrotoluene	15	61	26	144	0	0	0.17 U	9.04	6,400
4-Amino-2,6-Dinitrotoluene	15	61	10	80	0	0	0.14 U	0.73U	2,900
1,3-Dinitrobenzene	6.1	61	47	276	0	2	5.57	15	5,900
1,3,5-Trinitrobenzene	220	61	57	1,467	0	13,1	28	420	27,000
2,4,6-Trinitrotoluene	36	61	18	456	0	0	0.13	0.18U	26,000

mg/kg - Milligrams per kilogram.
U - Not detected. The associated value is the detection limit.

Table 2-3

Applicable and Relevant or Appropriate Requirements for Remedial Action
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
U.S. Environmental Protection Agency	Soil	Federal Land Disposal Restriction Alternative Treatment Standards for Contaminated Soil (40 CFR 268.49)	Applicable	Rules specify treatment standards for contaminated soil that contains a hazardous waste.	Remedial alternatives will comply with the treatment standards for contaminated soil that is placed back on site if the soil is managed outside the contiguous area of contamination.
U.S. Environmental Protection Agency	Soil	Federal Special Provisions for Cleanup – Staging Piles (40 CFR 264.554)	Applicable	Rule identifies requirements for temporary storage of solid, non-flowing hazardous remediation waste that is not in a containment building.	Remedial alternatives will comply with these requirements by observing the standards and design criteria for staging piles.

CFR – Code of Federal Regulations.

Table 2-4

Comparison of Alternative Treatment Standards for Contaminated Soil to Maximum Detected Concentrations Pentolite Road Red Water Pond Area Feasibility Study Addendum Former Plum Brook Ordnance Works Sandusky, Ohio

Chemicals of Concern and/or Underlying Hazardous Constituents	TCLP Limit (mg/L)	UTS[a] (mg/kg)	Minimum ATS[b] (mg/kg)	MDC (mg/kg)	MDC > ATS[c]
Nitroaromatics					
2,4,6-Trinitrotoluene	- -	- -	- -	26,000	NA
2,4-Dinitrotoluene	0.13	140	1,400	22,000	**Yes**
2,6-Dintrotoluene	- -	28	280	3,000	**Yes**
2-Amino-4,6-dinitrotoluene	- -	- -	- -	6,400	NA
4-Amino-2,6-dinitrotoluene	- -	- -	- -	2,900	NA
1,3-Dinitrobenzene	- -	- -	- -	5,900	NA
1,3,5-Trinitrotoluene	- -	- -	- -	27,000	NA

- - = Not applicable (no regulatory limit established)
MDC - Maximum detected concentration.
mg/L - Milligrams per liter.
NA - Not Applicable (No UTS established).
TCLP - Toxicity characteristic leaching procedure.
UTS - Universal Treatment Standard.
ATS - Alternative LDR Treatment Standard for contaminated soil.

Notes:
[a] The UTSs are defined in 40 Code of Federal Regulations (CFR) 268.48 Table UTS.
[b] The minimum ATS for contaminated soil is 10 x UTS. For soil that contains a hazardous waste (i.e., listed or characteristic), LDR regs requires a 90 percent reduction in all underlying hazardous constituents (UHC), with treatment not required below 10 x UTS (40 CFR 268.49).
[c] Treatment is required prior to land disposal for hazardous soil containing a UHC with a concentration > ATS.

Table 3-1

Comparison of TNTB Composted Soil Concentrations to Remedial Goals
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Chemical of Concern	PRRWP RG (mg/kg)	TNTB Soil Conc. After 6 Weeks of Composting			
		Windrow 1 (mg/kg)	Windrow 2 (mg/kg)	Windrow 3 (mg/kg)	Windrow 4 (mg/kg)
2,4,6-Trinitrotoluene	36	16.7	10.2	7.85	7.41
Dinitrotoluenes, total	7.2	37.77	13.17	7.70	<1.417
Aminodinitrotoluenes, total	30	16.8	10.2	6.76	<3.705
1,3-Dinitrobenzene	6.1	<0.490	<0.476	<0.493	<0.485
1,3,5-Trinitrotoluene	220	<0.490	<0.476	<0.493	<0.485

Notes:
mg/kg - Milligrams per kilogram.
PRRWP - Pentolite Road Red Water Pond.
RG - Remedial goal.
TNTB - TNT Area B.
Composted soil concentrations that exceed a remedial goal are highlighted.

Table 3-2

Comparison of PRRWP Area Soil Data to VAAP Alkaline Hydrolysis Pilot Test Results
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Plum Brook Ordnance Works
Sandusky, Ohio

Chemical	Units	PRRWP Maximum Conc.	PRRWP Average Conc.	PRRWP Soil RG	20 X TCLP Limit	Minimum ATS for Soil	VAAP Sample BS6[a]		VAAP Sample BS7[b]		VAAP Sample BS8[c]	
							Initial Conc.	Final Conc.	Initial Conc.	Final Conc.	Initial Conc.	Final Conc.
2,4,6-Trinitrotoluene	mg/kg	26,000	456	36	- -	- -	8000 D	0.05 U	8000 D	0.05	8000 D	3.9
2,4-Dinitrotoluene	mg/kg	22,000	1,227	5.6	2.6	1400	2900 D	0.52 P	2900 D	1.2	2900 D	0.63
2,6-Dinitrotoluene	mg/kg	3,000	174	1.6	- -	280	1800 D	6.5 P	1800 D	3.2	1800 D	1.7
Total Dinitrotoluenes	mg/kg	25,000	1,401	7.2	- -	- -	4700 D	7	4700 D	4.4	4700 D	2.4
2-Amino-4,6-Dinitrotoluene[d]	mg/kg	6,400	144	15	- -	- -	50 UD	0.05 U	50 UD	0.05 U	50 UD	0.05 U
4-Amino-2,6-Dinitrotoluene[d]	mg/kg	2,900	80	15	- -	- -	50 UD	0.05 U	50 UD	0.05 U	50 UD	0.05 U
Nitrate[d]	mg/kg	- -	- -	- -	- -	- -	8.4	63 U	8.4	63 U	8.4	69 U
Nitrite[d]	mg/kg	- -	- -	- -	- -	- -	17.5	604	17.5	1110	17.5	1390
pH	mg/kg	- -	- -	- -	- -	- -	7.5	13.4	7.5	13.1	7.5	13.2

Notes:
[a] BS6 - 16 oz NaOH per 10 pounds of soil
[b] BS7 - 10 oz NaOH + 200 mL $FeCl_3$ per 10 pounds of soil
[c] BS8 - 10 oz NaOH + 100 mL $FeCl_3$ per 10 pounds of soil
[d] This constituent was not identified as a chemical of concern for the R2BG.
ATS - Alternative treatment standard.
MDC - Maximum detected concentration in soil.
mg/kg - Milligrams per kilogram.
PRRWP - Pentolite Road Red Water Pond.
RG - Remedial goal.
TCLP - Toxic characteristic leaching procedure.
VAAP - Volunteer Army Ammunition Plant.

Source: ***Summary of Bench Scale and Field Treatability Tests, Chemical Treatment of TNT- and DNT-Contaminted Soil, TNT Manufacturing Valley, Volunteer Army Ammunition Plant, Chattanooga, Tennessee*** ; prepared for the U.S. Army Corps of Engineers, Mobile District; prepared by Tetra Tech, Inc., Oak Ridge, Tennessee.

Table 3-3

Summary of PBOW TNTC Alkaline Hydrolysis Treatability Study Results
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Plum Brook Ordnance Works
Sandusky, Ohio

Treatment		TNT	2,6-DNT	2,4-DNT	4A-2,6-DNT	2A-4,6-DNT
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Max TNTC Conc.		12000	10274	8912	933	45.4
% Trt Conc > Limits						
TNTA RG		8	1.5	6.0	1.7	1.3
20X TCLP		-	-	2.6	-	-
Min ATS		-	280	1400	-	-
	pH					
After 7-day treatment						
Control[a]	7.80	2575[a]	11441[b]	10733[b]	11	4
Na_2CO_3	10.60	287	6916	6193	16	10
Na_2CO_3/Fe	10.60	305	8715	7834	8J	3J
Portland cement	11.55	21	11703	8867	8J	2J
Portland cement/Fe	11.48	67	10889	9025	7J	4J
NaOH	12.66	5	10055	344	10U	10U
NaOH/Fe	12.62	4	7783	282	4J	10U
CaO	12.02	1843	9809	7512	10	10U
CaO/Fe	12.02	3	9427	8002	7J	10U
Kiln. Dust	10.91	62	10415	7860	7J	3J
Kiln. Dust/Fe	10.96	89	9601	8711	7J	3J
Bed ash	12.00	92	10652	7911	7J	10U
Bed ash/Fe	12.00	23	9927	7710	7J	10U
After 14-day treatment						
Portland cement	NA	789	8446	7508	12.2	1.5J
Portland cement/Fe	NA	48	9877	7615	13.4	2.1J
NaOH	NA	1.8J	11182	127	6.9J	10U
NaOH/Fe	NA	1.9J	9256	67	6.9J	10U
CaO	NA	11	9948	8194	10.5	3.3J
CaO/Fe	NA	2.3J	9253	7486	9.8J	2.2J
Bed ash	NA	72	10290	7926	11	1.4J
Bed ash/Fe	NA	2.5	11149	7935	10.9	2J
After 28-day treatment						
Control	8.36	2191	9386	9560	8.6J	4.9J
Portland cement	11.27	103	9033	7020	8.5J	5 U
Portland cement/Fe	11.50	1	8392	6718	8.8J	5 U
NaOH	11.76	3	8452	35	6.4J	5 U
NaOH/Fe	11.89	0.8J	10667	17	4.5J	5 U
CaO/Fe	12.01	2.5 U	9691	6702	9.2J	5 U
Bed ash	11.84	4802	10085	6831	11.6	5 U
Bed ash/Fe	11.90	108	9850	6780	7J	5 U
After 40-day treatment						
Na_2CO_3	10.75	659	10005	9067	5	4
Na_2CO_3/Fe	10.77	408	9438	8113	6	5
Portland cement	NA	16	6826	5537	7	4 U
Portland cement/Fe	NA	2	9670	6414	9	4 U
NaOH	11.44	2 U	9744	35	5	4 U
NaOH/Fe	11.60	2 U	8931	12	3	4 U
CaO/Fe	NA	11	9378	6667	10	4 U
Bed ash	NA	27	10429	6390	8	4 U
Bed ash/Fe	NA	2 U	9851	6681	10	4 U

Table 3-3

Summary of PBOW TNTC Alkaline Hydrolysis Treatability Study Results
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Plum Brook Ordnance Works
Sandusky, Ohio

Notes:

4A-2,6-DNT - 4-Amino-2,6-dinitrotoluene.
2A-4,6-DNT - 2-Amino-4,6-dinitrotoluene.
ATS - Alternative land disposal restriction treatment standard for contaminated soil.
CaO - Calcium oxide.
2,4-DNT - 2,4-Dinitrotoluene.
2,6-DNT - 2,6-Dinitrotoluene.
Fe - Iron.
Na_2CO_3 - Sodium carbonate.
NaOH - Sodium hydroxide.
PBOW - Plum Brook Ordnance Works.
RG - Remedial goal.
TCLP - Toxicity characteristic leaching procedure.
TNT - 2,4,6-Trinitrotoluene.
TNTC - TNT Area C
[a] Concentration in untreated soil sample.
[b] Spiked concentration in untreated soil sample.
U - Not detected.
J - Estimated value below laboratory reporting limit.

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Alternative 2
Excavation/Off-Site Disposal Cost Estimate

Site: Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works

Date: 5/14/2013

Scope:
1. Prepare work plan, H&S plan, materials list, and procurement along with the final report
2. Mobilize/demobilize equipment and personnel.
3. Prepare site for remedial activity.
4. Excavate contaminated soil, perform confirmation sampling & characterize waste.
5. Off-site disposal.
6. Site restoration.
7. Demobilize equipment and personnel.

1.0 Work Plans and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal
Work Plans and Final Report	1	$25,000.00	/ls	$25,000.00
Procurement	1	$10,000.00	/ea	$10,000.00
			Subtotal	**$35,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.
2. Pressure washer to be purchased for use during project.

Service/Materials	Unit	Unit Cost		Subtotal
Labor/Equipment:				
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00
Office Trailer (set up/tear down)	1	$500.00	/ls	$500.00
Pressure Washer	1	$500.00	/ls	$500.00
			Subtotal	**$6,000.00**

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:
1. Survey and mark proposed remediation area
2. Construction and maintenance of erosion and sediment controls
3. Install/improve access road for transport of equipment
4. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.
5. Assumed mulch is not contaminated.
6. Assumed mulch and vegetative debris to be placed adjacent to site to decompose.

Assumptions and Calculations:

1. Area to be cleared (acres) =	3.8
2. Daily output clearing crew (acres/day) =	1
3. Days clearing contractor in field =	4
4. Silt Fence to be installed (lf) =	5000
5. Daily output silt fencing crew (LF/day) =	500
6. Days silt fence crew in field =	10
7. Number of Hay Bales =	1000

Service/Materials	Unit	Unit Cost		Subtotal
Decontamination Pad	1	$10,000.00	LS	$10,000.00
Road Improvement	1	$25,000.00	LS	$25,000.00
Weigh Station	1	$5,000.00	LS	$5,000.00
Contractor:				
Site Superintendent	14	$600.00	/day	$8,400.00
Equipment Operator	14	$406.00	/day	$5,684.00
Laborer	14	$341.60	/day	$4,782.40
Laborer	14	$341.60	/day	$4,782.40
Subcontractor:				
Surveying Crew	1	$2,000.00	/day	$2,000.00
Bushhog	3	$500.00	/ac	$1,500.00
Materials:				
Field Instruments	3	$1,150.00	/wk	$3,450.00
Silt Fencing	5,000	$1.60	/day	$8,000.00
Hay Bales	1,000	$5.00	/ea	$5,000.00
Surface Water Controls	1	$5,000.00	/ls	$5,000.00
			Subtotal	**$88,599.00**

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of soil with contaminants exceeding RGs.
2. Screen oversize material.
3. Stockpile screened soil
4. Confirmatory sampling and analysis to verify extent of excavation.

Assumptions and Calculations:

1a. Remedial area (including NTCRA area)		121,783	ft^2
1b. Cubic yards (bank) of soil within remedial area =		28,195	bcy
2. Total depth of excavation (feet) =		8	ft
3. Slope line (run/rise) in lieu of shoring		2	ft/ft
4. Perimeter of excavation		2,870	ft
4a. Cutback area for excavation slope		45,920	ft^2
5. Unit volume of excavated soil within slope line		2.37	bcy/ft
6. Volume of excavated soil within slope line		6,803	bcy
7. Total volume of soil excavated		34,998	bcy
8. Swell factor for soil upon excavation =		1.3	lcy/bcy
9. Cubic yards (loose) of unconsolidated soil =		45,497	lcy
10. Bulk density of loose soil =		1.1	tons/lcy
11. Mass of unconsolidated soil =		50,047	tons
12. Capacity of screening plant =		300	tons/hr
13. Hydraulic excavator, CAT 321D bucket size		1.31	bcy
13a. Excavator cycle time		0.42	min
13b. Excavator production, 100% efficiency, CAT p4-210		187	lcy/hr
13c. Excavator efficiency		75%	
13d. Excavator production (tons/hr), (lcy/hr) =	154	140	lcy/hr
14. Excavator production (tons/day)/(bcy/day) =	1,234	1,122	lcy/day
15. Days to excavate soil =		41	days
16. Maximum distance to stockpile =		400	ft
17. Track loader CAT 963D bucket size		3.2	lcy
18. Track loader load and dump times =	0.07	0.04	min
19. Max. round trip travel time excavation to stockpile		1.8	min
20. Track load maneuver time =		0.2	min
21. Track loader max. cycle time =		2.11	min
22. Track loader cycles per hour, 100% efficiency		28.4	cycles/hr
23. Loader efficiency		83%	
24. Track loader cycles per hour		23	
25. Track loader production =		74	lcy/hr
26. No. of loaders required =		2	loaders
27. Number of excavation crew =		3	workers
28. Number of screening crew =		2	workers
29. Lineal foot of excavation per confirmation sample =		20	ft
30. Resampling factor for confirmation sampling =		110%	
31. Number of confirmatory samples from excavated area =		420	samples
32. Excavation area =		95,157	ft^2
33. Fraction of excavation work performed in Level C PPE =		10%	
35. Days excavation crew in Level C =		5	days
36. Days screening crew in Level C =		5	days
38. Work days per week		5	days
39. Work hours per day		8	hrs

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site Superintendent	41	$600.00	/day	$24,600.00
QA (Sampling) Coordinator	41	$496.00	/day	$20,336.00
Chemist (home office)	4	$600.00	/day	$2,460.00
Excavator Operator	41	$406.00	/day	$16,646.00
Track Loader Operator	41	$406.00	/day	$16,646.00
Track Loader Operator	41	$406.00	/day	$16,646.00
Screening Plant Operator	41	$406.00	/day	$16,646.00
Laborer	41	$341.60	/day	$14,005.60

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil (continued)					
Equipment:					
CAT 321D Excavator	2	$6,500.00	/4-wks	$13,000.00	
300-ton/hr Screening Plant	2	$9,000.00	/4-wks	$18,000.00	
CAT 953 Track Loader	4	$8,800.00	/4-wks	$35,200.00	
2000 gal. Water Truck	2	$3,800.00	/4-wks	$7,600.00	
Office Trailer	2	$800.00	/mo	$1,600.00	
Generator	2	$595.00	/mo	$1,190.00	
P/U Truck	2	$1,200.00	/mo	$2,400.00	
Analytical:					
Excavation Confirmation Sampling:					
NACs (8330)	420	$125.00	/ea	$52,500.00	
NAC field analyses	420	$40.00	/ea	$16,800.00	
Shipping	28	$40.00	/ea	$1,120.00	
Materials & Services:					
Level D PPE	180	$10.00	/day	$1,800.00	
Level C PPE	25	$35.00	/day	$875.00	
PID rental	2	$974.00	/mo.	$1,948.00	
CGI rental	2	$380.00	/mo.	$760.00	
				Subtotal	**$282,779.00**

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Off-Site Disposal

Includes:
1. Characterization of excavated soil for offsite disposal.
2. Characterization of stormwater runoff from soil staging area for offsite disposal.
3. Offsite disposal of non-hazardous soil at local municipal landfill.
4. Offsite disposal of soil hazardous for 2,4-DNT at a hazardous waste landfill.
5. Costs for characterization of uncontaminated excavated soil are in Section 6, Site Restoration.

Assumptions and Calculations:

1. Percent of contaminated soil within remedial area:		75%	
2. Percent of excavated soil assumed to be hazardous.		20%	
3. Waste characterization and disposal sampling: 1 sample per		300	lcy
4. Erie County Landfill daily capacity		200	tons
5. EQ Environmental TSDF daily capacity		300	tons
6. Bulk density of loose soil =		1.1	tons/lcy
7. Volume of soil within remedial area		36,654	lcy
8. Volume of contaminated soil		27,491	lcy
9. Volume of hazardous soil for disposal =		7,331	lcy
10. Volume of nonhazardous soil for disposal =		20,160	lcy
11. Mass of D030 soil for haz disposal =		8,064	tons
12. Mass of nonhazardous soil for disposal =		22,176	tons
13. Non-haz waste disposal costs ($/ton) =		$35	Erie County Landfill
14. D030 Haz waste disposal cost ($/ton) =		$250	EQ Environmental [a]
15. Haz waste transportation cost (without fuel surcharge)		$704	per truck load
16. Haz waste transportation fuel surcharge		47%	per truck load
17. Haz waste transportation cost (incl. fuel surcharge) =		$1,035	per truck load
18. Truck loads to transport haz soil		448	truck loads
19. Number of workers in field crew =		3	
20. Average load capacity of a 22 ton end dump truck =.		18	tons
21. Round trip duration from site to non-haz landfill =		1.5	hrs
22. Truck loads to transport non-haz soil =		1,232	loads
23. Total transportation time to municipal landfill =		1,848	hrs
24. Daily haul cycles per truck		5	loads
25. Daily haul capacity per truck		90	tons
26. Number of trucks required		3	trucks
27. CAT 924K wheel loader bucket volume		2.5	lcy
28. Wheel loader cycle time, truck loading =		0.5	min
29. Cycles per hour, 100% efficiency =		120	cycles/hr
30. Wheel loader efficiency =		83%	
31. Cycles per hour =		100	cycles/hr
32. Wheel loader production (lcy/day), (tons/day) =	1,992	2,191	tons/day
33. No. of wheel loaders =		1	
34. No. of days to complete nonhazardous soil disposal =		111	days
35. No. of days to complete hazardous soil disposal =		27	days
36. Volume of stormwater requiring off-site disposal (gal) =		20,000	
37. Truck loads of stormwater for disposal =		5	truck loads
38. Number of wastewater samples =		5	samples
39. Work days per week =		5	days
40. Work hours per day =		8	hours

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site Superintendent	111	$600.00	/day	$66,600.00
QA (Sampling) Coordinator	111	$496.00	/day	$55,056.00
Wheel Loader Operator	111	$406.00	/day	$45,066.00
Truck Drivers (non haz soil)	333	$406.00	/day	$135,198.00
Laborer	111	$341.60	/day	$37,917.60
Materials:				
Level D PPE	333	$10.00	/day	$3,330.00

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Off-Site Disposal (continued)					
Equipment:					
CAT 924K Wheel Loader	6	$4,000.00	/4-wks	$24,000.00	
Dump Truck	18	$4,000.00	/4-wks	$72,000.00	
Office Trailer	6	$800.00	/mo	$4,800.00	
Generator	6	$595.00	/mo	$3,570.00	
P/U Truck	6	$1,200.00	/mo	$7,200.00	
Analytical:					
Waste Characterization Soil Sampling:					
TCLP 2,4-DNT	92	$125.00	/ea	$11,500.00	
NACs (8330)	92	$125.00	/ea	$11,500.00	
Stormwater Sampling:					
TCLP 2,4-DNT	5	$125.00	/ea	$625.00	
NACs (8330)	5	$125.00	/ea	$625.00	
Off-Site Disposal Costs:					
Disposal Cost (Non-Haz waste)	22,176	$35.00	/ton	$776,160.00	Erie County Landfill
Transportation (Haz Waste)	448	$1,035	/load	$463,680.00	
Disposal Cost (D030 haz waste)	8,064	$250.00	/ton	$2,016,000.00	Chemical oxidation
Disposal Cost (D030 haz waste)	0	$500.00	/ton	$0.00	Incineration
Stormwater Disposal	20,000	$0.25	/gal	$5,000.00	Enviro-Tank Clean
				Subtotal	**$3,739,828.00**

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 Site Restoration

Includes:
1. Sample and analyze soil believed to be uncontaminated.
2. Backfill excavated areas with uncontaminated excavated soil and clean backfill.
3. Re-seed site.

Assumptions and Calculations:

1. Volume of consolidated soil excavated (bcy) =	34,998	bcy
2. Soil compaction factor =	1.15	lcy/bcy
3. Volume of soil required for backfill =	40,248	lcy
4. Vol. of stockpiled uncontaminated soil used to slope excavation	6,803	bcy
5. Volume of soil within remedial area that is uncontaminated	7,049	bcy
6. Vol. of excavated soil used for backfill =	18,008	lcy
7. Volume of offsite backfill required =	22,240	lcy
8. Track loader production =	589	lcy/day
9. No. of track loaders	2	loaders
10. Total track loader output =	1,178	lcy/day
11. Field days required to backfill soil =	35	days
12. CAT 815F2 soil compactor wheel drum width =	3.25	ft
13. Soil compactor ground speed, 10% rolling (total) resistance =	5	mph
14. Compacted lift thickness =	6	in
15. No. of soil compactor passes =	6	passes/lift
16. Soil compactor production, 100% efficiency =	529	bcy/hr
17. Soil compactor efficiency =	83%	
18. Soil compactor production =	4,039	lcy/day
19. Number of field crew =	3	workers
20. Reseeding time =	5	days
21. Task duration (days) =	40	
22. Days per work week =	5	days/week
23. Hours per work day =	8	hrs/day
24. Characterization sampling for onsite backfill: 1 sample per	300	lcy
25. No. of onsite backfill samples	60	samples

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	40	$600.00	/day	$24,000.00	
QA Coordinator	40	$496.00	/day	$19,840.00	
Track Loader Operator	35	$406.00	/day	$14,210.00	
Soil Compactor Operator	35	$406.00	/day	$14,210.00	
Laborer	35	$341.60	/day	$11,956.00	
Reseeding	122	$80.00	/1000 ft^2	$9,760.00	
Road Repair	1	$175,000.00	/ls	$175,000.00	Erie Blacktop
Equipment:					
CAT 953 Track Loader	4	$8,800.00	/4-wks	$35,200.00	
CAT 815F2 Soil Compactor	2	$12,600.00	/4-wks	$25,200.00	
Office Trailer	2	$800.00	/mo	$1,600.00	
Generator	2	$595.00	/mo	$1,190.00	
P/U Truck	2	$1,200.00	/mo	$2,400.00	
Material:					
Backfill	22,240	$12.00	/cy	$266,880.00	delivered to site
PID rental	2	$974.00	/mo.	$1,948.00	
CGI rental	2	$380.00	/mo.	$760.00	
Level D PPE	120	$10.00	/day	$1,200.00	
Analytical:					
NACs (8330)	60	$125.00	/ea	$7,500.00	
Shipping	10	$40.00	/ea	$400.00	
				Subtotal	**$613,254.00**

Table 4-1

Alternative 2 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Overall Cost	
Total Capital Cost	**$4,765,500.00**
Contingency (25%)	**$1,191,375.00**
Contractor Oversight (5%)	**$238,275.00**
Total Cost	**$6,195,200.00**

[a] EQ Environmental, Wayne, MI. Treatment of soil using chemical oxidation at TSDF to lower DNT concentrations to comply with LDRs followed by disposal in RCRA C cell.
[b] CAT equip rental prices from Ohio CAT Rental, Toledo, http://www.ohiocat.com/en/EQUIPMENT%20DIVISION/Rentals.aspx
*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Alternative 3	**Site:**	Pentolite Road Red Water Pond Area
Excavation/Composting/Off-Site Disposal		Plum Brook Ordnance Works
Cost Estimate	**Date:**	**5/14/2013**

Scope:
1. Prepare composting work plan, H&S plan, materials list, and procurement along with the final report
2. Mobilize equipment and personnel.
3. Prepare site for remedial activity.
4. Excavate contaminated soil, perform confirmation sampling & characterize waste.
5. Treatment of soil contaminated with nitroaromatic compounds via windrow composting.
6. Off-site disposal.
7. Site restoration.
8. Demobilize equipment and personnel.

1.0 Work Plans and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal	
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00	
Procurement	1	$15,000.00	/ea	$15,000.00	
				Subtotal	**$50,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.
2. Pressure washer to be purchased for use during project.

Service/Materials	Unit	Unit Cost		Subtotal	
Labor/Equipment:					
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00	
Office Trailer (set up/tear down)	1	$500.00	/ls	$500.00	
Pressure Washer	1	$500.00	/ls	$500.00	
				Subtotal	**$6,000.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:
1. Survey and mark proposed remediation area
2. Construction and maintenance of Erosion and Sediment Controls
3. Install/improve access road for transport of equipment
4. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.
5. Assumed mulch is not contaminated.
6. Assumed mulch and vegetative debris to be placed adjacent to site to decompose.

Assumptions and Calculations:

1. Area to be cleared (acres) =	3.8
2. Daily output clearing crew (acres/day) =	1
3. Days clearing contractor in field =	4
4. Silt Fence to be installed (lf) =	5000
5. Daily output silt fencing crew (LF/day) =	500
6. Days silt fence crew in field =	10
7. Number of Hay Bales =	1,000

Service/Materials	Unit	Unit Cost		Subtotal
Decontamination Pad	1	$10,000.00	LS	$10,000.00
Road Improvement	1	$25,000.00	LS	$25,000.00
Weigh Station	1	$5,000.00	LS	$5,000.00
Contractor:				
Site Superintendent	14	$600.00	/hr	$8,400.00
Equipment Operator	14	$406.00	/day	$5,684.00
Laborer	14	$341.60	/day	$4,782.40
Laborer	14	$341.60	/day	$4,782.40
Subcontractor:				
Surveying Crew	1	$2,000.00	/day	$2,000.00
Bushhog	3	$500.00	/ac	$1,500.00
Materials:				
Field Instruments	3	$1,150.00	/wk	$3,450.00
Silt Fencing	5,000	$1.60	/day	$8,000.00
Hay Bales	1,000	$5.00	/ea	$5,000.00
Surface Water Controls	1	$5,000.00	/ls	$5,000.00
			Subtotal	**$88,599.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of soil with contaminants exceeding RGs.
2. Screen oversize material.
3. Stockpile screened soil
4. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. Remedial area		121,783	ft^2
1b. Total cubic yards of consolidated soil excavated =		28,195	bcy
2. Total depth of excavation (feet) =		8	ft
3. Slope line (run/rise) in lieu of shoring		2	ft/ft
4. Perimeter of excavation		2,870	ft
4a. Cutback area for excavation slope		45,920	ft^2
5. Unit volume of excavated soil within slope line		2.37	bcy/ft
6. Volume of excavated soil within slope line		6,803	bcy
7. Total volume of soil excavated		34,998	bcy
8. Swell factor for soil upon excavation =		1.3	lcy/bcy
9. Cubic yards (loose) of unconsolidated soil =		45,497	lcy
10. Bulk density of loose soil =		1.1	tons/lcy
11. Mass of unconsolidated soil =		50,047	tons
12. Capacity of screening plant =		300	tons/hr
13. Hydraulic excavator, CAT 321D bucket size		1.31	bcy
13a. Excavator cycle time		0.42	min
13b. Excavator production, 100% efficiency, CAT p4-210		187	lcy/hr
13c. Excavator efficiency		75%	
13d. Excavator production (tons/hr), (lcy/hr) =	154	140	lcy/hr
14. Excavator production (tons/day)/(bcy/day) =	1,234	1,122	lcy/day
15. Days to excavate soil =		41	days
16. Maximum distance to stockpile =		400	ft
17. Track loader CAT 963D bucket size		3.2	lcy
18. Track loader load and dump times =	0.07	0.04	min
19. Max. round trip travel time excavation to stockpile		1.8	min
20. Track load maneuver time =		0.2	min
21. Track loader max. cycle time =		2.11	min
22. Track loader cycles per hour, 100% efficiency		28.4	cycles/hr
23. Loader efficiency		83%	
24. Track loader cycles per hour		23	
25. Track loader production =		74	lcy/hr
26. No. of loaders required =		2	loaders
27. Number of excavation crew =		3	workers
28. Number of screening crew =		2	workers
29. Lineal foot of excavation per confirmation sample =		20	ft
30. Resampling factor for confirmation sampling =		110%	
31. Number of confirmatory samples from excavated area =		420	samples
32. Excavation area =		95,157	ft^2
33. Fraction of excavation work performed in Level C PPE =		10%	
35. Days excavation crew in Level C =		5	days
36. Days screening crew in Level C =		5	days
38. Work days per week		5	days
39. Work hours per day		8	hrs

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site Superintendent	41	$600.00	/day	$24,600.00
QA (Sampling) Coordinator	41	$496.00	/day	$20,336.00
Chemist (home office)	4	$600.00	/day	$2,460.00
Excavator Operator	41	$406.00	/day	$16,646.00
Track Loader Operator	41	$406.00	/day	$16,646.00
Track Loader Operator	41	$406.00	/day	$16,646.00
Screening Plant Operator	41	$406.00	/day	$16,646.00
Laborer	41	$341.60	/day	$14,005.60

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil (continued)					
Equipment:					
CAT 321D Excavator	2	$6,500.00	/4-wks	$13,000.00	
300-ton/hr Screening Plant	2	$9,000.00	/4-wks	$18,000.00	
CAT 953 Track Loader	4	$8,800.00	/4-wks	$35,200.00	
2000 gal. Water Truck	2	$3,800.00	/4-wks	$7,600.00	
Office Trailer	2	$800.00	/mo	$1,600.00	
Generator	2	$595.00	/mo	$1,190.00	
P/U Truck	2	$1,200.00	/mo	$2,400.00	
Analytical:					
Excavation Confirmation Sampling:					
NACs (8330)	420	$125.00	/ea	$52,500.00	
NAC field analyses	420	$40.00	/ea	$16,800.00	
Shipping	28	$40.00	/ea	$1,120.00	
Materials & Services:					
Level D PPE	180	$10.00	/day	$1,800.00	
Level C PPE	25	$35.00	/day	$875.00	
PID rental	2	$974.00	/mo.	$1,948.00	
CGI rental	2	$380.00	/mo.	$760.00	
				Subtotal	**$282,779.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Windrow Composting of Contaminated of Soil

Includes:
1. Rental of composting equipment.
2. Procurement & stockpiling of composting amendments.
3. Mix and compost soil and amendments.
4. Composting of soil hazardous due to leachable concentrations of 2,4-DNT
5. Pre-compliance testing: after compost formation & at end of treatment.
6. Pre-compliance testing using definitive field analysis for NAC.

Assumptions:

1. Percent of excavated soil in remedial area that is contaminated:	75%			
2. Percent of contaminated soil hazardous for 2.4-DNT:	20%			
3. Width of treatment area [a]	156	ft		
4. Length of treatment area [a]	323	ft		
5. Volume of excavated soil in remedial area	28,195	bcy		
6. Swell factor for soil upon excavation =	1.3	lcy/bcy		
7. Volume of excavated soil in remedial area =	36,654	lcy		
8. Volume of hazardous soil to be treated	7,331	lcy		
9. Bulk density of loose soil	1.1	tons/lcy		
10. Mass of hazardous soil to be treated	8,064	tons		
13. Wt % and Vol % of soil in compost	85.74%		25.0% [a]	
14. Wt % and Vol % of manure in compost	6.69%		2.9% [a]	
15. Wt % and Vol % of straw in compost	7.58%		72.1% [a]	
16. Total mass of compost	18,811,155	lbs		
17. Mass of soil in compost	16,128,000	lbs		
18. Mass of manure in compost	1,257,720	lbs		
19. Mass of straw in compost	1,425,435	lbs		
20. Volume (lcy) and bulk density (lb/cy) of soil	7,331		2,200	lb/cy
21. Volume (cy) and bulk density (lb/cy) of manure	850		1,479	lb/cy [e]
22. Volume (lcy) and bulk density (lb/cy) of straw	21,142		67	lb/lcy [c]
23. Volume (cy) and bulk density of compost [b]	25,559		642	lb/cy
24. Bulk density of baled straw	169	lb/cy [c]		
25. Windrow width [a]	24	ft		
26. Windrow height [a]	9	ft		
27. Windrow length [a]	300	ft		
28. Volume of compost per windrow	1,500	cy		
29. Mass of windrow	481	tons		
30. Mass of soil per windrow [a]	413	tons		
31. Soil volume per windrow	375	cy		
32. Number of windrows per treatment cycle [a]	4	windrows/cycle		
33. Number of treatment cycles =	5	cycles		
34. Number of windrows =	19.5	windrows		
35. Treatment duration per batch	6	weeks		
36. Compliance analytical TAT	2	weeks		
37. Erie County Landfill waste capacity per day	200	tons/day		
28. Treatment delay due to offsite disposal [d]	38	workdays		
40. Total treatment duration (days) =	318	workdays		
40. Total treatment duration (weeks) =	46	weeks		
41. Work hours per day	8	hrs		
42. Work days per week	7	days		
43. Number of field crew =	6			
44. Tractor and straw blower are in-use 1 day/week and on stand-by the rest of the week.				
45. Pre-compliance testing shall weekly per windrow and consist of:				
- EnSys TNT 20, one per batch. Number of samples =	120			
- EnSys TNT 20, no. of samples per kit =	20			
- Total NAC, one per batch. Number of samples =	100			
46. Compliance testing:				
- Composite samples per windrow =	3			
- Total NACs. Number of samples =	60			
- TCLP 2,4-DNT. Number of samples =	60			
47. Unit cost for straw	$200	per ton		Meyer Hatchery
48. Unit cost for chicken manure	$100	per ton		Meyer Hatchery

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Windrow Composting of Contaminated of Soil (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	318	$600.00	/day	$191,094.05	
QA (Sampling) Coordinator	318	$496.00	/day	$157,971.08	
Equipment Operator	318	$567.20	/day	$180,647.58	
Equipment Operator	318	$406.00	/day	$129,306.98	
Equipment Operator	318	$406.00	/day	$129,306.98	
Laborer	318	$341.60	/day	$108,796.21	
Equipment:					
Windrow Turner (Allu 38H-24'x9')	12	$45,000.00	/mo	$540,000.00	
CAT 321D Excavator	12	$6,150.00	/4-wks	$73,800.00	
CAT 924K Wheel Loader	12	$4,000.00	/4-wks	$48,000.00	
2000 gal. Water Truck	12	$4,200.00	/4-wks	$50,400.00	
CAT 725 Articulated Truck	12	$9,100.00	/4-wks	$109,200.00	
CAT 725 Articulated Truck	12	$9,100.00	/4-wks	$109,200.00	
Tractor	12	$5,500.00	/mo	$66,000.00	
Straw Blower	12	$4,000.00	/mo	$48,000.00	
21000 gallon Frac Tank	12	$1,400.00	/mo	$16,800.00	
21000 gallon Frac Tank	12	$1,400.00	/mo	$16,800.00	
2-in Trash Pump	12	$345.00	/mo	$4,140.00	
3-in Trash Pump	12	$435.00	/mo	$5,220.00	
Office Trailer	12	$800.00	/mo	$9,600.00	
Generator	12	$595.00	/mo	$7,140.00	
P/U Truck	12	$1,200.00	/mo	$14,400.00	
Spectrophotometer	0	$3,012.00	/ls	$0.00	Previously purchased
Materials:					
Straw (baled)	713	$200.00	/ton	$142,543.50	
Manure	629	$100.00	/ton	$62,886.00	
Water	1,932	$9.40	/kgal	$18,160.80	
Level C PPE	318	$35.00	/day	$11,147.15	
Air Monitoring Screening Kits	1	$2,500.00	/ls	$2,500.00	
Moisture/Temp Probes	1	$700.00	/ea	$700.00	
Analytical:					
Pre-Compliance Sampling:					
EnSys Kit (TNT 20) - 20 samples per kit	6	$693.00	/ea	$4,158.00	Modern Water
Compliance Sampling:					
Total NACs	60	$105.00	/ea	$6,300.00	
TCLP 2,4-DNT	60	$135.00	/ea	$8,100.00	
				Subtotal	**$2,272,318.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 On-Site Disposal

Includes:
1. Onsite disposal of treated soil.

Assumptions and Calculations:

1. Volume of treated soil for onsite disposal =	0	lcy
2. Loader output =	589	lcy/day
3. Days to load compost =	0	days
4. Dump truck capacity (cy) =	12	
5. Dump truck haul distance (mi.) =	0.5	
6. Dump truck output (cy/day) =	250	
7. No. of dump trucks per day =	2	
8, Work days per week =	5	days
9. Work hours per day =	8	hrs
10. The duration to load & haul treated soil (days) =	0	

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	0	$49.00	/hr	$0.00	
QA Coordinator	0	$36.00	/hr	$0.00	
Equipment Operator	0	$406.00	/day	$0.00	
Equipment Operator	0	$406.00	/day	$0.00	
Laborer/Oiler	0	$293.00	/day	$0.00	
Truck Drivers	0	$341.60	/day	$0.00	
Equipment:					
Wheel Loader	0	$5,000.00	/mo	$0.00	load compost
Dump Truck (6 ea)	0	$3,890.00	/mo	$0.00	haul compost
Dozer	0	$3,500.00	/mo	$0.00	spread compost
Office Trailer	0	$800.00	/mo	$0.00	
Generator	0	$595.00	/mo	$0.00	
P/U Truck	0	$1,200.00	/mo	$0.00	
Material:					
PID rental	0	$974.00	/mo.	$0.00	
CGI rental	0	$380.00	/mo.	$0.00	
Level D PPE	0	$10.00	/day	$0.00	
				Subtotal	**$0.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Off-Site Disposal

Includes:
1. Waste characterization of untreated soil for offsite disposal.
2. Compost characterization included in Section 5, Windrow Composting
3. Characterization of uncontaminated excavated soil included in Section 8, Site Restoration
4. Offsite disposal of compost and untreated soil at local municipal landfill.
5. Characterization of collected stormwater runoff from treatment area.
6. Offsite disposal of stormwater as a nonhazardous waste.
7. Costs for site superintendent, QA coordinator, wheel loader operator, wheel loader, office trailer, generator and PU truck associated with disposal of compost is accounted for in Section 5, Windrow Composting.

Assumptions and Calculations:

1. Percent of contaminated soil within remedial area:		75%	
2. Percent of excavated soil assumed to be hazardous.		20%	
3. Waste characterization and disposal sampling: 1 sample per		300	lcy
4. Erie County Landfill daily capacity		200	tons
5. Total volume of compost for nonhazardous disposal =		25,559	cy
6. Bulk density of compost (tons/cy) =		0.321	tons/cy
7. Mass of treated soil =		8,064	tons
8. Mass of compost amendments =		1,342	tons
9. Mass of compost for off-site disposal =		9,406	tons
10. Volume of untreated soil for off-site non-haz disposal =		20,160	lcy
11. Bulk density of loose soil =		1.1	tons/lcy
12. Mass of untreated soil for off-site non-haz disposal =		22,176	tons
13. Total mass of material for offsite nonhazardous disposal		31,582	tons
14. Average load capacity of a 22 ton end dump truck =.		18	tons
15. Distance to municipal landfill		10	mi
16. Round trip duration from site to non-haz landfill =		1.5	hrs
17. Truck loads to transport non-haz soil =		1,755	loads
18. Total transportation time to municipal landfill =		2,633	hrs
19. Daily haul cycles per truck		5	loads
20. Daily haul capacity per truck		90	tons
21. Number of trucks required		3	trucks
22. CAT 924K wheel loader bucket volume		2.5	lcy
23. Wheel loader cycle time, truck loading =		0.5	min
24. Cycles per hour, 100% efficiency =		120	cycles/hr
25. Wheel loader efficiency =		83%	
26. Cycles per hour =		100	cycles/hr
27. Wheel loader production (lcy/day), (tons/day) =	1,992	2,191	tons/day
28. No. of wheel loaders =		1	loader
29. No. of days to complete compost disposal =		47	days
30. No. of days to complete untreated soil disposal =		110.9	days
31. No. of days to complete nonhazardous waste disposal =		158	days
32. No. of days to complete hazardous soil disposal =		0	days
33. Volume of stormwater requiring off-site disposal (gal) =		20,000	gal
34. Truck loads of stormwater for disposal =		5	truck loads
35. Number of wastewater samples =		5	samples
36. Work days per week =		5	days
37. Work hours per day =		8	hours

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Off-Site Disposal (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	111	$600.00	/day	$66,600.00	See note 7 above
QA Coordinator	111	$496.00	/day	$55,056.00	See note 7 above
Wheel Loader Operator	111	$406.00	/day	$45,066.00	See note 7 above
Truck Drivers	474	$341.60	/day	$161,918.40	
Materials:					
Level D PPE	111	$10.00	/day	$1,110.00	
Equipment:					
CAT 924K Wheel Loader	6	$4,000.00	/4-wks	$24,000.00	
Dump Trucks	24	$4,000.00	/4-wks	$94,800.00	
Office Trailer	6	$800.00	/mo	$4,800.00	
Generator	6	$595.00	/mo	$3,570.00	
P/U Truck	6	$1,200.00	/mo	$7,200.00	
Analytical:					
Waste Characterization Soil Sampling:					
TCLP 2,4-DNT	67	$125.00	/ea	$8,375.00	
NACs (8330)	67	$125.00	/ea	$8,375.00	
Stormwater Sampling:					
TCLP 2,4-DNT	5	$125.00	/ea	$625.00	
NACs (8330)	5	$125.00	/ea	$625.00	
Off-Site Disposal Costs:					
Disposal (Non-Haz)	31,582	$35.00	/ton	$1,105,370.00	Erie County Landfill
Stormwater Disposal	20,000	$0.25	/gal	$5,000.00	Enviro-Tank Clean
				Subtotal	**$1,592,490.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

8.0 Site Restoration

Includes:

1. Sample and analyze soil believed to be uncontaminated.
2. Backfill excavated areas with uncontaminated excavated soil and clean backfill.
3. Re-seed site.

Assumptions and Calculations:

1. Volume of consolidated soil excavated (bcy) =	34,998	bcy
2. Soil compaction factor =	1.15	lcy/bcy
3. Volume of soil required for backfill =	40,248	lcy
4. Vol. of stockpiled uncontaminated soil used to slope excavation	6,803	bcy
5. Volume of soil within remedial area that is uncontaminated	7,049	bcy
6. Vol. of excavated soil used for backfill =	18,008	lcy
7. Volume of offsite backfill required =	22,240	lcy
8. Track loader production =	589	lcy/day
9. No. of track loaders	2	loaders
10. Total track loader output =	1,178	lcy/day
11. Field days required to backfill soil =	35	days
12. CAT 815F2 soil compactor wheel drum width =	3.25	ft
13. Soil compactor ground speed, 10% rolling (total) resistance =	5	mph
14. Compacted lift thickness =	6	in
15. No. of soil compactor passes =	6	passes/lift
16. Soil compactor production, 100% efficiency =	529	bcy/hr
17. Soil compactor efficiency =	83%	
18. Soil compactor production =	4,039	lcy/day
19. Number of field crew =	3	workers
20. Reseeding time =	5	days
21. Task duration =	40	days
22. Days per work week =	5	days/week
23. Hours per work day =	8	hrs/day
24. Characterization sampling for onsite backfill: 1 sample per	300	lcy
25. No. of onsite backfill samples	60	samples

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	40	$600.00	/day	$24,000.00	
QA Coordinator	40	$496.00	/day	$19,840.00	
Track Loader Operator	35	$406.00	/day	$14,210.00	
Soil Compactor Operator	35	$406.00	/day	$14,210.00	
Laborer	35	$341.60	/day	$11,956.00	
Reseeding	122	$80.00	/1000 ft^2	$9,760.00	
Road Repair	1	$175,000.00	/ls	$175,000.00	Erie Blacktop
Equipment:					
CAT 953 Track Loader	4	$8,800.00	/4-wks	$35,200.00	
CAT 815F2 Soil Compactor	2	$12,600.00	/4-wks	$25,200.00	
Office Trailer	2	$800.00	/mo	$1,600.00	
Generator	2	$595.00	/mo	$1,190.00	
P/U Truck	2	$1,200.00	/mo	$2,400.00	
Material:					
Backfill	22,240	$12.00	/cy	$266,880.00	delivered to site
PID rental	2	$974.00	/mo.	$1,948.00	
CGI rental	2	$380.00	/mo.	$760.00	
Level D PPE	120	$10.00	/day	$1,200.00	
Analytical:					
NACs (8330)	60	$125.00	/ea	$7,500.00	
Shipping	10	$40.00	/ea	$400.00	
				Subtotal	**$613,254.00**

Table 4-2

Alternative 3 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

9.0 Overall Cost	
Total Capital Cost	**$4,905,400.00**
Contingency (25%)	**$1,226,350.00**
Contractor Oversight (5%)	**$245,270.00**
Total Cost	**$6,377,000.00**

Notes:
[a] Final Compost After Action Report, TNT Area B and Pentolite Road Red Water Pond Area, WTI, Inc, July 2006.
[b] Bulk density of compost at Crane using same recipe was 0.368 tons/cy = 736 lb/cy
[c] http://cdn.intechopen.com/pdfs/17491/InTech-Biomass_feedstock_pre-processing_part_1_pre_treatmen.pdf
[d] Windrow disposal time is restricted by the receiving capacity of Erie County Landfill. Windrow disposal and construction would be staggered. As one windrow is moved off site, a second one will be constructed immediately afterward.
[e] On-Farm Composting Handbook, Natural Resource, Agriculture, and Engineering Service Cooperative Extension, NRAES-54
*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Alternative 4
Excavation/Alkaline Hydrolysis/Offsite Disposal
Cost Estimate

Site: Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works

Date: 5/14/2013

Scope:
1. Prepare work plans and closeout report, and complete procurement.
2. Mobilize/demobilize equipment and personnel.
3. Prepare site for remedial activity.
4. Excavate contaminated soil, perform confirmation sampling & characterize waste.
5. Alkaline hydrolysis and neutralization of soil that contains 2,4-DNT above remedial goals.
6. On site disposal of soil treated via alkaline hydrolysis.
7. Site restoration.

1.0 Treatability Study, Work Plans, Reports and Procurement

Includes:
1. Labor to generate work plans, including engineering specifications and Health and Safety Plan, along with the Final Report.
2. Procure equipment and materials.

Service	Unit	Unit Cost		Subtotal	
Work Plans and Final Report	1	$35,000.00	/ls	$35,000.00	
Procurement	1	$15,000.00	/ls	$15,000.00	
				Subtotal	**$50,000.00**

2.0 Mobilization/Demobilization of Equipment and Personnel

Includes:
1. Mobilization and demobilization of local equipment and personnel.
2. Set-up/tear down office trailer.

Assumptions:
1. Labor and equipment are available locally.
2. Pressure washer to be purchased for use during project.

Service/Materials	Unit	Unit Cost		Subtotal	
Labor/Equipment:					
Mobe/Demobe	1	$5,000.00	/ls	$5,000.00	
Office Trailer (set up/tear down)	1	$500.00	/ls	$500.00	
Pressure Washer	1	$500.00	/ls	$500.00	
				Subtotal	**$6,000.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

3.0 Site Preparation

Includes:
1. Survey and mark proposed remediation area
2. Construction and maintenance of Erosion and Sediment Controls
3. Install/improve access road for transport of equipment
4. Clearing (medium brush without grubbing) will be performed in 100% of excavation area.
5. Assumed mulch is not contaminated.
6. Assumed mulch and vegetative debris to be placed adjacent to site to decompose.

Assumptions and Calculations:

1. Area to be cleared (acres) =	3.8 acres
2. Daily output clearing crew (acres/day) =	1
3. Days clearing contractor in field =	4
4. Silt Fence to be installed (lf) =	5,000
5. Daily output silt fencing crew (LF/day) =	500
6. Days silt fence crew in field =	10
7. Number of Hay Bales =	1,000

Service/Materials	Unit	Unit Cost		Subtotal
Decontamination Pad	1	$10,000.00	LS	$10,000.00
Road Improvement	1	$25,000.00	LS	$25,000.00
Weigh Station	1	$5,000.00	LS	$5,000.00
Contractor:				
Site Superintendent	14	$600.00	/day	$8,400.00
Equipment Operator	14	$406.00	/day	$5,684.00
Laborer	14	$341.60	/day	$4,782.40
Laborer	14	$341.60	/day	$4,782.40
Subcontractor:				
Surveying Crew	1	$2,000.00	/day	$2,000.00
Bushhog	3	$500.00	/ac	$1,500.00
Materials:				
Field Instruments	3	$1,150.00	/wk	$3,450.00
Silt Fencing	5,000	$1.60	/day	$8,000.00
Hay Bales	1,000	$5.00	/ea	$5,000.00
Surface Water Controls	1	$5,000.00	/ls	$5,000.00
			Subtotal	**$88,599.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil

Includes:
1. Excavation of soil with contaminants exceeding RGs.
2. Screen oversize material.
3. Stockpile screened soil
4. Collect confirmatory samples to verify extent of excavation.

Assumptions and Calculations:

1a. Remedial area		121,783	ft^2
1b. Cubic yards (bank) of soil within remedial area =		28,195	bcy
2. Total depth of excavation (feet) =		8	ft
3. Slope line (run/rise) in lieu of shoring		2	ft/ft
4. Perimeter of excavation		2,870	ft
4a. Cutback area for excavation slope		45,920	ft^2
5. Unit volume of excavated soil within slope line		2.37	bcy/ft
6. Volume of excavated soil within slope line		6,803	bcy
7. Total volume of soil excavated		34,998	bcy
8. Swell factor for soil upon excavation =		1.3	
9. Cubic yards (loose) of unconsolidated soil =		45,497	lcy
10. Density of unconsolidated soil =		1.1	tons/lcy
11. Mass of unconsolidated soil =		50,047	tons
12. Capacity of screening plant =		300	tons/hr
13. Hydraulic excavator, CAT 321D bucket size		1.31	bcy
13a. Excavator cycle time		0.42	min
13b. Excavator production, 100% efficiency, CAT p4-210		187	lcy/hr
13c. Excavator efficiency		75%	
13d. Excavator production (tons/hr), (lcy/hr) =	154.3	140	lcy/hr
14. Excavator production (tons/day)/(bcy/day) =	1,234	1,122	lcy/day
15. Days to excavate soil =		41	days
16. Maximum distance to stockpile =		400	ft
17. Track loader CAT 963D bucket size		3.2	lcy
18. Track loader load and dump times =	0.07	0.04	min
19. Max. round trip travel time excavation to stockpile		1.8	min
20. Track load maneuver time =		0.2	min
21. Track loader max. cycle time =		2.11	min
22. Track loader cycles per hour, 100% efficiency		28.4	cycles/hr
23. Loader efficiency		83%	
24. Track loader cycles per hour		23	
25. Track loader production =		74	lcy/hr
26. No. of loaders required =		2	loaders
27. Number of excavation crew =		3	workers
28. Number of screening crew =		2	workers
29. Lineal foot of excavation per confirmation sample =		20	ft
30. Resampling factor for confirmation sampling =		110%	
31. Number of confirmatory samples from excavated area =		420	samples
32. Excavation area =		95,157	ft^2
33. Fraction of excavation work performed in Level C PPE =		10%	
35. Days excavation crew in Level C =		5	days
36. Days screening crew in Level C =		5	days
38. Work days per week		5	days
39. Work hours per day		8	hrs

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site Superintendent	41	$600.00	/day	$24,600.00
QA (Sampling) Coordinator	41	$496.00	/day	$20,336.00
Chemist (home office)	4	$600.00	/day	$2,460.00
Excavator Operator	41	$406.00	/day	$16,646.00
Track Loader Operator	41	$406.00	/day	$16,646.00
Track Loader Operator	41	$406.00	/day	$16,646.00
Screening Plant Operator	41	$406.00	/day	$16,646.00
Laborer	41	$341.60	/day	$14,005.60

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

4.0 Excavation of Contaminated Soil (continued)					
Equipment:					
CAT 321D Excavator	2	$6,500.00	/4-wks	$13,000.00	
300-ton/hr Screening Plant	2	$9,000.00	/4-wks	$18,000.00	
CAT 953 Track Loader	4	$8,800.00	/4-wks	$35,200.00	
2000 gal. Water Truck	2	$3,800.00	/4-wks	$7,600.00	
Office Trailer	2	$800.00	/mo	$1,600.00	
Generator	2	$595.00	/mo	$1,190.00	
P/U Truck	2	$1,200.00	/mo	$2,400.00	
Analytical:					
Excavation Confirmation Sampling:					
NACs (8330)	420	$125.00	/ea	$52,500.00	
NAC field analyses	420	$40.00	/ea	$16,800.00	
Shipping	28	$40.00	/ea	$1,120.00	
Materials & Services:					
Level D PPE	180	$10.00	/day	$1,800.00	
Level C PPE	25	$35.00	/day	$875.00	
PID rental	2	$974.00	/mo.	$1,948.00	
CGI rental	2	$380.00	/mo.	$760.00	
				Subtotal	**$282,779.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Alkaline Hydrolysis with Neutralization

Includes:
1. Alkaline hydrolysis of soil with NaOH and ferric sulfate.
2. Post-treatment acidification of soil with acetic acid to pH ≤ 12.

Assumptions and Calculations:

1. Percent of excavated soil in remedial area that is contaminated:	75%	
2. Percent of contaminated soil hazardous for 2.4-DNT:	20%	
3. Width of treatment area [a]	156	ft
4. Length of treatment area [a]	323	ft
5. Volume of excavated soil in remedial area	28,195	bcy
6. Swell factor for soil upon excavation =	1.3	
7. Volume of excavated soil in remedial area =	36,654	lcy
8. Volume of hazardous soil to be treated	7,331	lcy
9. Bulk density of loose soil	1.1	tons/lcy
10. Mass of hazardous soil to be treated	8,064	tons
11. Treatment row batch volume	375	lcy
12. Number of windrows during one treatment cycle =	13	windrows/cycle
13. Dosage of caustic soda, NaOH pellets [a]	3%	wt%
14. Dosage of caustic soda, NaOH pellets =	66	lb/lcy soil
15. Water, used to saturate soil with water =	37	gal/lcy soil
16. Dosage of ferric sulfate 50% solution [b]	2.2	gal/cy soil
17. Dosage of 80% CH_3OOH (post-treatment to pH ≤ 12) [c]	1.1	gal/lcy soil
18. Dosage of 80% CH_3OOH (post-treatment to pH ≤ 10) [c]	11.8	gal/lcy soil
19. NaOH mol wt =	40	lb/lb mol
20. Windrow treatment time with acidification to pH≤=12	8	weeks/windrow
21. Windrow treatment time with acidification to pH≤=10	12	weeks/windrow
22. Compliance analytical TAT	2	weeks
23. Erie County Landfill waste capacity per day	200	tons
24. Bulk density of treated soil =	1.2	tons/lcy
25. Mass of treated soil in a windrow =	450	tons
26. Total number of treatment windrows =	20	windrows
27. Number of treatment cycles =	2	cycles
28. Treatment delay due to offsite disposal [d]	30	workdays
29. Total workdays to treat soil (post-treatment to pH≤12) =	110	workdays
30. Treatment duration (post-treatment pH≤12) =	28	wks
31. Hours per workday	10	hrs
32. Workdays per week	4	days
33. Number of field crew =	6	workers
34. Mass of caustic soda =	483,833	lb
35. Volume of ferric sulfate 50% solution =	16,128	gal
36. Density of 50% ferric sulfate solution =	11.97	lb/gal
37. Volume of acetic acid 80% solution (post-treatment pH ≤ 12)	8,064	gal
38. Volume of acetic acid 80% solution (post-treatment pH ≤ 10)	86,504	gal
39. Density of 80% acetic acid solution =	8.92	lb/gal
40. Volume of water =	271,240	gal

41. Compliance sampling after AH prior to acidification for nitroaromatics, nitrate, nitrite, and pH.
42. Compliance sampling after acidification for nitrate, nitrite and pH.

43. Number of composite samples per windrow	1	sample

44. Temporary storage is required for the caustic soda pellets and 50% ferric sulfate preventing
45. The caustic soda pellets come in 2000 pound super sacks at approximately 4-feet by 4-feet by 3-feet high.

46. Number of caustic soda super sacks =	242	supersacks
47. Required storage capacity for caustic soda pellets (cf) =	11,616	ft^3

48. The 50% ferric sulfate solution comes in 330 gallon totes at approximately 46.5-inches by 46.5-inches by

49. Volume of tote container	300	gal
50. Number of totes for 50% ferric sulfate solution =	54	totes
51. Required storage capacity for 50% ferric acid solution =	3,244	ft^3
52. Number of totes for 80% acetic acid solution =	27	totes
53. Required storage capacity for 50% ferric acid solution =	1,622	ft^3

54. Temporary storage shall be provided utilizing a 48-foot swing open-door land-sea cargo trailer. The trailer is

55. Available capacity in the Land-Sea Cargo Trailer (cf) =	1,920	
56. Number of Land-Sea Cargo Trailers for NaOH storage =		7
57. Number of Land-Sea Cargo Trailers for ferric sulfate storage =		2
58. Number of Land-Sea Cargo Trailers for acetic acid storage =		1

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

5.0 Alkaline Hydrolysis with Neutralization (continued)

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	110	$750.00	/day	$82,500.00	
QA (Sampling) Coordinator	110	$620.00	/day	$68,200.00	
Equipment Operator	110	$507.50	/day	$55,825.00	
Equipment Operator	110	$507.50	/day	$55,825.00	
Equipment Operator	110	$507.50	/day	$55,825.00	
Laborer	110	$427.00	/day	$46,970.00	
Equipment:					
Windrow Turner	7	$45,000.00	/mo	$315,000.00	
Excavator	7	$6,500.00	/4-wks	$45,500.00	
CAT 924K Wheel Loader	7	$4,000.00	/4-wks	$28,000.00	
CAT 725 Articulated Truck	7	$9,100.00	/4-wks	$63,700.00	
CAT 725 Articulated Truck	7	$9,100.00	/4-wks	$63,700.00	
Fork Lift	7	$1,250.00	/mo	$8,750.00	
2000 gal. Water Truck	7	$3,800.00	/4-wks	$26,600.00	
21,000 gal Frac Tank	14	$1,400.00	/mo	$19,600.00	
2-in Trash Pump	7	$345.00	/mo	$2,415.00	
3-in Trash Pump	7	$435.00	/mo	$3,045.00	
Air Monitoring	7	$750.00	/ls	$5,250.00	
Office Trailer	7	$800.00	/mo	$5,600.00	
Generator	7	$595.00	/mo	$4,165.00	
P/U Truck	7	$1,200.00	/mo	$8,400.00	
Materials:					
Caustic Soda	483,833	$1.00	/lb	$483,833.00	Brenntag Mid South
Ferric Sulfate 50% Solution	16,128	$3.50	/gal	$56,448.00	Brenntag Mid South
Acetic Acid 80% Solution	8,064	$6.50	/gal	$52,416.00	Brenntag Mid South
Water	271	$9.40	/kgal	$2,547.40	
Level C PPE	330	$35.00	/day	$11,550.00	
PID rental	7	$974.00	/mo.	$6,818.00	
CGI rental	7	$380.00	/mo.	$2,660.00	
Chem Storage - NaOH pellets	35	$100.00	/mo.	$3,500.00	
Chem Storage - 50% Ferric Sulfate	10	$100.00	/mo.	$1,000.00	
Chem Storage - 80% Acetic Acid	5	$100.00	/mo.	$500.00	
Analytical:					
Pre-Compliance Sampling:					
pH meter	1	$1,800.00	/ea	$1,800.00	
Alkaline Hydrolysis Compliance Sampling (1 week TAT):					
NACs (8330)	20	$125.00	/ea	$2,500.00	
TCLP 2,4-DNT	20	$125.00	/ea	$2,500.00	
E300 - Nitrite and Nitrate	20	$25.00	/ea	$500.00	
Post-Treatment Acidification Compliance Sampling (1 week TAT):					
pH	20	$15.00	/ea	$300.00	
E300 - Nitrite and Nitrate	20	$25.00	/ea	$500.00	
				Subtotal	**$1,594,242.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

6.0 On-Site Disposal

Includes:
1. Onsite disposal of treated soil.

Assumptions and Calculations:

1. Volume of treated soil for onsite disposal =	0	lcy
2. Loader output (cy/day) =	589	
3. Days to backfill uncontaminated soil =	0	
4. Dump truck capacity (cy) =	12	
5. Dump truck haul distance (mi.) =	0.5	
6. Dump truck output (cy/day) =	250	
7. No. of dump trucks per day =	2	
8, Work days per week =	5	days
9. Work hours per day =	8	hrs

Service/Materials	Unit	Unit Cost		Subtotal
Labor:				
Site Superintendent	0	$600.00	/day	$0.00
QA Coordinator	0	$496.00	/day	$0.00
Equipment Operator	0	$406.00	/day	$0.00
Equipment Operator	0	$406.00	/day	$0.00
Laborer	0	$341.60	/day	$0.00
Truck Drivers	0	$341.60	/day	$0.00
Equipment:				
Wheel Loader	0	$5,000.00	/mo	$0.00
Dump Truck (6 ea)	0	$3,890.00	/mo	$0.00
Dozer	0	$3,500.00	/mo	$0.00
Office Trailer	0	$800.00	/mo	$0.00
Porta Jon	0	$175.22	/mo	$0.00
Generator	0	$170.35	/mo	$0.00
P/U Truck	0	$1,800.00	/mo	$0.00
Material:				
PID rental	0	$974.00	/mo.	$0.00
CGI rental	0	$380.00	/mo.	$0.00
Level D PPE	0	$10.00	/day	$0.00
			Subtotal	**$0.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Off-Site Disposal

Includes:

1. Waste characterization of untreated soil for offsite disposal.
2. Characterization of treated soil included in Section 5, Alkaline Hydrolysis
3. Characterization of uncontaminated excavated soil included in Section 8, Site Restoration
4. Offsite disposal of treated and untreated soil at local municipal landfill.
5. Characterization of collected storm water runoff from treatment area.
6. Offsite disposal of stormwater as a nonhazardous waste.
7. Costs for Site Superintendent, QA Coordinator, wheel loader operator, wheel loader, office trailer, generator and PU truck associated with disposal of treated soil is accounted for in Section 5, Windrow Composting.

Assumptions and Calculations:

1. Percent of contaminated soil within remedial area:		75%	
2. Percent of excavated soil assumed to be hazardous.		20%	
3. Waste characterization and disposal sampling: 1 sample per		300	lcy
4. Erie County Landfill daily capacity		200	tons
5. Bulk density of loose soil =		1.1	tons/lcy
6. Volume of untreated soil for off-site non-haz disposal =		20,160	lcy
7. Volume of soil treated onsite =		7,331	lcy
8. Volume of soil for disposal offsite at municipal landfill		27,491	lcy
9. Mass of untreated soil for off-site non-haz disposal =		22,176	tons
10. Mass of treated soil =		8,064	tons
11. Mass of treatment chemicals =		375	tons
10. Mass of soil treated onsite (incl. treatment chemicals) =		8,439	tons
11. Mass of soil for disposal offsite at municipal landfill		30,615	tons
12. Average load capacity of a 22 ton end dump truck =.		18	tons
13. Distance to municipal landfill		10	mi
13. Round trip travel time to non-haz waste landfill (hr) =		1.5	hrs
15. Truck loads to transport non-haz soil =		1,701	loads
16. Total transportation time to municipal landfill =		2,552	hrs
17. Daily haul cycles per truck		5	loads
18. Daily haul capacity per truck		90	tons
19. Number of trucks required		3	trucks
10. CAT 924K wheel loader bucket volume		2.5	lcy
11. Wheel loader cycle time, truck loading =		0.5	min
12. Cycles per hour, 100% efficiency =		120	cycles/hr
13. Wheel loader efficiency =		83%	
14. Cycles per hour =		100	cycles/hr
15. Wheel loader production (lcy/day), (tons/day) =	1,992	2,191	tons/day
26. No. of wheel loaders =		1	loader
27. No. of days to complete AH treated soil disposal =		42.2	days
27a. No. of days to complete untreated soil disposal =		110.9	days
28. No. of days to complete nonhazardous soil disposal =		154	days
29. No. of days to complete hazardous soil disposal =		0	days
1. Volume of stormwater requiring off-site disposal =		20,000	gal
3. No. of stormwater samples (1 per truckload) =		5	samples
21. Work hours per day		8	hrs
22. Work days per week		5	days

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

7.0 Off-Site Disposal (continued)					
Service/Materials	**Unit**	**Unit Cost**		**Subtotal**	
Labor:					
Site Superintendent	112	$600.00	/day	$67,200.00	
QA Coordinator	112	$496.00	/day	$55,552.00	
Wheel Loader Operator	112	$406.00	/day	$45,472.00	
Truck Drivers	462	$406.00	/day	$187,572.00	
Materials:					
Level D PPE		$10.00	/day	$0.00	
Equipment:					
CAT 924K Wheel Loader	6	$4,000.00	/4-wks	$24,000.00	
Dump Trucks	23	$4,000.00	/mo	$92,400.00	
Office Trailer	6	$800.00	/mo	$4,800.00	
Generator	6	$595.00	/mo	$3,570.00	
P/U Truck	6	$1,200.00	/mo	$7,200.00	
Analytical:					
Waste Characterization Sampling (Soil):					
TCLP 2,4-DNT	67	$125.00	/ea	$8,400.00	
NACs (8330)	67	$125.00	/ea	$8,400.00	
Stormwater Sampling:					
TCLP 2,4-DNT	5	$125.00	/ea	$625.00	
NACs (8330)	5	$125.00	/ea	$625.00	
Off-Site Disposal Costs:					
Disposal (Non-Haz)	30,615	$35.00	/ton	$1,071,520.80	Erie County Landfill
Stormwater Disposal	20,000	$0.25	/gal	$5,000.00	Enviro-Tank Clean
				Subtotal	**$1,582,337.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

8.0 Site Restoration

Includes:
1. Sample and analyze soil believed to be uncontaminated.
2. Backfill excavated areas with uncontaminated excavated soil and clean backfill.
3. Re-seed site.

Assumptions and Calculations:

1. Volume of consolidated soil excavated (bcy) =	34,998	bcy
2. Soil compaction factor =	1.15	lcy/bcy
3. Volume of soil required for backfill =	40,248	lcy
4. Vol. of stockpiled uncontaminated soil used to slope excavation	6,803	bcy
5. Volume of soil within remedial area that is uncontaminated	7,049	bcy
6. Vol. of excavated soil used for backfill =	18,008	lcy
7. Volume of offsite backfill required =	22,240	lcy
8. Track loader production =	589	lcy/day
9. No. of track loaders	2	loaders
10. Total track loader output =	1,178	lcy/day
11. Field days required to backfill soil =	35	days
12. CAT 815F2 soil compactor wheel drum width =	3.25	ft
13. Soil compactor ground speed, 10% rolling (total) resistance =	5	mph
14. Compacted lift thickness =	6	in
15. No. of soil compactor passes =	6	passes/lift
16. Soil compactor production, 100% efficiency =	529	bcy/hr
17. Soil compactor efficiency =	83%	
18. Soil compactor production =	4,039	lcy/day
19. Number of field crew =	3	workers
20. Reseeding time =	5	days
21. Task duration =	40	days
22. Days per work week =	5	days/week
23. Hours per work day =	8	hrs/day
24. Characterization sampling for onsite backfill: 1 sample per	300	lcy
25. No. of onsite backfill samples	60	samples

Service/Materials	Unit	Unit Cost		Subtotal	
Labor:					
Site Superintendent	40	$600.00	/day	$24,000.00	
QA Coordinator	40	$496.00	/day	$19,840.00	
Track Loader Operator	35	$406.00	/day	$14,210.00	
Soil Compactor Operator	35	$406.00	/day	$14,210.00	
Laborer	35	$341.60	/day	$11,956.00	
Reseeding	122	$80.00	/1000 ft^2	$9,760.00	
Road Repair	1	$175,000.00	/ls	$175,000.00	Erie Blacktop
Equipment:					
CAT 953 Track Loader	4	$8,800.00	/4-wks	$35,200.00	
CAT 815F2 Soil Compactor	2	$12,600.00	/4-wks	$25,200.00	
Office Trailer	2	$800.00	/mo	$1,600.00	
Generator	2	$595.00	/mo	$1,190.00	
P/U Truck	2	$1,200.00	/mo	$2,400.00	
Material:					
Backfill	22,240	$12.00	/cy	$266,880.00	delivered to site
PID rental	2	$974.00	/mo.	$1,948.00	
CGI rental	2	$380.00	/mo.	$760.00	
Level D PPE	120	$10.00	/day	$1,200.00	
Analytical:					
NACs (8330)	60	$125.00	/ea	$7,500.00	
Shipping	10	$40.00	/ea	$400.00	
				Subtotal	**$613,254.00**

Table 4-3

Alternative 4 Cost Estimate
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

9.0 Overall Cost	
Total Capital Cost	**$4,217,200.00**
Contingency (25%)	**$1,054,300.00**
Contractor Oversight (5%)	**$210,900.00**
Total Cost	**$5,482,400.00**

[a] Initial dosage of soil at TNTA of 2 wt% NaOH was not adequate for all batches but 3 wt% was (Owens, 2013).
[b] Dosage based on Tetra Tech bench-scale tests performed for TMG (Owens, 2012).
[c] Acid dosage based on full-scale remediation of soil at PBOW (Owens, 2013).
[d] Estimate of minimum treatment time based on full-scale remediation of soil at PBOW (Owens, 2013)
*This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Criteria	**Alternative 1:** No Action	**Alternative 2:** Excavation and Off-Site Disposal	**Alternative 3:** Excavation, Windrow Composting, and Off-Site Disposal	**Alternative 4:** Excavation, Alkaline Hydrolysis and Off-Site Disposal
Overall Protectiveness				
Human Health Protection	No reduction in risk. Does not meet the threshold criteria for protectiveness.	Reduces the concentration of COCs to levels below RGs.	Reduces the concentration of COCs to levels below RGs.	Reduces the concentration of COCs to levels below RGs.
Environmental Protection	No reduction in risk. Does not meet the threshold criteria for protectiveness.	Significantly reduces the hazard quotients calculated for ecological receptors and lowers the likelihood of contaminant spread to other media.	Significantly reduces the hazard quotients calculated for ecological receptors and lowers the likelihood of contaminant spread to other media.	Significantly reduces the hazard quotients calculated for ecological receptors, and lowers the likelihood of contaminant spread to other media.
Compliance with ARARs				
Chemical-Specific ARARs	No chemical-specific ARARs.	No chemical-specific ARARs.	No chemical-specific ARARs.	No chemical-specific ARARs.
Location-Specific ARARs	No location-specific ARARs.	No location-specific ARARs.	No location-specific ARARs.	No location-specific ARARs.
Action-Specific ARARs	No action-specific ARARs.	Complies with all action-specific ARARs.	Complies with all action-specific ARARs.	Complies with all action-specific ARARs.
Other Criteria and Guidance	Permits exposures to concentrations of COCs above risk-based RGs that are derived from EPA toxicity data.	Prevents exposures to concentrations of COCs above risk-based RGs that are derived from EPA toxicity data.	Prevents exposures to concentrations of COCs above risk-based RGs that are derived from EPA toxicity data.	Prevents exposures to concentrations of COCs above risk-based RGs that are derived from EPA toxicity data.

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Criteria	**Alternative 1:** No Action	**Alternative 2:** Excavation and Off-Site Disposal	**Alternative 3:** Excavation, Windrow Composting, and Off-Site Disposal	**Alternative 4:** Excavation, Alkaline Hydrolysis and Off-Site Disposal
Long-Term Effectiveness and Permanence				
Magnitude of Residual Risk	Existing unacceptable risk will remain.	Residual risk will be within the risk management range.	Residual risk will be within the risk management range.	Residual risk will be within the risk management range.
Adequacy and Reliability of Controls	No controls over remaining contamination. No reliability.	No long-term controls required at site.	No long-term controls required at site.	No long-term controls required at site.
Reduction of Toxicity, Mobility, or Volume through Treatment				
Treatment Process Used	None	Off-site treatment of soil.	Biological treatment of nitroaromatic compounds and using windrow composting.	Chemical treatment of nitroaromatic compounds using alkaline hydrolysis.
Amount Destroyed or Treated	None	No soil treated on site. Some soil will be treated at an off-site TSDF to comply with LDRs.	20 percent of excavated soil within the remedial area will be treated on site.	20 percent of excavated soil within the remedial area will be treated on site.
Irreversible Treatment	None.	No on-site treatment.	Composting research has demonstrated that a high percentage (>80%) of TNT-carbon is irreversibly bound to the soil through covalent binding with humic substances.	Alkaline hydrolysis irreversibly transforms NACs in soil to less toxic end products.

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Criteria	**Alternative 1:** No Action	**Alternative 2:** Excavation and Off-Site Disposal	**Alternative 3:** Excavation, Windrow Composting, and Off-Site Disposal	**Alternative 4:** Excavation, Alkaline Hydrolysis and Off-Site Disposal
Type and Quantity of Residuals Remaining after Treatment (all volumes are based on in-place, consolidated soil)	An estimated 21,146 BCY (in place volume) of contaminated soil remains onsite. No treatment residuals.	Estimated 7,331 LCY (excavated volume) of untreated soil for off-site disposal as a hazardous waste. An estimated 20,160 LCY of untreated soil for off-site disposal as a nonhazardous waste.	An estimated 25,559 LCY of compost and 20,160 LCY of untreated soil for off-site disposal as a nonhazardous waste.	An estimated 7,331 LCY of alkaline hydrolysis treated soil and 20,160 LCY of untreated soil for off-site disposal as a nonhazardous waste.
Short-Term Effectiveness				
Community Protection	No risk to community.	Normal safeguards would be required during transportation of waste materials off site.	Normal safeguards would be required during transportation of waste materials off site.	Normal safeguards would be required during transportation of waste materials off site.

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Criteria	**Alternative 1:** No Action	**Alternative 2:** Excavation and Off-Site Disposal	**Alternative 3:** Excavation, Windrow Composting, and Off-Site Disposal	**Alternative 4:** Excavation, Alkaline Hydrolysis and Off-Site Disposal
Worker Protection	No risk to workers	Dust released during excavation and screening may require controls.	Safeguards would be required to protect workers from chemical exposures during windrow turning operations. Dust released during excavation, screening, amendment mixing, and windrow turning may require controls.	Chemicals used in the treatment process are very corrosive. Material handling processes would be designed to protect workers from chemical exposures. Safeguards would be required to protect workers from chemical exposures during windrow turning operations. Dust released during excavation, screening, amendment mixing, and windrow turning may require controls.

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

Criteria	**Alternative 1:** No Action	**Alternative 2:** Excavation and Off-Site Disposal	**Alternative 3:** Excavation, Windrow Composting, and Off-Site Disposal	**Alternative 4:** Excavation, Alkaline Hydrolysis and Off-Site Disposal
Environmental Impacts	No impact to ecological receptors or other environmental media.	Design of staging piles would require safeguards to prevent migration of contaminants.	Design of staging piles would require safeguards to prevent migration of contaminants. Treatment area would be bermed and a contact water retention system provided to control storm water run-on and run-off.	Design of staging piles would require safeguards to prevent migration of contaminants. Treatment area would be bermed and a contact water retention system provided to control stormwater run-on and runoff. Hazardous chemicals would be managed to segregate incompatible chemicals and prevent uncontrolled releases to the environment.
Time Until Action is Complete	Not applicable	15 months	26 months	22 months
Implementability				
Ability to Construct and Operate	No construction or operation.	No significant issues.	Technologies well developed and implemented on a full-scale basis at numerous sites. Composting previously implemented at TNTB and PRRWP.	Alkaline hydrolysis using caustic soda to treat NACs in soil is a relatively new process, but has been successfully implemented at full scale at two sites.
Ease of Doing More Action if Needed	Does not preclude additional remedial action for soil.	Does not preclude additional remedial action for soil.	Does not preclude additional remedial action for soil.	Does not preclude additional remedial action for soil.

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

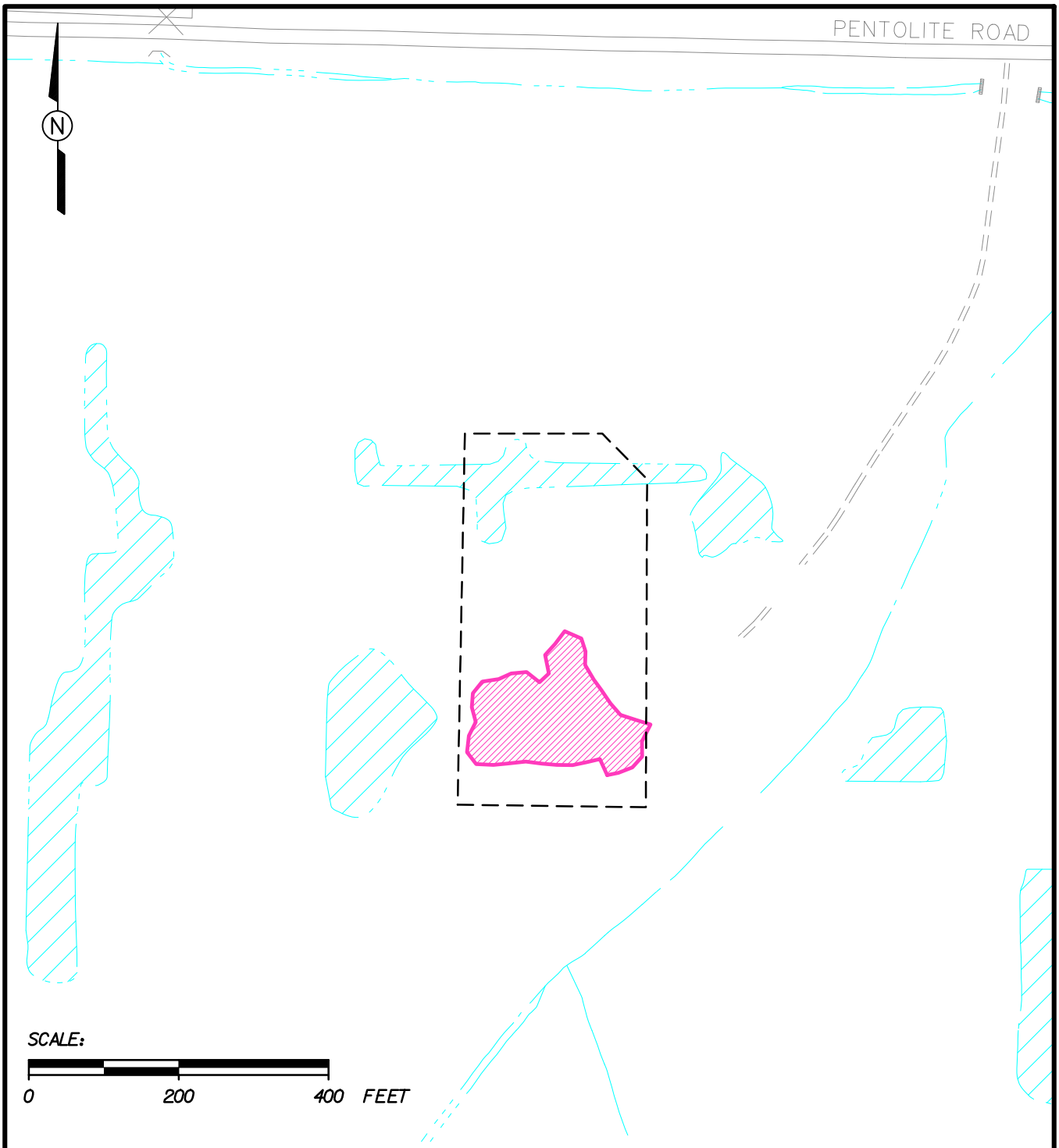
Criteria	**Alternative 1:** No Action	**Alternative 2:** Excavation and Off-Site Disposal	**Alternative 3:** Excavation, Windrow Composting, and Off-Site Disposal	**Alternative 4:** Excavation, Alkaline Hydrolysis and Off-Site Disposal
Ability to Monitor Effectiveness	No monitoring performed.	Effectiveness of excavation is evaluated by confirmatory soil sampling and analysis.	Effectiveness of excavation is evaluated by confirmatory soil sampling and analysis. Effectiveness of composting is evaluated by post-treatment sampling and analysis of treated soil.	Effectiveness of excavation is evaluated by confirmatory soil sampling and analysis. Effectiveness of alkaline hydrolysis is evaluated by post-treatment sampling and analysis of treated soil.
Ability to Obtain Approvals and Coordinate with Other Agencies	None required	Off-site disposal of RCRA waste at a hazardous waste landfill. Off-site disposal of nonhazardous solid waste at landfill approved to accept that waste.	Off-site disposal of nonhazardous solid waste at landfill approved to accept that waste.	Off-site disposal of nonhazardous solid waste at landfill approved to accept that waste.
Availability of Equipment, Specialists, and Materials	None required	Equipment, technical specialists, and materials readily available.	Equipment, technical specialists, and materials readily available.	Equipment, technical specialists, and materials readily available.
Availability of Technologies	None required	Available	Available	Available
Cost				
Capital Cost	None	$6.2 million	$6.4 million	$5.5 million
Annual O&M Cost	None	None	None	None
Present Worth Cost	None	$6.2 million	$6.4 million	$5.5 million
State Acceptance	To be determined	To be determined	To be determined	To be determined
Community Acceptance	To be determined	To be determined	To be determined	To be determined

Table 5-1

Comparative Analysis of Remedial Alternatives
Pentolite Road Red Water Pond Area Feasibility Study Addendum
Former Plum Brook Ordnance Works
Sandusky, Ohio

ARAR	-	Applicable or relevant and appropriate requirement.
COC	-	Contaminant of concern.
BCY	-	Bank cubic yard.
LCY	-	Loose cubic yard.
LDR	-	Land disposal restrictions
mg/kg	-	Milligrams per kilogram.
NAC	-	Nitroaromatic compound.
O&M	-	Operation and maintenance.
OEPA	-	Ohio Environmental Protection Agency.
PRRWP	-	Pentolite Road Red Water Pond.
RCRA	-	Resource Conservation and Recovery Act.
RG	-	Remedial goal.
ROD	-	Record of decision.
TNT	-	Trinitrotoluene.
TNTB	-	TNT Area B.
TSDF	-	Treatment, storage, and disposal facility.
USEPA	-	U.S. Environmental Protection Agency.

FIGURES



LEGEND

- APPROXIMATE HISTORICAL LOCATION OF POND
- CREEK, DITCH, CONVEYANCE
- POND, SURFACE WATER
- COMPLETED TNT SOIL REMOVAL AREA

FIGURE 1-3

LOCATION OF THE NONTIME CRITICAL REMOVAL ACTION EXCAVATION

PENTOLITE ROAD RED WATER POND AREA
ADDENDUM TO THE FOCUSED FEASIBILITY STUDY
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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

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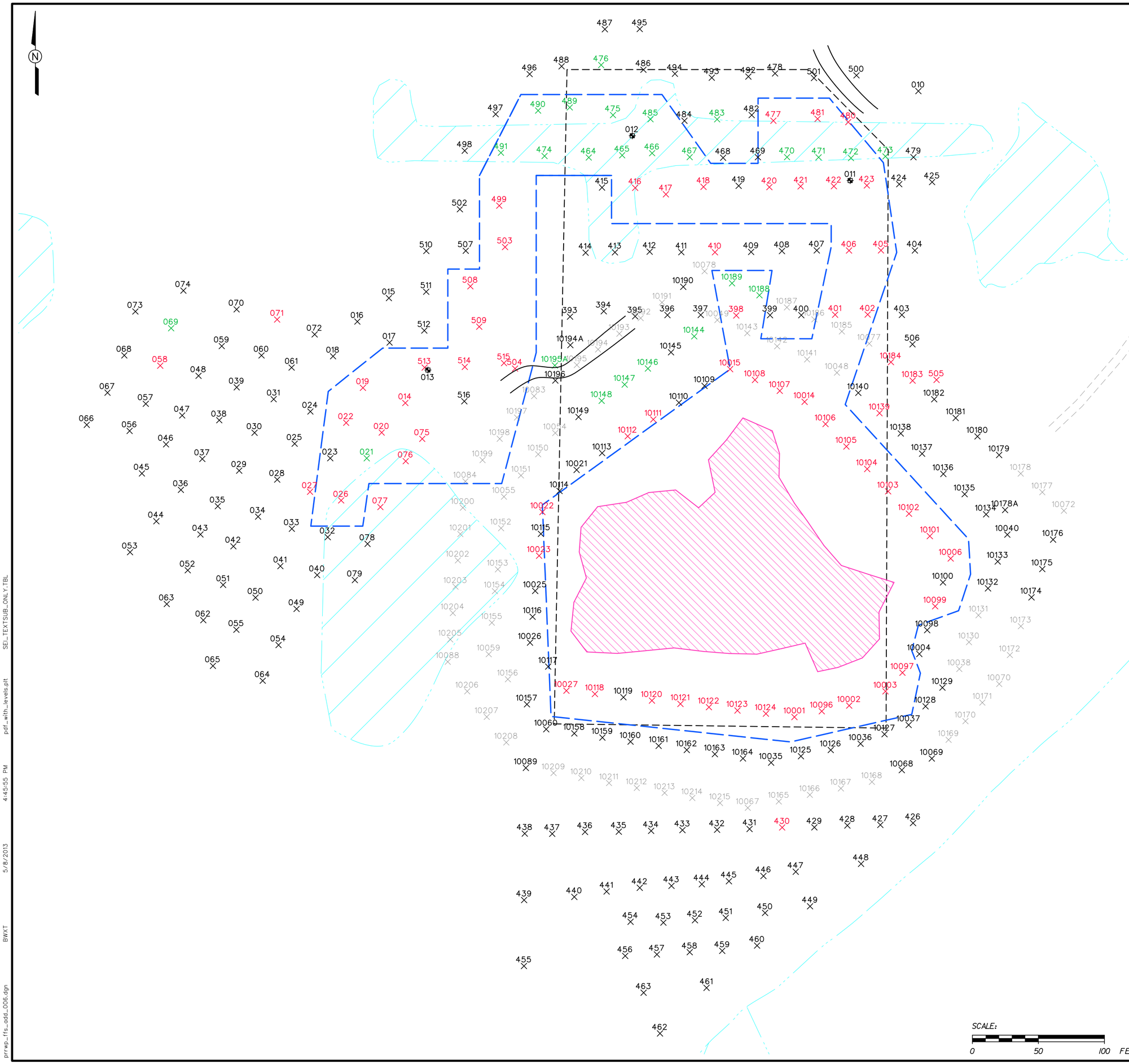

LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 2)
- SAMPLE LOCATION THAT DID NOT EXCEED ANY REMEDIAL GOALS (RG)
- SAMPLE LOCATION THAT EXCEEDS AT LEAST ONE RG
- ONLY SCREENING DATA WERE COLLECTED AND THE TOTAL NITROAROMATICS CONCENTRATION EXCEEDS 10 mg/kg (SEE NOTE 5)
- SOIL BERMS
- ESTIMATED EXTENT OF SOIL REQUIRING REMEDIAL ACTION

NOTES:

1. LOCATION OF SAMPLE 10194A IS APPROXIMATE.
2. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. RG EXCEEDANCES OUTSIDE OF THE ESTIMATED REMEDIAL ACTION AREA ONLY MARGINALLY EXCEED AN RG.
5. BASED ON COMPARISON OF SCREENING DATA TO LAB DATA FROM THE SAME LOCATION, CONCENTRATIONS GREATER THAN 10 MILLIGRAMS PER KILOGRAM (mg/kg) WERE IDENTIFIED AS MORE LIKELY TO HAVE ELEVATED LABORATORY RESULTS. THIS 10 mg/kg VALUE IS NOT REGARDED AS A "BRIGHT LINE" CRITERION, BUT IS A GENERAL OBSERVATION.
6. TEST KIT RESULTS FOR TOTAL NITROAROMATICS CONCENTRATIONS ARE PRESENTED ON FIGURE 5-1 OF THE SITE DELINEATION REPORT (APPENDIX C OF THE FEASIBILITY STUDY).

Remedial Areas and Volumes

	Remedial Area (SQ FT)	Remedial Depth (FT)	Remedial Volume (BCY)	Remedial Volume (LCY)
Clean Soil	95,157	2	7,049	9,164
Nonhazardous Soil		6	15,507	20,159
Hazardous Soil			5,639	7,331
Total		8	28,195	36,654

Remedial area does not include earlier NTCRA excavation.

FIGURE 2-1
ESTIMATED EXTENT OF SOIL REQUIRING REMEDIAL ACTION

PENTOLITE ROAD RED WATER POND AREA ADDENDUM TO THE FOCUSED FEASIBILITY STUDY
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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

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Figure 2-2
Histogram of 2,4-DNT Concentrations in Remedial Area Soil Samples at PRRWP Area

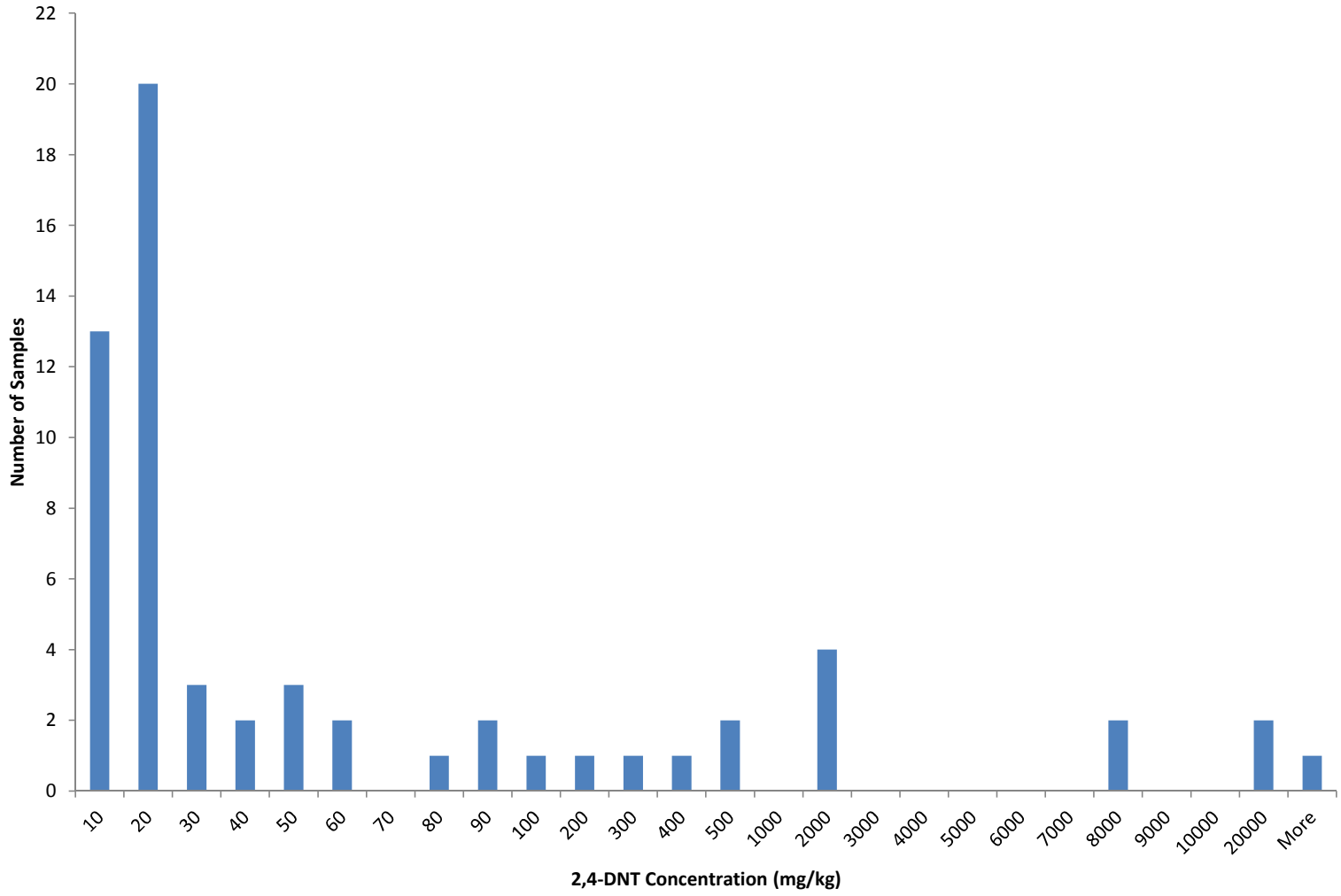


Figure 3-1

Cometabolic Reduction of 2,4,6-TNT During Fermentation of Glucose

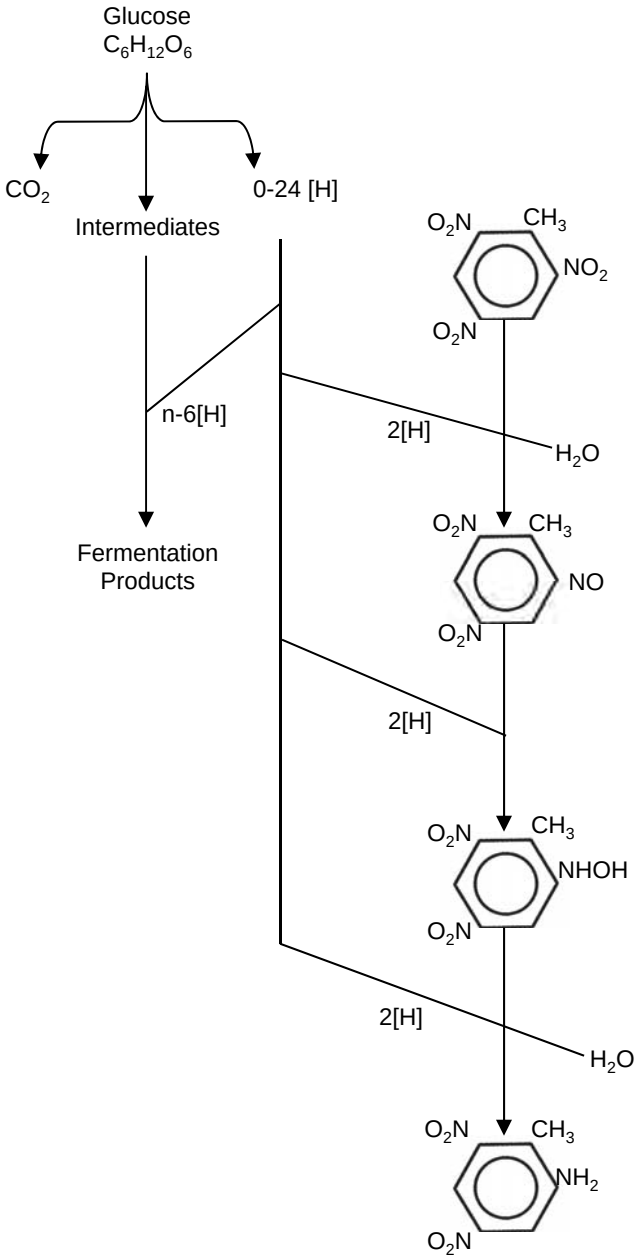


Figure 3-2
Transformation and Humification of TNT in an Anaerobic/ Aerobic Composting System

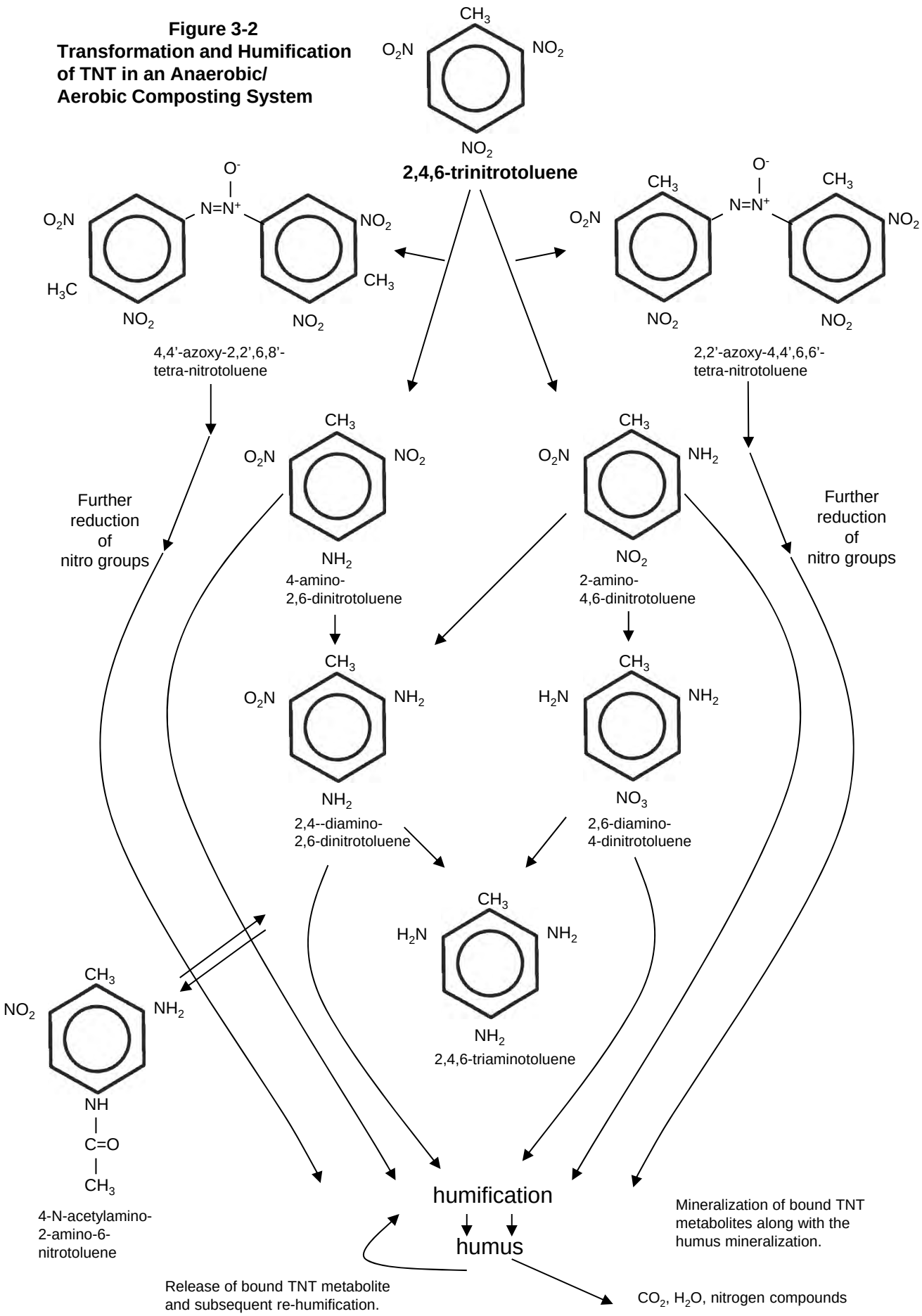
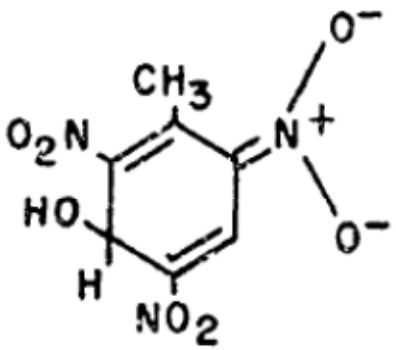
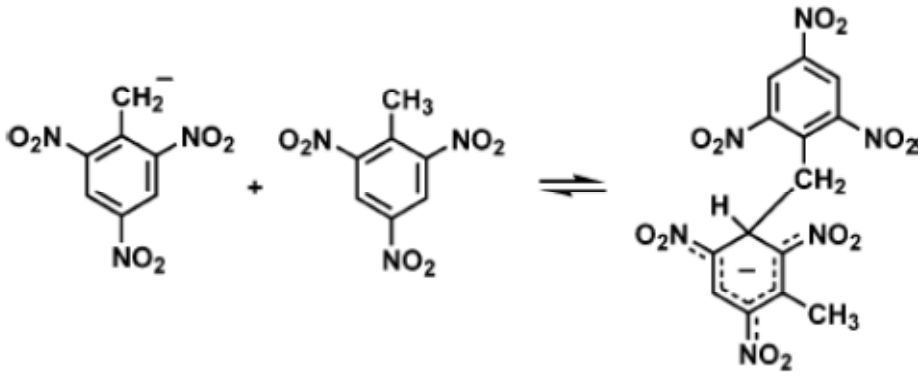


Figure 3-3

Intermediate Reaction Products from the Alkaline Hydrolysis of TNT



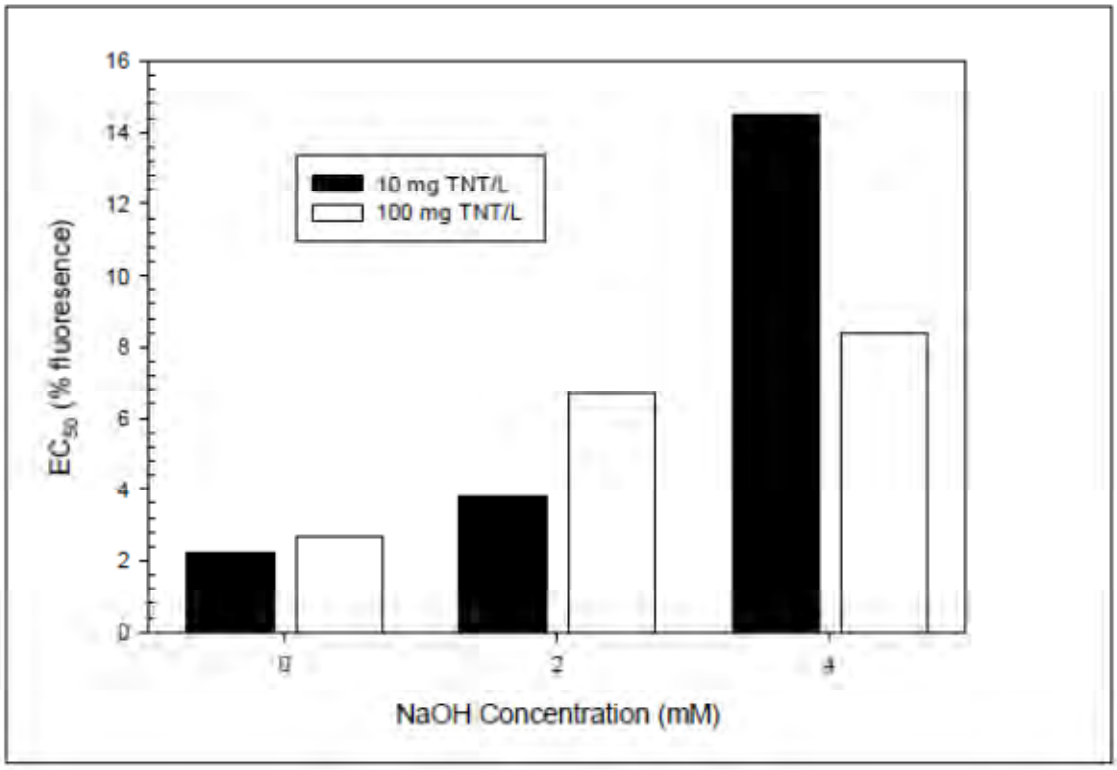
a. TNT Meisenheimer Complex (Hammersley, 1975)



b. Janovsky Complex Formed from Reaction of a TNT Carbanion (TNT^-) with TNT (Thorn et al., 2004)

Figure 3-4

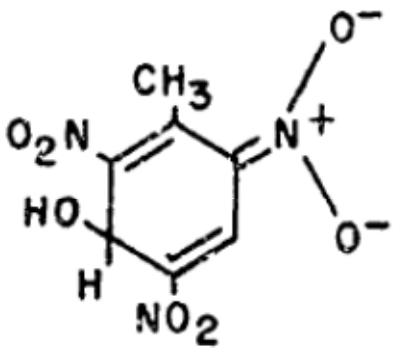
Aquatic Toxicity of Untreated and Alkaline Hydrolysis Treated Solutions of TNT in Water



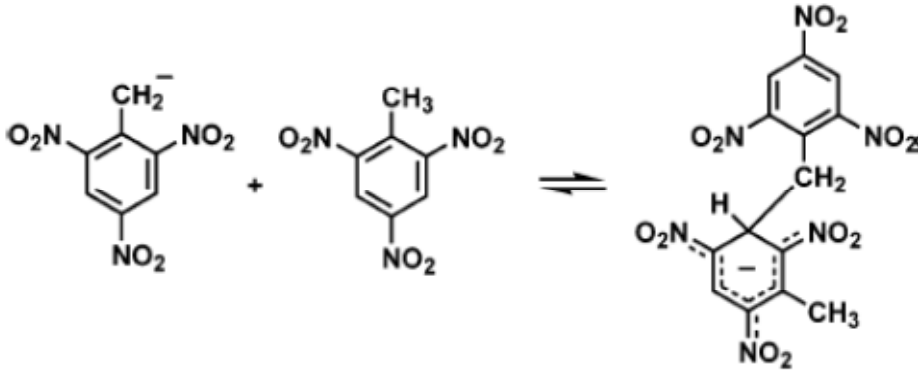
Source: Hansen et al., 2001

Figure 3-5

Intermediate Reaction Products from the Alkaline Hydrolysis of TNT



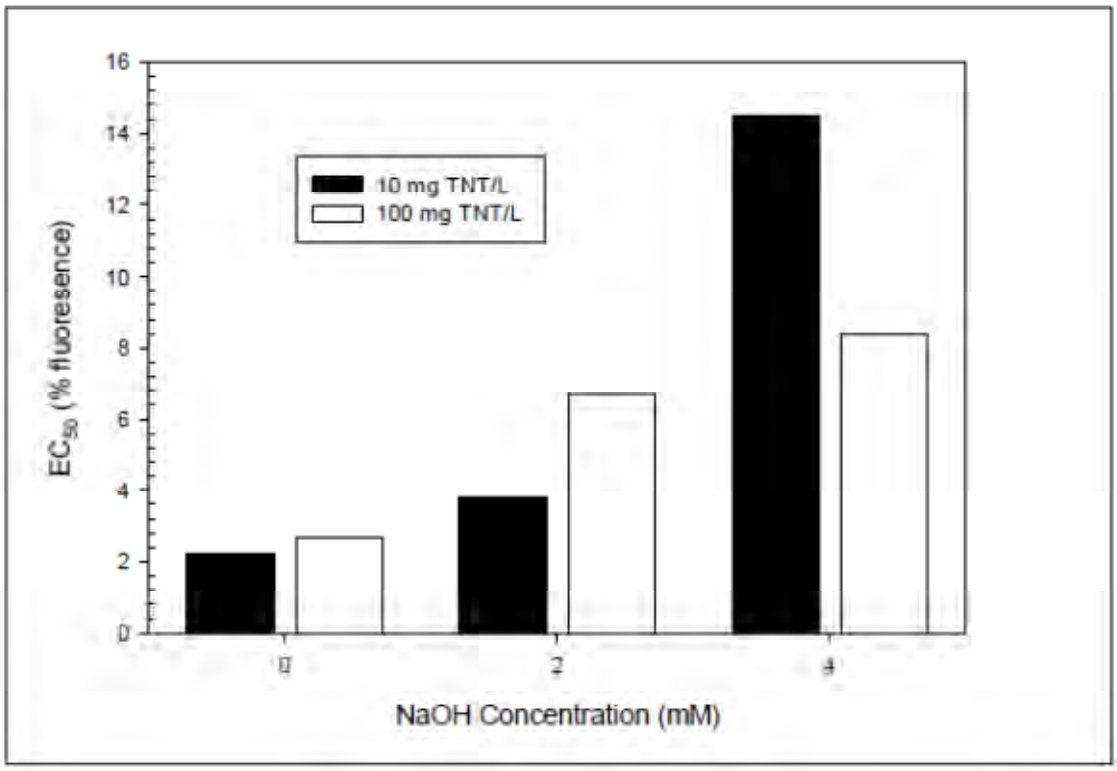
a. TNT Meisenheimer Complex (Hammersley, 1975)



b. Janovsky Complex Formed from Reaction of a TNT Carbanion (TNT^-) with TNT (Thorn et al., 2004)

Figure 3-6

Aquatic Toxicity of Untreated and Alkaline Hydrolysis Treated Solutions of TNT in Water



Source: Hansen et al., 2001

APPENDIX C

PENTOLITE ROAD RED WATER POND AREA SITE DELINEATION REPORT (ELECTRONIC DELIVERABLE)

Revised Final

Pentolite Road Red Water Pond Area
Site Delineation Report

Former Plum Brook Ordnance Works
Sandusky, Ohio

Prepared for:

U.S. Army Corps of Engineers, Nashville District
P. O. Box 1070
Nashville, Tennessee 37202-1070

Prepared by:

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)
312 Directors Drive
Knoxville, Tennessee 37923

Shaw Project No. 132458

May 2013

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List of Acronyms

bgs	below ground surface
D&M	Dames and Moore, Inc.
DNB	dinitrobenzene
DNT	dinitrotoluene
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FS	feasibility study
HI	hazard index
IDW	investigation-derived waste
ILCR	incremental lifetime cancer risk
McTech	McTech Corp.
mg/kg	milligrams per kilogram
NASA	National Aeronautics and Space Administration
NT	nitrotoluene
NTCRA	non-time-critical removal action
PBOW	Plum Brook Ordnance Works
PRRWP	Pentolite Road Red Water Pond
QAPP	quality assurance project plan
RI	remedial investigation
RSL	regional screening level
Shaw	Shaw Environmental, Inc.
SOW	scope of work
SSAP	site-specific sampling and analysis plan
SWSAP	site-wide sampling and analysis plan
TNB	trinitrobenzene
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers
WARWP	West Area Red Water Pond

Executive Summary

The U.S. Army is conducting studies of the environmental impact of suspected hazardous waste sites at previously owned U.S. Department of Defense properties. This investigation is being conducted for the Pentolite Road Red Water Pond (PRRWP) Area at the former Plum Brook Ordnance Works (PBOW) in Sandusky, Erie County, Ohio. PBOW is being investigated under the Defense Environmental Restoration Program for Formerly Used Defense Sites. The investigation is being managed and technically overseen by the Nashville and Huntington Districts of the U.S. Army Corps of Engineers (USACE). This 9,000-acre facility was used for the manufacture of explosives during World War II. The site is currently maintained by the National Aeronautics and Space Administration and is operated as the Plum Brook Station of the John H. Glenn Research Center at Lewis Field.

This site delineation report has been prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) (a CB&I company) for the fieldwork conducted in 2009 and 2010 in support of the feasibility study (FS) addendum planned for the PRRWP Area. This work was performed under Delivery Order DX03 of Contract Number W912QR-08-D-0013. The field activities completed by Shaw were conducted pursuant to the site-specific sampling and analysis plan, which was developed in accordance with the PBOW site-wide sampling and analysis plan and the quality assurance project plan to ensure that work performed at the subject site will be of the quality required to satisfy the overall and site-specific project objectives. A site-wide accident prevention/site-wide safety and health plan was also prepared for this investigation to help provide a safe work environment.

The PRRWP was an unlined pond that received waste process water from Waste Water Treatment Plant 1 from 1942 to 1945 via an elevated discharge pipe. This waste originated from the trinitrotoluene (TNT) manufacturing processes at TNT Area A and TNT Area B. The pond was reported to have covered an area of 1 to 2 acres during plant operations. In 1977, retention dikes and sump pits were installed at the PRRWP Area in response to reddish-brown water that was observed in an adjacent surface ditch. In April and May 1977, approximately 60,000 gallons of the reddish-brown water were removed, and the original basin was then backfilled. The original pond area was backfilled to a higher elevation than the surrounding area to prevent ponding in the original PRRWP footprint.

Focused remedial investigation (RI) sampling at the Red Water Ponds was performed in 1994. A total of 104 soil samples, 7 overburden groundwater samples, and 4 bedrock groundwater

samples were collected from both Red Water Pond Areas, the PRRWP Area and the West Area Red Water Pond Area.

Soil, sediment, surface water, and groundwater sampling was conducted as part of a 1998 direct-push investigation. This included the collection and analysis of 20 surface soil, 39 subsurface soil, 20 overburden groundwater, 4 surface water, and 4 sediment samples from the PRRWP Area. In addition to the samples collected during the focused RI and direct-push investigation, groundwater samples have been collected from overburden and bedrock monitoring wells associated with the PRRWP Area since 1997.

Based on the results of the previous investigations, a focused FS was completed in December 2002 that described a requirement for remediation of soils contaminated with nitroaromatics within the PRRWP Area. The focused FS developed and evaluated remedial alternatives for the PRRWP Area, with 2,4,6-TNT being the only chemical of concern identified based on the RI results. An action memorandum for a non-time-critical removal action (NTCRA) for PRRWP soils was presented to the public in September 2002 to remediate the area of contamination described in the focused FS as being contaminated with TNT to a residential risk-based cleanup goal of 13.8 milligrams per kilogram. The NTCRA subsequently began in January 2003, and the action memorandum was finalized in June 2003. This NTCRA included excavation, windrow composting, and backfilling the excavation with clean soil and composted material that met cleanup criteria. During the NTCRA soil removal, a dark seam of impacted soil was discovered, prompting the need for additional excavation. USACE conducted field-scale and laboratory-scale treatability studies to determine the best approach to address the newly discovered additional contamination at the PRRWP Area. An action that included excavation, windrow composting, off-site disposal, and backfilling the excavation with clean soil and composted material that met cleanup criteria was selected. This action commenced in July 2007 and was completed in March 2009. This project was returned to the Comprehensive Environmental Response, Compensation, and Liability Act process (RI/FS phase) at the end of the NTCRA.

The soil analytical results from the test pits along the extent of the NTCRA excavation at the PRRWP Area were reviewed. During this review, it was discovered that the noncancer hazard index (HI) associated with residual soil along the walls of the test pits exceeded a value of 1 based on future residential land use. In the field of risk assessment, HI values greater than 1 are indicative of potential adverse noncancer health effects. These HI values were calculated based on a comparison of the average nitroaromatics concentrations in the residual soil samples along the excavation walls to U.S. Environmental Protection Agency Region 9 preliminary remedial goals for residential soil. This noncancer hazard was based on unexpectedly high concentrations of TNT and other PBOW-related nitroaromatics that were not identified as chemicals of concern

based on the RI. Therefore, USACE deemed that further delineation of this contamination was necessary. Initial delineation sampling at approximately 100 locations was conducted by McTech Corp. in May and June 2009, and data gaps were still identified.

The field program conducted by Shaw in 2009 and 2010 was designed to use on-site field screening analysis of soil samples to fully delineate the extent of contamination at the PRRWP. Additional delineation sampling was conducted by Shaw in July through November 2009 and June and November 2010 to supplement the earlier McTech Corp field investigation. The additional delineation consisted of sampling and analysis of 173 locations.

Based on visual observations coupled with analytical data, the PRRWP boundary is generally limited to the historical footprint of the PRRWP with the exception of subsurface contamination immediately to the west of the pond. This interpretation is based on the presence of the dark brown to black seam of silty clay interpreted to be the pond bottom. Based on the concentration of nitroaromatics and the risk evaluation, the extent of the contamination from the PRRWP has been delineated during this investigation.

The reasons for the greater extent of subsurface contamination to the north of the original NTCRA excavation appears to be related to either the transport of waste water through agricultural drain tile, advective transport in groundwater, or a combination of these mechanisms. Another possible explanation is that the extent of the pond was actually greater than initially interpreted. The contamination detected to the west of the PRRWP footprint may also be the result of the same contaminant transport mechanisms since this area is outside of the pond footprint. The apparent limitation of contamination to the subsurface soil implies that soil volumes may be significantly reduced by segregating clean and contaminated soil should remediation be required.

Soil data collected during this investigation adequately define the extent of the contamination associated with the PRRWP Area. The following recommendations are based on all data collected during PRRWP Area investigations:

- The extent of the original PRRWP footprint and associated soil contamination has been adequately delineated, and an FS addendum should be completed to evaluate cleanup options for site soil.
- The findings suggest that should additional soil remediation be required for the PRRWP Area, significant cost savings may be realized through segregation of the potentially uncontaminated surface soil (0 to 3 feet). Remedial designs, if required, should account for this segregation of soil.

1.0 Introduction

The U.S. Army is conducting studies of the environmental impact of suspected hazardous waste sites at previously owned U.S. Department of Defense properties. This investigation is being conducted for the Pentolite Road Red Water Pond (PRRWP) Area at the former Plum Brook Ordnance Works (PBOW) in Sandusky, Erie County, Ohio (Figure 1-1). PBOW is being investigated under the Defense Environmental Restoration Program for Formerly Used Defense Sites. The investigation is being managed and technically overseen by the Nashville and Huntington Districts of the U.S. Army Corps of Engineers (USACE). This 9,000-acre facility was used for the manufacture of explosives during World War II. The site is currently maintained by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station of the John H. Glenn Research Center at Lewis Field.

This delineation report has been prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) (a CB&I company) for the fieldwork conducted in 2009 in support of the feasibility study (FS) addendum planned for the PRRWP Area. This work was performed under Delivery Order DX03 of Contract Number W912QR-08-D-0013. The field activities completed by Shaw were conducted pursuant to the site-specific sampling and analysis plan (SSAP) (Shaw, 2009). The SSAP was developed in accordance with the PBOW site-wide sampling and analysis plan (SWSAP) (Shaw, 2008a) and the quality assurance project plan (QAPP) (Shaw, 2008b) to ensure that work performed at the subject site will be of the quality required to satisfy the overall and site-specific project objectives. A site-wide accident prevention/site-wide safety and health plan (Shaw, 2008c) was also prepared for this investigation to help provide a safe work environment.

1.1 PBOW Facility History

The PBOW site was built in early 1941 and manufactured 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives began in December 1941 and continued until 1945. After the plant was shut down, decontamination of TNT, acid, pentolite, and DNT processing lines began; decontamination was completed by the Army during the last quarter of 1945. The property was under the supervision of the Army Ordnance Department. The War Assets Administration accepted custody of the property (3,230 acres) except for the retained area known as the magazine area (2,800 acres) in 1946. The Department of the Army reacquired the 3,230 acres in 1954 and performed cleanup efforts during the 1950s through 1963. Two property use agreements were entered into by the National Advisory Committee of Aeronautics, the predecessor of NASA, and the Army in 1956 and 1958, respectively. In 1963, accountability and custody of the entire PBOW property (6,030 acres) was transferred to NASA by the

Department of the Army. NASA has operated and maintained PBOW since 1963, and it is currently the NASA Glenn Research Center, Plum Brook Station.

Figure 1-2 shows various PBOW areas of concern, including the PRRWP Area. The two Red Water Pond Areas are the PRRWP Area and the West Area Red Water Pond (WARWP) Area.

1.2 Pentolite Road Red Water Pond Description and History

The PRRWP is an unlined pond that received waste process water from Waste Water Treatment Plant 1 from 1942 to 1945 via an elevated discharge pipe. This waste originated from the TNT manufacturing processes at TNT Area A and TNT Area B. The pond covered an area of 1 to 2 acres during plant operations. In 1977, retention dikes and sump pits were installed at the PRRWP Area in response to reddish-brown water that was observed in an adjacent surface ditch. In April and May 1977, approximately 60,000 gallons of the reddish-brown water were removed, and the original basin was backfilled. The original pond area was backfilled to a higher elevation than the surrounding area to prevent ponding in the original PRRWP footprint (Dames and Moore, Inc. [D&M], 1997a).

The areas outside of the PRRWP footprint are covered in old field vegetation, scrub/shrub, and moderate forest, with isolated areas of standing water with emergent wetland vegetation. Currently, the area encompassing the original PRRWP footprint is sparsely vegetated with grass due to recent soil remediation completed in 2009 (McTech Corp. [McTech], 2009). Seasonally ponded areas, which have been observed since the pond was regraded, are present near the PRRWP but outside of the original PRRWP footprint. A drainage ditch, which has been observed as algae covered and containing a few inches of flowing water, is located along the eastern edge of the PRRWP Area. No buildings are present, and the PRRWP Area is not used by NASA.

Focused remedial investigation (RI) sampling at the Red Water Ponds was performed in 1994. A total of 104 soil samples, 7 overburden groundwater samples, and 4 bedrock groundwater samples were collected from both Red Water Pond Areas. Additional samples were collected from only the WARWP Area.

Soil, sediment, surface water, and groundwater sampling was conducted as part of a direct-push investigation in 1998. In the PRRWP Area, 20 surface soil, 39 subsurface soil, 20 overburden groundwater, 4 surface water, and 4 sediment samples were collected.

In addition to the samples collected during the focused RI and direct-push investigation, groundwater samples have been collected from overburden and bedrock monitoring wells associated with the PRRWP Area since 1997.

Based on the results of the previous investigations, a focused FS was completed in December 2002 that described a requirement for remediation of soils contaminated with nitroaromatics within the PRRWP Area. The focused FS developed and evaluated remedial alternatives for the PRRWP Area. An action memorandum for a non-time-critical removal action (NTCRA) for PRRWP soils was presented to the public in September 2002. The NTCRA subsequently began in January 2003, and the action memorandum was finalized in June 2003 (USACE, 2003). This NTCRA included excavation of TNT-contaminated soil, windrow composting, and backfilling of the excavation with clean soil and composted material that met cleanup criteria. During the NTCRA soil removal, a dark seam of impacted soil was discovered, prompting the need for additional excavation. USACE conducted field-scale and laboratory-scale treatability studies to determine the best approach to address the newly discovered additional contamination at the PRRWP Area. A composting action was selected and began in 2007 and was completed in March 2009. This project was returned to the normal Comprehensive, Environmental Response, Compensation, and Liability Act process (RI/FS phase) at the end of the NTCRA. The extent of the NTCRA excavation is shown on Figure 1-3.

The soil analytical results from the test pits along the extent of the NTCRA excavation at the PRRWP Area were reviewed. During this review, it was discovered that the noncancer hazard index (HI) associated with residual soil sampled from along the walls of the test pits was at an unacceptably high level (i.e., more than 1) based on future residential land use. Therefore, the USACE deemed further delineation of this contamination was necessary. Initial delineation sampling was conducted by McTech in May and June 2009, and data gaps were still identified.

Groundwater underlying the PRRWP Area, along with groundwater underlying the WARWP Area and the TNT Areas, is being addressed as a separate Defense Environmental Restoration Program-Formerly Used Defense Sites site. Thus, PRRWP Area groundwater is not further discussed in this report.

1.3 Objectives and Scope of Work

As previously noted, during a recent review of the analytical results of the test pit soil samples which represent the extent of the NTCRA excavation at the PRRWP Area, it was discovered that the noncancer HI associated with residual soil along the walls of the test pits was at an unacceptably high level based on potential future residential land use. Further delineation was

required to determine the extent of the residual contamination so that the site may be remediated for this potential use.

The primary objective of the PRRWP Area soil delineation investigation was to delineate the extent of contamination outside the NTCRA excavation at the PRRWP Area. Specific objectives of the delineation investigation are summarized as follows:

- Define site physical features and characteristics.
- Determine nature and extent of U.S. Department of Defense-related contamination in soil outside the NTCRA excavation in the PRRWP Area.
- Determine chemical characteristics of contamination.
- Obtain site data of quality, quantity, and distribution appropriate for site characterization, risk assessment, and FS.

As specified in the scope of work (SOW), field activities consisted of the following tasks:

- Clearing brush necessary to access sampling locations
- Excavating test pits and completing direct-push technology and hand auger soil borings
- Sampling soil from test pits and soil borings
- Field screening soil samples from all test pits and select soil borings
- Laboratory analysis of soil samples from selected test pits and soil borings
- Managing and disposing of investigation-derived waste (IDW)
- Preparing and submitting a geographic information system deliverable
- Preparing an electronic data deliverable
- Preparing and submitting a delineation sampling report.

The above activities, analytical data, and evaluation are presented in this delineation sampling report.

1.4 Report Organization

Chapter 2.0 of this report describes PBOW and the PRRWP site, its physical setting, geology, and hydrogeology features. Sampling strategy and field procedures are described in Chapter 3.0. The analytical program and background comparison data are presented in Chapter 4.0. Chapter 5.0 describes specific-site information, historical and current analytical data, and the risk-based evaluation of this information and data. Chapter 6.0 presents media conclusions and recommendations. References that were used in preparing the report are listed in Chapter 7.0.

Soil boring logs, test pit logs, and sample collection logs are provided in Appendix A. Appendix B contains land survey data. Appendix C presents the risk-based evaluation for the soil contamination delineation. Appendices D through F contain the data validation summary, the analytical data summary, and data quality evaluations.

2.0 Physical Setting

2.1 Geography, Topography, and Surface Drainage

PBOW is located within the Eastern Lake Region of the Central Lowland Province (Soil Conservation Service, 1971). Erie County is overlain by lacustrine sediment, glacial outwash, and glacial till. The surface is a plain with a slight slope of approximately 25 feet per mile to the north-northeast toward Lake Erie. Elevations at PBOW range from 680 feet above mean sea level at the intersection of Taylor Road and Patrol Road on the southwestern side of the site to 625 feet above mean sea level at the northern portion of the installation. In general, the topography of PBOW is characterized by a flat ground surface with occasional low hummocks caused primarily by glacial scouring and deposition. A low escarpment trends from the western to the northeastern portion of the site (Shaw, 2005).

PBOW lies in the eastern region of the Pickeral Creek-Pipe Creek Basin, which is part of the St. Lawrence River drainage basin (D&M, 1997a). Eleven streams exist within PBOW and flow north-northeast toward Lake Erie, which is located approximately 3.5 miles north of the site. The site is 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 (north-central PBOW). All four drainage areas flow into Sandusky Bay (D&M, 1997b). Overall, surface water drainage of PBOW is controlled by site topography. The streams are incised into bedrock and are poorly developed where they have not yet eroded to the bedrock. Two drainages at the site, Kuebler Ditch and Plum Brook, are monitored by NASA Plum Brook Station for National Pollutant Discharge Elimination System outfall permits. In addition to the streams, 17 isolated ponds and reservoirs and former red water ponds are located at PBOW (U.S. Geological Survey, 1992; D&M, 1997b).

Seasonally ponded areas are present within the PRRWP Area but outside of the original PRRWP footprint. A drainage ditch, which has been observed as algae covered and containing a few inches of flowing water, is located along the eastern edge of the PRRWP Area.

2.2 Geology

2.2.1 Regional Geology

The bedrock in northern Ohio consists of Devonian and Silurian carbonates (limestone and dolomite) and clastics (shale, siltstone, and sandstone). These units unconformably overlie older sedimentary sequences of Ordovician and Cambrian Age rocks, which in turn unconformably overlie pre-Cambrian basement rocks (D&M, 1997a). The local bedrock is situated on the

eastern flank of the Findlay Arch. In the Devonian and Silurian of northern and western Erie County, weathering of the carbonates has produced cavernous porosity and karst topography.

2.2.2 Local Geology

At PBOW, three bedrock units are present: the Delaware Limestone, the Olentangy Shale, and the Ohio Shale. The Delaware Limestone is the lowermost formation screened by PBOW site wells. It is characterized as a hard, dense, finely crystalline limestone and dolomite. The unit is typically buff colored, hard, and massive, and usually is described as fossiliferous with pyrite crystals. In the vicinity of PBOW, quarries (Hanson Aggregates to the north, Hanson-Sandusky Crushed Stone to the southwest, and abandoned Castalia quarry to the west) mine limestone from the Delaware. Traces of natural petroleum-derived hydrocarbons and hydrogen sulfide are common in all three quarries. Overlying the Delaware Limestone is the Olentangy Shale. Two members of the Olentangy Shale have been characterized at the site: the Plum Brook Shale and the overlying Prout Limestone. The Plum Brook Shale is interpreted to consist of approximately 35 feet of bluish-gray, soft, fossiliferous shale containing thin layers of dark, hard, fossiliferous limestone. The Prout Limestone has been described as an approximately 15- to 50-foot-thick unit which occasionally outcrops in a 1,000-2,000-foot-wide, northeast-striking band across the middle portion of PBOW. It is described as a dark gray to blue, very hard, siliceous, fossiliferous limestone or dolomitic mudstone. Olentangy Shale of PBOW dips to the southeast at a slope of approximately 21.1 feet per mile. The uppermost formation at the site is the Ohio Shale. Geographic information system data show that the Ohio Shale dips to the southeast at a slope of approximately 26.4 feet per mile (Shaw, 2005). Only one member of the Ohio Shale is present in the PBOW area: the Huron Shale. This unit is described as black and thinly bedded, with abundant carbonaceous matter. Some large pyrite/carbonate concretions are also present in the Huron Shale, some as large as 6 feet in diameter (D&M, 1997a).

3.0 Field Activities

3.1 Introduction

To conduct studies of the environmental impact of suspected hazardous waste at the former PBOW TNT manufacturing facility in Sandusky, Ohio, an SOW was issued by the Nashville USACE for RI efforts to be conducted at the PRRWP. The SOW included test pit excavation, soil sampling, on-site analysis using colorimetric test kits, laboratory analysis, and disposal of IDW. Field activities at each of the investigation areas were performed in accordance with the site-wide safety and health plan (Shaw, 2008c), SWSAP (Shaw, 2008a) and site-specific work plan, as noted in Chapter 1.0.

Prior to any intrusive work, to comply with NASA regulations, a NASA authorized dig permit was obtained for the PRRWP Area. The dig permit included review of utility maps for the investigative area for any underground utility locations. Storm water, sewer, electrical, natural gas, telephone, cable, and fiber optic lines were included with this review.

The fieldwork was completed in an iterative approach, with six separate sampling events conducted to delineate the subsurface soil contamination at the site. A combination of test pit excavation, direct-push drilling, and hand auger sampling were used to complete the investigation.

3.2 Investigation Approach

The field program was designed to use on-site field screening analysis of soil samples to fully delineate the extent of contamination at the PRRWP. The following sections describe the general approach to the investigation, including sample planning, sampling, field screening, and confirmation analysis carried out by McTech and Shaw.

3.2.1 Initial Sampling Grid Layout

During the initial delineation sampling by McTech (2009), approximately 225 potential sampling locations were staked and surveyed in a concentric ring pattern around the earlier NTCRA excavation and in east-west-trending linear patterns north and south of the NTCRA excavation (Figure 3-1). The concentric pattern, consisting of three rings, is defined by the 10,000-series numbers, as shown on Figure 3-1. Each ring represents an approximate 30-foot stepout from either the NTCRA excavation boundary or each subsequent ring. Because the NTCRA excavation had been backfilled and no longer provided visual evidence to the excavation boundaries, these presurveyed locations provided accurate starting points for delineation sampling. Note that not all of these presurveyed locations were sampled because the final

delineation was based on field screening and confirmation data collected in an iterative fashion. In addition, some locations were sampled and field screened but not sent off for confirmation analysis (Section 3.2.2). Typically, this was the case where field screening showed relatively high concentrations of nitroaromatics.

Similar to the rationale for the layout of the concentric ring pattern, east-west linear patterns were presurveyed to the north (defined by location numbers 393 through 425) and to the south (defined by location numbers 426 through 463). These two linear areas were added based on review of the historical aerial photographs, suggesting the PRRWP may extend further to the north/south than previously thought. McTech collected approximately 100 samples for off-site analysis from these potential locations. As previously noted, not all of the presurveyed locations were sampled during this initial effort.

3.2.2 Delineation Grid Layout

Based on the initial analytical results from the McTech sampling, additional delineation sampling was conducted by Shaw from July through November 2009 and in June and November 2010 to address existing data gaps in the delineation effort. Where available, existing presurveyed locations completed by McTech were used (Section 3.2.1). This included additional samples collected from the concentric ring layout south of the PRRWP Area (bounded by locations 10157 to 10129), east of the PRRWP Area (bounded by locations 10174 and 10184), and northwest of the PRRWP Area (bounded by locations 10146 through 10149). To complete the delineation, additional locations were staked in the field in a grid pattern, consistent with previous sampling (locations 464 through 516 [2009]) and locations PRWP-SO010 through PRWP-SO079 [2010]). These latter locations were all sampled since they were located based on either confirmation samples and/or field screening results. All new locations were surveyed upon completion of the sampling.

3.3 Soil Sampling

As previously noted, three methods of soil sampling were used during the investigation: test pit excavations, direct-push drilling, and hand augering. Figure 3-1 shows locations of all test pits, soil borings, and hand auger locations.

During the initial test pit excavations (June 2009) completed by MHM Services, Inc. of Huntsville, Alabama, composite soil samples were collected from 1 to approximately 10 feet below ground surface (bgs) using a mini-excavator and submitted for field screening analysis of nitroaromatics content. Select samples were also sent to the off-site laboratory for nitroaromatic analysis. Because the depth of the test pits precluded entry by sampling personnel, composite samples were collected from the excavator bucket.

Direct-push drilling activities were conducted by Tri-State Drilling, LLC of Chattanooga, Tennessee, during the second phase of the investigation in August 2009. A track-mounted CME 55 direct-push rig was used at all boring locations during this sampling event. Soil boring locations at PRRWP were selected using the confirmation data collected from test pits during the initial phase of the investigation. (The direct-push rig was mobilized to the site primarily for soil boring and piezometer installation at the TNT Area B sewer line but was utilized on this site as a cost-saving measure.) Composite soil samples were collected from ground surface to 10 feet bgs from each soil boring. It should be noted that a few of the borings were completed through existing berms, resulting in the borings being advanced deeper than 10 feet bgs so that the sample could be collected from original ground surface to 10 feet bgs. The soil samples were analyzed for nitroaromatics in the off-site laboratory.

The third phase of the investigation was completed in October 2009 by Envirocore, Inc. of Plain City, Ohio, using a track-mounted Geoprobe 6610 DT direct-push rig. Again, soil boring locations were selected using the confirmation data collected during the previous phases of the investigation. The direct-push rig was mobilized to the site primarily for soil boring and monitoring well installation at the TNT Area B sewer line but was again utilized on this site as a cost-saving measure. As with the previous investigation, composite soil samples were collected from ground surface to 10 feet bgs from each boring. The soil samples were analyzed for nitroaromatics in the off-site laboratory.

Hand auger samples were collected by the Shaw field sampling team during the fourth phase of soil sampling in November 2009. Soil boring locations were selected using the confirmation data collected during the previous phases of the investigation. A stainless-steel bucket auger was used to collect composite soil samples from ground surface to 10 feet bgs from each boring. The soil samples were analyzed for nitroaromatics in the off-site laboratory.

The fifth phase of sampling (June 2010) was completed by the Shaw field sampling team using a mini-excavator. Soil boring locations were selected using the confirmation data collected during the previous phases of the investigation. Composite soil samples were collected from ground surface to 10 feet bgs from each excavation except for three samples collected from a more shallow depth, ranging from ground surface to 3 feet bgs. The shallow soil samples were collected in the areas where contamination appeared to be associated with the drainage tiles. Based on field observations, it was thought that soil overlying the vicinity of these drainage tiles was unlikely to be impacted by nitroaromatic contamination since contaminant transport appeared to be the result of water movement within the drain tiles; these 0- to 3-foot samples

were collected to determine whether or not these shallower soils were appreciably impacted. The soil samples were analyzed for nitroaromatics in the off-site laboratory.

The final phase of sampling was completed in November 2010 by Envirocore, LLC using a track-mounted Geoprobe 6610 DT direct-push rig. Soil boring locations were selected using the confirmation data collected during the previous phases of the investigation. Composite soil samples were collected from 1 to 10 feet bgs from each soil boring and submitted for field screening analysis of nitroaromatics. Select samples were also submitted to the off-site laboratory for nitroaromatic analysis.

Continuous lithologic logs were recorded for all test pits and soil borings and are included in Appendix A.

3.4 Field Screening

All soil samples collected during the initial and final phases of the investigation were screened using EnSys® TNT field screening kits (U.S. Environmental Protection Agency [EPA] Method 8515). These test kits provide quantitative results for two groups of nitroaromatics:

- 2,4,6-TNT, 1,3,5-trinitrobenzene (TNB), 1,3-dinitrobenzene (DNB), 2-nitrotoluene (NT), 3-NT, 4-NT, 4-amino-2,6-dinitrotoluene, and nitrobenzene
- Total DNT.

Note that the test kits may not be adequately sensitive for environmentally relevant concentrations of 2-NT, 3-NT, 4-NT, nitrobenzene, and 4-amino-2,6-dinitrotoluene. However, of these five compounds, only 4-NT and 4-amino-2,6-dinitrotoluene were detected in the samples sent for laboratory analysis, and these were detected at low concentrations in comparison to the other nitroaromatics. This information suggests that the lack of sensitivity for these five compounds does not preclude the usefulness of the test kits for field screening in the PRRWP Area.

The field program was designed to use on-site field screening analysis of soil samples to fully delineate the extent of contamination at the PRRWP Area. However, residual human health risks must be considered in the delineation process. Evaluation of the field screening data alone is insufficient for risk evaluation for a number of reasons. Usually, only data of definitive quality are used for risk evaluation because the field screening results do not yield chemical-specific results. Use of these field screening data could yield extremely high uncertainties with respect to risk factors resulting from the different toxicities associated with the various nitroaromatics. For example, both DNB and TNB have been detected at relatively high concentrations as a

proportion of total detected nitroaromatics in a number of the laboratory samples. Because the noncancer hazard of DNB is regarded as being 300 times greater than that of TNB on a per-weight basis, the uncertainty of the chemicals responsible for the screening-level detections would alone add orders of magnitude of uncertainty to an evaluation of risks. Therefore, based on discussions with the USACE on-site representative, it was decided that selected soil samples would be sent for laboratory confirmation analysis, the data evaluated, and a determination made whether follow-on field sampling would be necessary at a given location. This resulted in additional phases of the investigation, consisting of sample collection, on-site/off-site sample analysis, and evaluation of the data. The sampling techniques were modified to avoid costly mobilization of additional equipment to the site. These modifications included direct-push soil sampling during periods when a direct-push rig was on site for other activities and hand augering when equipment was not readily available and only a limited number of samples were to be collected. The modification of sampling does not impact the data quality.

3.5 Decontamination Procedures

Decontamination of the excavator, drill rig, and sampling equipment was performed in accordance with Section 5.0 of the SWSAP (Shaw, 2008a). Specifically, the excavator and drill rigs were cleaned at the decontamination pad using high-pressure hot water from a steam cleaner before entering the drilling site, between sites, and after completion of the last excavation or borehole. Other sampling equipment was decontaminated by rinsing in sequence with phosphate-free soapy water, tap water, methanol, and finally with deionized water. Equipment was then air dried before use, provided that the air temperature was sufficiently warm to allow for drying. In some instances, hand augers were used prior to drying because the ambient temperature was too low to allow drying.

3.6 Land Survey

An Ohio-registered professional land surveyor surveyed the excavations and direct-push soil boring locations. Horizontal coordinates were surveyed to the closest 0.1 foot and referenced to the Ohio State Plane Coordinate System. Vertical coordinates (land surface elevation) were surveyed to the nearest 0.01 foot and referenced to the 1929 National Geodetic Vertical Datum. Land survey data reports are included in Appendix B.

3.7 Investigation-Derived Waste Management

IDW generated during investigation activities included soil, decontamination water, and personal protective equipment. All IDW was managed and handled in accordance with procedures described in the SWSAP (Shaw, 2008a). Personal protective equipment (Tyvek®, latex gloves) was double-bagged and disposed of in an on-site industrial dumpster. Decontamination water and soil generated during field activities were stored in labeled 55-gallon drums.

All IDW was sampled and found to be nonhazardous. Soil and liquid IDW was transported to a registered disposal facility. All fluids and solids were transported by Triad Transport, Inc. to the Environmental Quality Company in Detroit, Michigan, for disposal.

4.0 Analytical Program

4.1 Analytical Program and Methodologies

The following subsections present all employed analytical programs and methodologies.

4.1.1 Sample Analysis and Data Validation

Soil samples were collected in two steps as part of this investigation. Initially, soil samples were collected from each test pit excavation and the sample was screened for nitroaromatics using EnSys® field test kits for nitroaromatics. A determination was made based on professional judgment as to whether or not the results of each screening sample were likely to be indicative of nitroaromatics concentrations that would result in exceedances of the risk management levels (incremental lifetime cancer risk [ILCR] exceeding 1E-5 or noncancer HI exceeding a value of 1 [Appendix C]). This judgment was based on a comparison, to date, of screening data to laboratory data along with a comparison of screening results to those of adjacent samples. If the field screening results for a given sample were regarded as indicative of nitroaromatics concentrations that are unlikely to result in exceedances of the risk management levels, an additional soil sample was collected from the corresponding test pit and submitted for fixed-based laboratory confirmation analysis. As described in Appendix C, rather than conducting a formal risk assessment on the residual PRRWP Area soil, risk evaluation is used as a tool for delineating soil contamination in support of the FS for remediation volume estimates and remedial alternative development.

Accutest Laboratories of Orlando, Florida, served as the fixed-base laboratory for primary and field-duplicate project samples. Nitroaromatic field split samples were shipped to Test America of North Canton, Ohio. Test America of Denver, Colorado, analyzed the field split nitroaromatic samples. Shaw performed the data validation; summaries are presented in Appendix D. Analytical results are summarized in Appendix E. A data quality evaluation is presented in Appendix F.

All data were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the EPA *Contract Laboratory Program National Functional Guidelines for Organic Methods Data Review* (EPA, 2008), EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2004), the QAPP (Shaw, 2008b), and specific analytical method requirements. Data were evaluated against specific criteria to verify precision, accuracy, representativeness, completeness, and comparability goals established to meet the project data quality objectives (DQO). The criteria for blank evaluation were based on those detailed in *Region 3 Modifications*

to the Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (EPA, 1994) and *Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, 1993).

4.1.2 Analytical Methods

Chemical analyses were performed in accordance with guidelines detailed in EPA's *Test Methods for Evaluating Solid Waste (SW-846), Physical/Chemical Methods* (EPA, 1986) and subsequent revisions. Method 8330 was used for nitroaromatic analysis.

4.1.3 Data Quality Evaluation

The project-specific quality assurance procedures specified in the SWSAP (Shaw, 2008a) and QAPP (Shaw, 2008b) and its site-specific attachments demonstrate reliability of sampling and analytical procedures employed. Application of these procedures assures that the data are representative of the areas under investigation.

The DQOs for this project have the goal of ensuring that all data will be useful for its intended purposes. Criteria used in meeting these DQOs are listed below.

- All data will be scientifically valid and of known accuracy and precision.
- All data will be complete with respect to identified critical samples.
- All data will be comparable to similar data types.
- All data will be representative of the medium sampled.

Evaluation of the data using the DQO criteria and the validation process resulted in the determination that the data set is valid and of sufficient quality to meet the objectives of the investigation. A complete evaluation of the analytical results is presented in the data quality evaluation (Appendix F).

4.1.4 Blank Evaluation

The purpose of blank analysis is to detect contamination resulting from laboratory and field activities. Blank analysis evaluation includes data qualification based on associated field bank, trip blank, equipment rinsate, and laboratory method blank analysis results. The criteria for blank evaluation are listed below.

- 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 but less than 5 times (most analytes) or 10 times (common laboratory contaminants) that of the blank result, the sample result is qualified "B."

- For organics, if the sample result is less than the contract-required quantitation limit and less than 5 times (most analytes) or 10 times (common laboratory contaminants) 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 but less than 5 times the blank result, the sample result is qualified "B."

- If the sample result is greater than 5 times (most analytes) or 10 times (common laboratory contaminants) 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 found to have the highest concentration of a contaminant. Blank results are not subtracted from sample concentrations. No qualification of PRRWP sample data was required based on the associated blanks.

4.2 Comparison to Delineation Criteria

The analytical result tables presented in Chapter 5.0 include a comparison to EPA (2012) regional screening levels (RSL), as described in Appendix C. The RSLs are used in this report as risk-based delineation criteria. Concentrations of analytes that exceed the RSLs are highlighted in the tables in Chapter 5.0. RSLs do not infer a regulatory limit or mandated cleanup level, nor is the identification of an exceedance intended to necessarily represent an unacceptable human health risk or a need for remedial action for soils represented by that exceedance. Instead, comparisons to RSLs are used, along with other site information, to guide delineation of soil contamination in support of the FS.

5.0 Investigation Results

5.1 Local Physical Setting

PRRWP Site-Specific Soils. As noted in Section 1.2, the PRRWP was an unlined pond that received waste process water from Wastewater Treatment Plant 1 from 1942 to 1945 via an elevated discharge pipe. The pond is thought to have covered an area of 1 to 2 acres during plant operations. In 1977, retention dikes and sump pits were installed at the PRRWP Area in response to reddish-brown water that was observed in an adjacent surface ditch. In April and May 1977, approximately 60,000 gallons of the reddish-brown water were removed, and the original basin was backfilled. The original pond area was backfilled to a higher elevation than the surrounding area and regraded to prevent ponding in the original PRRWP footprint.

During this investigation, lithologic logging of the test pits showed variability in the geologic material at the site. As previously discussed, a dark brown to black seam of silty clay was identified during the NTCRA and was interpreted as the original pond bottom. This dark brown to black silty clay was observed in most of the excavations north of the pond during the current investigation (i.e., locations 464 through 501). In test pits to the south (e.g., 10158 through 10164), soil borings to the northwest (502 through 516), excavations to the west (PRWP-SO010 through PRWP-SO019), and soil borings to the west (PRWP-SO020 through PRWP-SO079), the soils consisted of sands and silts with some clay in deeper horizons, but the brown to black seam was not present. This sand likely represents fill material brought into the site. Similar sandy material was used to cover building foundations at the TNT manufacturing areas. Test pits to the north had sands, silts, and clays overlying the dark brown to black silty clay seam (where present). This apparent fill material may have been derived from berms surrounding the pond, although this is speculative.

Based on these observations, the pond may have been more extensive than originally reported, extending approximately 200 feet further to the north than shown on Figure 3-1. The pond may have been slightly larger to the east as well, based on observations from test pits 10104, 10138, 10139, and 10140. Two soil berms were also observed during the investigation. The berms to the northeast (near location 501) and the west (near locations 10194 and 10195) are interpreted to be unrelated to the original PRRWP, but their actual origins are unclear and may be related to runoff control. During the investigation, a historical map was located that was not consistent with other available historic drawings and showed the pond extending further to the north, more consistent with field observations.

Drain Tiles/Wood Staves/Corrugated Pipe. During this investigation, as well as that completed by McTech (2009), clay drain tile was observed in excavations (419, 468, 492, 10035, and 10126). These 4-inch terracotta pipes appear to have been oriented north to south and east to west. Discussions with members of the Restoration Advisory Board suggest these drain tiles are associated with pre-World War II agricultural activities. When broken open, these drain tiles were found to contain red water with high concentrations of nitroaromatics. The extent of this piping was not specifically delineated during this investigation, which focused only on the pond itself. However, based on test pit observations and analytical data, the extent of the drain tile was limited to the area investigated. In addition to the terracotta pipe, a black plastic corrugated pipe (4-inch diameter) was observed at location 492. Red water was observed draining from the pipe. This plastic pipe is interpreted to have been installed more recently (after World War II and likely much later) as part of efforts to contain or drain water from this area. A larger diameter (8-inch) clay pipe was also observed at location 10194A, which may have been a main trunk for the drain tile network. A wood-stave pipe approximately 12 inches in diameter was observed at location 10037, although field screening analyses of the soil and black sand around the pipe did not detect any contamination.

5.2 Soil

Test pit excavations were completed during this investigation to supplement existing data collected by McTech. Field screening data were evaluated daily to determine the necessity for additional test pit excavation (Table 5-1). During the initial phases of the investigation, these include locations 464 through 501 as well as selected locations to the south and east sides of the pond (Figure 5-1). The test pit pattern of excavations followed that set up by McTech (2009), with test pits spaced 30 to 60 feet apart. Excavations were completed in an iterative manner based on the field screening data until the area was delineated.

Results of the field screening data collected during this phase of investigation ranged from nondetect to >84.1 milligrams per kilogram (mg/kg) for total nitroaromatics. Based on the initial sampling during July 2009, selected samples were sent for laboratory confirmation analysis (Table 5-2). This initial off-site analysis included delineation samples with low levels of nitroaromatics based on field screening data as well as selected locations with elevated concentrations. The samples with elevated concentrations of nitroaromatics were sent to confirm the field screening method was accurate for detections and to verify the accuracy of the field screening techniques.

The field screening technique was judged to generally be an effective qualitative tool at determining where levels of elevated nitroaromatics exist. A total of 85 screening samples were sent for laboratory analysis and could thus be evaluated using the risk-based tool described in

Appendix C. A majority (7 of 13 or 54 percent) of the screening values that exceeded 10 mg/kg total nitroaromatics also exceeded an ILCR value of 5E-6, whereas only 11 of 72 samples (13 percent) with screening sample concentrations of 10 mg/kg or less had a corresponding ILCR exceeding 5E-6. Please note that the 5E-6 value is used as a point of reference for comparing the overall effectiveness of the screening results versus laboratory analytical data and is not a cleanup goal. Although the screening tests are regarded as a useful, economical tool in the field, they were not relied upon to assume a particular concentration, nor were they used to identify the outer boundary of contamination without the collection of a quantitative laboratory sample.

After receipt and evaluation of the analytical data during the first phase, it was determined that data gaps existed to the east near location 10183 and to the northwest near location 499. Two additional sampling events were conducted in these areas (locations 502 through 512). Elevated detections of nitroaromatics at locations 503, 504, 508, and 509 prompted a fourth phase of sampling (locations 513 through 516). These detections in the vicinity of locations 513, 514, and 515 were interpreted to be the result of the drain tiles extending beyond the pond limits and prompted the fifth sampling event (locations 010 through 019). During the fifth sampling event, one boring (010) was placed at the northeast corner of the investigation area to define the extent of contamination to the northeast of location 480. Observations during the investigation suggested that the contaminant distribution in this northern area may be due to transport within the drain tile or advective transport in groundwater. To evaluate the contaminant distribution, three borings (011, 012, and 013) were advanced from 0 to 3 feet bgs to confirm that the upper 3 feet of soil in the vicinity of the encountered drain tiles were not impacted. The remaining borings (014 through 019) were placed northwest, west, and south, respectively, of location 513 to define the extent of contamination. Detections in the vicinity of locations 014 and 019 resulted in the sixth and final sampling event. Locations 020 through 079 were advanced to the south and west of 014 and 019 to define the extent of contamination suspected to be the result of the discovered drain tiles that extended beyond the limits of the pond.

The total nitroaromatic data shown on Figure 5-1 are useful for a qualitative evaluation of the extent of the pond and associated contamination. The extent is further delineated by the risk-based evaluation presented in the following section.

5.3 Risk-Based Evaluation

As previously noted, a risk-based evaluation was completed using the confirmation data (Appendix C). Initial samples were collected by McTech approximately 30 feet beyond the NTCRA excavation (Section 1.2). These samples appear to have bounded the contamination west of the NTCRA excavation, but ILCR values were as high as 3.5E-2 north of the NTCRA excavation and as high as 2.4E-3 southeast of the NTCRA excavation (Figure 5-2). Similarly, the

HI values of the initial step-out samples were as high as 1224 northeast of the NTCRA excavation and as high as 105 southeast of the excavation (Figure 5-3). Note that these values far exceed the PBOW cancer risk (ILCR ≤ 1E5) and noncancer hazard (HI ≤ 1) goals.

After an additional 30-foot step-out was made, test pits were again sampled by McTech during May and June 2009. This additional step-out, shown as the second concentric band outside of the NTCRA excavation boundary on Figures 5-2 and 5-3, appears to have delineated the contamination along the south and east of the NTCRA excavation. Further contamination is indicated north of the NTCRA excavation from near samples 401 and 402 northward to samples 477, 480, and 481, and also westward to sample location 416. However, east-west and north-south tile drain lines containing water with detections of DNT were discovered while digging the test pit for sample 420. Although the dark brown to black seam of silty clay interpreted to be the pond bottom was present in this area, drain tiles were also observed in this area. Therefore, at least some of the subsurface soil contamination in this area may be the result of preferential transport of PRRWP contaminants through the drain tiles. Conversely, this subsurface contamination may also be the result of limited lateral movement of subsurface contamination in the saturated soil or simply backfilling of the pond with clean soil. Regardless of the mechanism of contaminant transport (drain tiles, advective transport in the saturated zone, or simple backfilling), sampling results for the upper 3 feet of soil in this area indicates that potentially uncontaminated soil is present overlying the PRRWP contamination.

Residual contamination with ILCR values exceeding the PBOW goal of 1E-5 was found in several samples extending well north of the NTCRA excavation. Contamination was also found northwest of the NTCRA excavation, on the other side of the berm (Figure 5-2). This area extends from sample PRWP-SO028 north-northeast to sample 499. Tile drains were also found in this area. Because this area is on the opposite side of the berm from the PRRWP Area and because it contains tile drains, it is likely that the contamination in this area is most directly associated with the tile drains. However, the contamination which apparently travelled via the tile drains is interpreted as originating from the PRRWP itself.

6.0 Conclusions and Recommendations

This chapter presents conclusions and recommendations of the delineation activities conducted at the PRRWP Area. Activities were conducted from July through November 2009 and in July and November 2010 and included test pit excavations, soil borehole drilling, field screening analysis, and confirmation analysis of soil samples.

6.1 Conclusions

Based on visual observations coupled with analytical data, the PRRWP boundary is generally limited to the historical footprint of the PRRWP, with the exception of subsurface contamination immediately to the west of the pond (Figure 6-1). This interpretation is based on the presence of the dark brown to black seam of silty clay interpreted to be the pond bottom. Based on the concentration of nitroaromatics and the risk evaluation presented in Appendix C, the extent of the contamination from the PRRWP has been delineated during this investigation.

The reasons for the greater extent of subsurface contamination to the north of the original NTCRA excavation appears to be related to transport of wastewater through agricultural drain tile, advective transport in groundwater, or a combination of these mechanisms. As previously noted, the pond may have extended this far north based on historical documents located during the investigation and this northern extent may simply represent the original pond footprint. This seems plausible, given that the upper 3 feet of material in this area may represent clean fill placed after operations ceased. The contamination detected to the west of the PRRWP footprint may also be the result of the same contaminant transport mechanisms since this area is outside of the pond footprint. The observation that contamination is limited to the subsurface soil (i.e., more than 3 feet bgs) in these areas implies that soil volumes may be significantly reduced by segregating clean and contaminated soil should remediation be required.

6.2 Recommendations

Soil data collected during this investigation adequately define the extent of the contamination associated with the PRRWP Area. The following recommendations are based on all data collected during PRRWP Area investigations:

- The extent of the original PRRWP footprint and associated soil contamination has been adequately delineated, and an FS addendum should be completed to evaluate cleanup options for site soil.

- The findings suggest that should additional soil remediation be required for the PRRWP Area, significant cost savings may be realized through segregation of the

potentially uncontaminated surface soil (0 to 3 feet). Remedial designs, if required, should account for this segregation of soil.

7.0 References

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TABLES

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO010				PRWP-SO011				PRWP-SO012				PRWP-SO013				PRWP-SO014			
			Sample No.:	PR0075				PR0076				PR0077				PR0078				PR0079			
			Sample Date:	16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10			
			Sample Depth:	1 - 10 Ft				0 - 3 Ft				0 - 3 Ft				0 - 3 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.343		0.00		-	-			0.889		0.01		-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.291		0.05		4.68		0.77		0.72		0.12		3.95		0.65	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			1.38		0.01	1.9E-06	8.24		0.07	1.1E-05	5.77		0.05	8.0E-06	21.2		0.18	2.9E-05
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	-	-			0.214		0.0001		3.55		0.002		0.435		0.0002		15.8		0.007	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			6.37		0.18	3.4E-07
Summed Sample HI/ILCR:						0.00	0.0E+00			0.06	1.9E-06			0.84	1.1E-05			0.17	8.0E-06			1.01	3.0E-05 CANC!

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO015				PRWP-SO016				PRWP-SO017				PRWP-SO018				PRWP-SO019			
			Sample No.:	PR0080				PR0081				PR0082				PR0083				PR0084			
			Sample Date:	16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.104	J	0.00		0.182		0.00		-	-			0.768		0.01		-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.448		0.07		0.175		0.03		1.3		0.21		5.57		0.91	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.803		0.01	1.1E-06	1.28		0.01	1.8E-06	2.9		0.02	4.0E-06	3.36		0.03	4.7E-06	18		0.15	2.5E-05
Dinitrotoluene, 2,6-	mg/kg	61	0.72	0.16	J	0.00	2.2E-07	-	-			0.551		0.01	7.7E-07	-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.66		0.0008		1.61		0.0007		3.29		0.001		3.53		0.002		18.7		0.01	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.01	1.3E-06			0.09	1.8E-06			0.06	4.8E-06			0.25	4.7E-06			1.07	2.5E-05 CANC!

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO019				PRWP-SO020				PRWP-SO022				PRWP-SO024				PRWP-SO026			
			Sample No.:	PR0085				PR0200				PR0201				PR0202				PR0203			
			Sample Date:	16-Jun-10				8-Nov-10				8-Nov-10				8-Nov-10				9-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	FD				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	3.57		0.59		21.7		3.56		8.25		1.35		0.175	J	0.03		12.6		2.07	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	12.3		0.10	1.7E-05	50.1		0.42	7.0E-05	16.4		0.14	2.3E-05	-	-			36.3		0.30	5.0E-05
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			21.3	J		4.8E-06	8.37	J		1.9E-06	0.21	J		4.8E-08	9.81	J		2.2E-06
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	13.1		0.01		74		0.03		28.9		0.01		1.72		0.001		43.4	J	0.02	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			9.74	J	0.27	5.1E-07	-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.69	1.7E-05 CANC!			4.28 NC!	7.5E-05 CANC!			1.50 NC!	2.5E-05 CANC!			0.03	4.8E-08			2.39 NC!	5.3E-05 CANC!

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO027				PRWP-SO028				PRWP-SO029				PRWP-SO030				PRWP-SO031			
			Sample No.:	PR0204				PR0205				PR0206				PR0207				PR0208			
			Sample Date:	9-Nov-10				9-Nov-10				9-Nov-10				9-Nov-10				9-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	3.61		0.59		1.62		0.27		1.61		0.26		1.13		0.19		0.497		0.08	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	9.28		0.08	1.3E-05	2.37		0.02	3.3E-06	3.58		0.03	5.0E-06	2.05		0.02	2.8E-06	0.492		0.00	6.8E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	1.52	J		3.5E-07	0.714	J		1.6E-07	1.21	J		2.8E-07	1.57	J		3.6E-07	0.47	J		1.1E-07
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	11.4		0.005		6.29		0.003		7.27		0.003		5.67		0.003		2.55		0.001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.67	1.3E-05			0.29	3.5E-06			0.30	5.2E-06			0.20	3.2E-06			0.09	7.9E-07

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO035				PRWP-SO035				PRWP-SO035				PRWP-SO040				PRWP-SO041			
			Sample No.:	PR0209				PR0210				PR0211				PR0212				PR0213			
			Sample Date:	10-Nov-10				10-Nov-10				10-Nov-10				10-Nov-10				10-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				FD				FS				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.152	J	0.00		-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.131	J	0.02		0.658	J	0.11		-	-			3.08		0.50		1.46		0.24	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	5.08	J	0.04	7.1E-06	1.02	J	0.01	1.4E-06	0.31	J	0.00	4.3E-07	5.51		0.05	7.7E-06	1.69		0.01	2.3E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	0.801	J		1.8E-07	0.351	J		8.0E-08	-	-			2.35	J		5.3E-07	0.321	J		7.3E-08
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	5.31	J	0.002		2.27	J	0.001		1.6	J	0.0007		10.5		0.005		3.52		0.002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			0.76	J	0.02	4.0E-08	-	-			-	-		
Summed Sample HI/ILCR:						0.07	7.2E-06			0.12	1.5E-06			0.02	4.7E-07			0.56	8.2E-06			0.26	2.4E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO042				PRWP-SO043				PRWP-SO044				PRWP-SO045				PRWP-SO053			
			Sample No.:	PR0214				PR0215				PR0216				PR0217				PR0218			
			Sample Date:	10-Nov-10				10-Nov-10				10-Nov-10				10-Nov-10				11-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.118	J	0.00		-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.558		0.09		0.431		0.07		0.204		0.03		-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.518		0.00	7.2E-07	2.52		0.02	3.5E-06	0.725		0.01	1.0E-06	-	-			-	-		
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	0.449	J		1.0E-07	0.7	J		1.6E-07	0.308	J		7.0E-08	0.11	J		2.5E-08	0.118	J		2.7E-08
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	4		0.002		6.01		0.003		1.34		0.0006		0.437		0.0002		0.407		0.0002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.10	8.2E-07			0.10	3.7E-06			0.04	1.1E-06			0.0002	2.5E-08			0.0002	2.7E-08

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO055				PRWP-SO055				PRWP-SO055				PRWP-SO056				PRWP-SO057			
			Sample No.:	PR0219				PR0220				PR0221				PR0222				PR0223			
			Sample Date:	11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				#NAME?				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				FD				FS				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			-	-			0.602		0.10		1.15		0.19	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.72	J	0.01	1.0E-06	0.402	J	0.00	5.6E-07	0.81		0.01	1.1E-06	0.777		0.01	1.1E-06	3.58		0.03	5.0E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			0.115	J	0.00	1.6E-07	-	-		
RDX	mg/kg	NA	4.4	-	-			0.298	J		6.8E-08	-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	2.13		0.001		1.42		0.0006		2.4		0.001		2.69		0.001		3.35		0.002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.01	1.0E-06			0.00	6.3E-07			0.01	1.1E-06			0.11	1.2E-06			0.22	5.0E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO058				PRWP-SO061				PRWP-SO062				PRWP-SO063				PRWP-SO064			
			Sample No.:	PR0224				PR0225				PR0226				PR0227				PR0228			
			Sample Date:	11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			0.186		0.00		-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.557		0.09		1.43		0.23		0.279		0.05		-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	1.66		0.01	2.3E-06	1.81		0.02	2.5E-06	-	-			0.101	J	0.00	1.4E-07	1.19		0.01	1.7E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.91		0.001		3.62		0.002		0.843		0.0004		1.11		0.0005		3.19		0.001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.11	2.3E-06			0.25	2.5E-06			0.05	0.0E+00			0.00	1.4E-07			0.01	1.7E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO065				PRWP-SO066				PRWP-SO067				PRWP-SO068				PRWP-SO070			
			Sample No.:	PR0229				PR0230				PR0231				PR0232				PR0233			
			Sample Date:	11-Nov-10				11-Nov-10				11-Nov-10				12-Nov-10				12-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	0.259		0.00		-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.185		0.03		0.624	J	0.10		0.388		0.06		1.05		0.17	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.789		0.01	1.1E-06	2.26		0.02	3.1E-06	5.35		0.04	7.4E-06	0.629	J	0.01	8.7E-07	2.41		0.02	3.3E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	3.02		0.001		2.17		0.0010		6.26		0.003		1.74		0.001		4.2		0.002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.01	1.1E-06			0.05	3.1E-06			0.15	7.4E-06			0.07	8.7E-07			0.19	3.3E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO071				PRWP-SO072				PRWP-SO073				PRWP-SO073				PRWP-SO073			
			Sample No.:	PR0234				PR0235				PR0236				PR0237				PR0238			
			Sample Date:	12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1-10 ft			
			Sample Purpose:	REG				REG				REG				FD				FS			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	1.25		0.20		0.258		0.04		-	-			-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	7.3		0.06	1.0E-05	0.638		0.01	8.9E-07	-	-			-	-			-	-		
Dinitrotoluene, 2,6-	mg/kg	61	0.72	1.44		0.02	2.0E-06	-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	8.27		0.004		1.1		0.0005		0.231		0.0001		0.334		0.0002		-	-		
Trinitrotoluene, 2,4,6-	mg/kg	36	19	0.317		0.01	1.7E-08	-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.3	1.2E-05			0.05	8.9E-07			0.0001	0.0E+00			0.0002	0.0E+00			0.0000	0.0E+00

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO074				PRWP-SO075				PRWP-SO076				PRWP-SO077				PRWP-SO078			
			Sample No.:	PR0239				PR0240				PR0241				PR0242				PR0243			
			Sample Date:	12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			1.78	J	0.01		-	-			-	-			1.03	J	0.01	
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			4.83		0.79		5.37		0.88		3.87		0.63		1.79		0.29	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			10.5		0.09	1.5E-05	11.1		0.09	1.5E-05	4.33		0.04	6.0E-06	3.88		0.03	5.4E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1.1		0.02	1.5E-06	1.25		0.02	1.7E-06	0.511	J	0.01	7.1E-07	-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.54		0.0007		22.1		0.0100		27.2		0.0124		12.3		0.0056		7.58		0.0034	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.0007	0.0E+00			0.92	1.6E-05 CANC!			1.01	1.7E-05 CANC!			0.68	6.7E-06			0.34	5.4E-06

RSL = U.S. EPA November 2012 Regional Screening Level; VQ = validation qualifier; HQ = hazard quotient; ILCR = incremental lifetime cancer risk; mg/kg = milligrams per kilogram; NA = not applicable; J = estimated concentration; HI =hazard index.

Notes:

1. Sample purpose "REG" is the regular sample, "FD" is the field duplicate, and "FS" is the field split. For REG and FD, the sample with the higher concentrations is shown. The FS samples are shown independently.
2. "-" indicates that the analyte was not detected in this sample.
3. RDX is shown as detected in several samples at concentrations less than the reporting limits. Because RDX has no association with Plum Brook Ordnance Works and is a common false positive in samples from collected from non-PBOW sites, the contribution of RDX is not included in the ILCR value for this sample.
4. A Sample HI Value with associated "NC!" below exceeds a value of 1 (rounded to one significant figure); HI value is shaded.
5. A Sample ILCR Value with associated "CANC!" below exceeds a value of 1E-5 (rounded to one significant figure); ILCR value is shaded.

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-00502				PR-00503				PR-00504				PR-00505				PR-00506			
			Sample Number:	PR0050				PR0051				PR0052				PR0054				PR0056			
			Sample Date:	18-Aug-09				18-Aug-09				18-Aug-09				18-Aug-09				18-Aug-09			
			Sample Depth:	0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 10 Ft			
			Sample Purpose:	REG				REG				REG				FD				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			0.102	J	0.00	
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	0.167	J	0.00		-	-			-	-			0.413		0.00		0.102	J	0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.0959	J	0.02		7.36		1.21		5.97		0.98		0.995	J	0.16		0.0904	J	0.01	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	2.06		0.02	2.9E-06	12.9		0.11	1.8E-05	13.1		0.11	1.8E-05	6.75	J	0.06	9.4E-06	0.827		0.01	1.1E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			1.12	J	0.02	1.6E-06	-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.75		0.0003		23.5		0.0107		32		0.0145		1.53	J	0.0007		0.16	J	0.0001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	0.0602	J	0.002	3.2E-09	-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.04	2.9E-06			1.32	1.8E-05			1.1024	1.8E-05			0.24117	1.1E-05			0.0231	1.1E-06
											CANC!				**CANC!**								

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-00507				PR-00508				PR-00509				PR-00510				PR-00511			
			Sample Number:	PR-00507				PR-00508				PR-00509				PR-00510				PR-00511			
			Sample Date:	21-Oct-09				21-Oct-09				21-Oct-09				21-Oct-09				21-Oct-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			1.4		0.01		-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	1.09		0.18		6.09		1.00		5.32		0.87		2.78		0.46		1.25		0.20	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	4.09	J	0.03	5.7E-06	15.2		0.13	2.1E-05	11.6		0.10	1.6E-05	4.4		0.04	6.1E-06	4.41		0.04	6.1E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	0.24		0.00	3.3E-07	0.973		0.02	1.4E-06	-	-			0.308		0.01	4.3E-07	0.562		0.01	7.8E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	2.54		0.0012		18.1		0.0082		16.9		0.0077		4.12		0.0019		3.67		0.0017	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			0.3		0.008	1.6E-08	-	-			-	-			0.0613	J	0.002	3.2E-09
Sample HI and ILCR						0.2179	6.0E-06			1.15754	2.2E-05			0.98581	1.6E-05			0.49933	6.5E-06			0.25425	6.9E-06
											CANC!				**CANC!**								

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-00512				PR-00513				PR-00514				PR-00515				PR-00516			
			Sample Number:	PR-00512				PR-00513				PR-00514				PR-00515				PR-00516			
			Sample Date:	21-Oct-09				19-Nov-09				19-Nov-09				19-Nov-09				19-Nov-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.572		0.09		9.62	J	1.58		6.86	J	1.12		6.62	J	1.09		0.919		0.15	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.538		0.00	7.5E-07	22.5	J	0.19	3.1E-05	13.5	J	0.11	1.9E-05	16.5	J	0.14	2.3E-05	2.33		0.02	3.2E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			8.1	J		1.8E-06	-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.717		0.0003		40.4	J	0.0184		31.2	J	0.0142		30.2	J	0.0137		3.29		0.0015	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.09858	7.5E-07			1.78291	3.1E-05			1.25127	1.9E-05			1.23647	2.3E-05			0.17157	3.2E-06
										NC!	**CANC!**				**CANC!**				**CANC!**				

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10035				PR-10036				PR-10037				PR-10040				PR-10060			
			Sample Number:	PR0025				PR0028				PR0030				PR0068				PR0017			
			Sample Date:	24-Jul-09				24-Jul-09				24-Jul-09				19-Aug-09				24-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				2 - 12 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			0.385		0.00		0.0577	J	0.0004		-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			0.33		0.00		-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.362		0.06		-	-			-	-			-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.298		0.00	4.1E-07	-	-			0.364		0.00	5.1E-07	-	-			0.121	J	0.00	1.7E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.47		0.0007		1.66		0.0008		0.628		0.0003		-	-			0.235		0.0001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			1.99		0.055	1.0E-07	0.167		0.005	8.8E-09	-	-		
Sample HI and ILCR						0.0625	4.1E-07			0.00075	0.0E+00			0.06336	6.1E-07			0.00502	8.8E-09			0.00112	1.7E-07

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10125				PR-10126				PR-10127				PR-10132				PR-10133			
			Sample Number:	PR0026				PR0027				PR0029				PR0060				PR0060			
			Sample Date:	24-Jul-09				23-Jul-09				24-Jul-09				19-Aug-09				19-Aug-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				1 - 11 Ft				1 - 11 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			0.0503	J	0.0003		-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.363		0.00	5.0E-07	0.159	J	0.00	2.2E-07	0.0675	J	0.0006	9.4E-08	-	-			-	-		
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.236		0.0001		-	-			0.19		0.0001		-	-			-	-		
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			0.888		0.025	4.7E-08	0.185		0.005	9.7E-09
Sample HI and ILCR						0.00313	5.0E-07			0.00133	2.2E-07			0.00098	9.4E-08			0.02467	4.7E-08			0.00514	9.7E-09

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10136				PR-10138				PR-10139				PR-10140				PR-10149			
			Sample Number:	PR0072				PR0057				PR0058				PR0059				PR0016			
			Sample Date:	19-Aug-09				19-Aug-09				19-Aug-09				19-Aug-09				22-Jul-09			
			Sample Depth:	0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR		VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.112	J	0.00075		-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.35		0.0023		-	-			-	-			0.0923	J	0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			1.93		0.32		4.07		0.67		-	-			0.813		0.13	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			5.44		0.05	7.6E-06	9.65		0.08	1.3E-05	3.89		0.03	5.4E-06	2.02		0.02	2.8E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.0508	J	0.00002		3.58		0.0016		9.16		0.0042		3.58		0.0016		1.47		0.0007	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.00077	0.0E+00			0.36569	7.6E-06			0.75179	1.3E-05			0.03404	5.4E-06			0.1514	2.8E-06

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10158				PR-10161				PR-10163				PR-10164				PR-10176			
			Sample Number:	PR0034				PR0021				PR0023				PR0024				PR0006			
			Sample Date:	24-Jul-09				24-Jul-09				24-Jul-09				24-Jul-09				23-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	FD				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			0.116	J	0.00		0.322		0.00		0.197		0.00	
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			0.214		0.00		0.345		0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			-	-			0.241		0.04		-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			-	-			0.0737	J	0.00	1.0E-07	0.802		0.01	1.1E-06	0.218		0.00	3.0E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.0583	J	0.0000		0.138	J	0.0001		0.345		0.0002		0.468		0.0002		0.0457	J	0.0000	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			0.0459	J	0.001	2.4E-09	1.75		0.049	9.2E-08
Sample HI and ILCR						2.65E-05	0.0E+00			6.27E-05	0.0E+00			0.00154	1.0E-07			0.05125	1.1E-06			0.05406	3.9E-07

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10178A				PR-10183				PR-10184				PR-477				PR-478			
			Sample Number:	PR0073				PR0066				PR0007				PR0011				PR0010			
			Sample Date:	19-Aug-09				19-Aug-09				23-Jul-09				22-Jul-09				22-Jul-09			
			Sample Depth:	0 - 10 Ft				0 - 10 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				FD				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.0569	J	0.00		-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.182		0.00		0.229		0.00		9.04	J	0.06		-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			2.54	J	0.42		4.38		0.72		8.45	J	1.39		0.822		0.13	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			10.6	J	0.09	1.5E-05	8.77		0.07	1.2E-05	16.7	J	0.14	2.3E-05	0.677		0.01	9.4E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1.56	J	0.03	2.2E-06	-	-			-	-			0.425		0.01	5.9E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	-	-			4.39	J	0.0020		9.07		0.0041		6.68	J	0.0030		3.62		0.0016	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	0.0692	J	0.002	3.6E-09	-	-			-	-			0.121	J	0.003	6.4E-09	-	-		
Sample HI and ILCR						0.0023	3.6E-09			0.53351	1.7E-05			0.79677	1.2E-05			1.59108	2.3E-05			0.14901	1.5E-06
											CANC!							**NC!**	**CANC!**				

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-479				PR-480				PR-481				PR-482				PR-486			
			Sample Number:	PR0008				PR0003				PR0009				PR0012				PR0013			
			Sample Date:	22-Jul-09				22-Jul-09				22-Jul-09				22-Jul-09				23-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				FS				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.32	J	0.00		-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.203		0.00		0.411		0.00		0.246		0.00		0.0953	J	0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.0594	J	0.01		4.8		0.79		9.33		1.53		2.07		0.34		5.1		0.84	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			10		0.08	1.4E-05	16.8		0.14	2.3E-05	6.29		0.05	8.7E-06	3.84		0.03	5.3E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1		0.02	1.4E-06	-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.324		0.0001		14		0.0064		11.4		0.0052		6.64		0.0030		6.72		0.0031	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			0.0608	J	0.002	3.2E-09	-	-			-	-			-	-		
Sample HI and ILCR						0.00988	0.0E+00			0.89815	1.5E-05			1.67743	2.3E-05			0.39642	8.7E-06			0.87176	5.3E-06
											CANC!			**NC!**	**CANC!**								

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-487				PR-488				PR-492				PR-493				PR-494			
			Sample Number:	PR0014				PR0015				PR0036				PR0037				PR0040			
			Sample Date:	23-Jul-09				23-Jul-09				24-Jul-09				24-Jul-09				27-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.0677	J	0.00		-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			0.0981	J	0.00		-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.0836	J	0.01		1.6		0.26		0.324		0.05		0.981		0.16	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			0.348		0.00	4.8E-07	2.15		0.02	3.0E-06	1.39		0.01	1.9E-06	1.43		0.01	2.0E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			0.89		0.01	1.2E-06	0.453		0.01	6.3E-07	0.496		0.01	6.9E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.212		0.0001		0.844		0.0004		3.76		0.0017		1.19		0.0005		1.58		0.0007	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Sample HI and ILCR						9.6E-05	0.0E+00			0.01744	4.8E-07			0.29717	4.2E-06			0.07267	2.6E-06			0.18159	2.7E-06

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-495				PR-496				PR-497				PR-498			
			Sample Number:	PR0041				PR0042				PR0043				PR0044			
			Sample Date:	27-Jul-09				27-Jul-09				27-Jul-09				27-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																			
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			0.225		0.04		0.102	J	0.02	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			0.262		0.00	3.6E-07	0.31		0.00	4.3E-07	0.151	J	0.00	2.1E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			0.0599	J	0.00	8.3E-08	-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.25		0.0001		0.391		0.0002		0.991		0.0005		0.641		0.0003	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.00011	0.0E+00			0.00334	4.5E-07			0.03992	4.3E-07			0.01827	2.1E-07

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-499				PR-499				PR-500				PR-501			
			Sample Number:	PR0045				PR-0047				PR0038				PR0039			
			Sample Date:	27-Jul-09				27-Jul-09				24-Jul-09				24-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				FS				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																			
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.24		0.00		-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.26	J	0.00		-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	4.27		0.70		5.5		0.90		-	-			0.323		0.05	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	11.1		0.09	1.5E-05	17		0.14	2.4E-05	-	-			0.349		0.00	4.8E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1.3		0.02	1.8E-06	-	-			0.194		0.00	2.7E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	14.5		0.0066		18		0.0082		0.858		0.0004		1.28		0.0006	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.79909	1.5E-05			1.07613	2.5E-05			0.00039	0.0E+00			0.05962	7.5E-07
							CANC!				**CANC!**								

RSL = U.S. EPA Regional Screening Level (Novermber 2012); VQ = validation qualifier; HQ = hazard quotient; ILCR = incremental lifetime cancer risk; mg/kg = milligrams per kilogram; NA = not applicable; J = estimated concentration; HI =hazard index.

Notes:

1. Sample purpose "REG" is the regular sample, "FD" is the field duplicate, and "FS" is the field split.
2. "-" indicates that the analyte was not detected in this sample.
3. RDX is shown as detected in Sample PR-00515 at an estimated concentration of 8.1 mg/kg. Because RDX has no association with Plum Brook Ordnance Works and is a common false positive in samples from non-PBOW sites, the contribution of RDX is not included in the ILCR value for this sample.
4. A Sample HI Value with associated "NC!" below exceeds a value of 1 (rounded to one significant figure); HI value is shaded.
5. A Sample ILCR Value with associated "CANC!" below exceeds a value of 1E-5 (rounded to one significant figure); ILCR value is shaded.

Table C-3

Sample-by-Sample Cancer Risk Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE ILCR
May 2009 Sample Identification	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	
Cancer Risk-Based RSL:	**NA**		**NA**		**19**		**0.72**		**0.72**		**NA**		**NA**		
Rows North and South of NTCRA Excavation															
393	1.4		0.51		0	0.00E+00	0.37	5.14E-07	0	0.00E+00	0.084		0		5.1E-07
394	7.0		1.2		0	0.00E+00	5.4	7.50E-06	0.56	7.78E-07	0.38		0		8.3E-06
395	3.6		0.58		0	0.00E+00	2.9	4.03E-06	0.28	3.89E-07	0.36		0		4.4E-06
396	7.8		2.4		0.26	1.37E-08	5.5	7.64E-06	0.6	8.33E-07	0.77		0		8.5E-06
397	5.6		1.6		0.52	2.74E-08	5.8	8.06E-06	0.75	1.04E-06	0.76		0		9.1E-06
398	7.0		0		4.5	2.37E-07	19	2.64E-05	2.4	3.33E-06	0		0		**3.0E-05**
399	3.2		2.2		0	0.00E+00	4.1	5.69E-06	0.58	8.06E-07	0.37		0		6.5E-06
400	0.39		0		0	0.00E+00	2.1	2.92E-06	0.23	3.19E-07	0		0		3.2E-06
401	18		5.4		0	0.00E+00	17	2.36E-05	1.9	2.64E-06	1.6		0		**2.6E-05**
402	9.9		3.4		0	0.00E+00	9.6	1.33E-05	1.2	1.67E-06	0.74		0		**1.5E-05**
403	0.099		0.058		0	0.00E+00	0.8	1.11E-06	0	0.00E+00	0.098		0.11		1.1E-06
404	2.2		1.4		0	0.00E+00	2.6	3.61E-06	0.33	4.58E-07	0.39		0		4.1E-06
405	28		12		0.1	5.26E-09	33	4.58E-05	3.6	5.00E-06	2.0		0		**5.1E-05**
405dup	27		0		0	0.00E+00	30	4.17E-05	0	0.00E+00	0		0		**4.2E-05**
406	18		7.6		0	0.00E+00	18	2.50E-05	1.8	2.50E-06	0.98		0		**2.8E-05**
407	0.39		0.29		0.074	3.89E-09	0.88	1.22E-06	0	0.00E+00	0.21		0		1.2E-06
408	2.3		1.3		0	0.00E+00	2.8	3.89E-06	0.39	5.42E-07	0.38		0		4.4E-06
409	0.92		0.62		0.1	5.26E-09	1.5	2.08E-06	0.19	2.64E-07	0		0		2.4E-06
410	8.3		3.6		0	0.00E+00	8.7	1.21E-05	0.89	1.24E-06	0		0		1.3E-05
411	9.8		3.6		0	0.00E+00	6	8.33E-06	0.8	1.11E-06	0		0		9.4E-06
412	9.1		3.3		0	0.00E+00	5.7	7.92E-06	0.67	9.31E-07	0		0		8.8E-06
413	12		4.9		0	0.00E+00	5.7	7.92E-06	0.95	1.32E-06	1.1		0		9.2E-06
414	1.8		0.46		0	0.00E+00	1.3	1.81E-06	0.23	3.19E-07	0		0		2.1E-06
415	3.2		1.0		0	0.00E+00	4	5.56E-06	0.61	8.47E-07	0		0		6.4E-06
416	19		0		0	0.00E+00	16	2.22E-05	2.6	3.61E-06	0		0		**2.6E-05**
417	7.2		3.0		0	0.00E+00	7.5	1.04E-05	1.1	1.53E-06	0		0		1.2E-05
418	22		7.8		0	0.00E+00	19	2.64E-05	3.1	4.31E-06	2.0		0		**3.1E-05**
419	3.9		2.4		0	0.00E+00	4.6	6.39E-06	0.85	1.18E-06	0		0		7.6E-06
420	10		4.1		0	0.00E+00	10	1.39E-05	1.4	1.94E-06	0		0		**1.6E-05**
421	10		3.7		0	0.00E+00	9.7	1.35E-05	1.2	1.67E-06	0		0		**1.5E-05**
422	14		6		0.054	2.84E-09	16	2.22E-05	2.5	3.47E-06	0		0		**2.6E-05**
423	31		15		0.13	6.84E-09	27	3.75E-05	3.4	4.72E-06	1.9		0		**4.2E-05**
423dil	29		0		0	0.00E+00	26	3.61E-05	0	0.00E+00	0		0		**3.6E-05**
424	1.5		0.77		0.04	2.11E-09	2.9	4.03E-06	0.46	6.39E-07	0		0		4.7E-06
425	2.4		0.44		0	0.00E+00	1.8	2.50E-06	0.36	5.00E-07	0.19		0		3.0E-06
426	0		0.086		0.71	3.74E-08	0.21	2.92E-07	0.036	5.00E-08	0.23		0		3.8E-07
427	0		0.011		0.31	1.63E-08	0.12	1.67E-07	0.031	4.31E-08	0.25		0.22		2.3E-07
428	0.32		0.033		0.16	8.42E-09	0.14	1.94E-07	0.038	5.28E-08	0.25		0.31		2.6E-07
429	0.86		0		0	0.00E+00	0.062	8.61E-08	0	0.00E+00	39		0.088		8.6E-08
430	4.5		2.2		0	0.00E+00	8.9	1.24E-05	1.3	1.81E-06	0		0		1.4E-05
431	1.9		0		0	0.00E+00	4.1	5.69E-06	0.66	9.17E-07	0.49		0		6.6E-06
432	0.067		0		0	0.00E+00	0.16	2.22E-07	0	0.00E+00	0		0		2.2E-07
433	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
434	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
435	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00

Table C-3

Sample-by-Sample Cancer Risk Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE ILCR
May 2009 Sample Identification	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	
Cancer Risk-Based RSL:	**NA**		**NA**		**19**		**0.72**		**0.72**		**NA**		**NA**		
436	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
437	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
438	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
439	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
440	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
441	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
442	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
443	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
444	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
445	0		0		0	0.00E+00	0.052	7.22E-08	0	0.00E+00	0		0		7.2E-08
446	6.7		0		0	0.00E+00	1.3	1.81E-06	0.26	3.61E-07	0.4		0		2.2E-06
447	0.3		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0.063		0.082		0.0E+00
448	0.078		0.019		0.49	2.58E-08	0.067	9.31E-08	0	0.00E+00	0.046		0.46		1.2E-07
449	0		0.036		0	0.00E+00	0.16	2.22E-07	0	0.00E+00	0.038		0		2.2E-07
450	0.071		0		0	0.00E+00	0.11	1.53E-07	0	0.00E+00	0.075		0.12		1.5E-07
451	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
452	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
453	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
454	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
455	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
456	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
457	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
458	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
459	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
460	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0.060		0.0E+00
461	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
462	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
463	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
30-Foot Step-Out						0		0		0.0000					0
10001	1800		50		0	0.00E+00	43	5.97E-05	0	0.00E+00	99		0		**6.0E-05**
10002	1200		77		0	0.00E+00	1400	1.94E-03	280	3.89E-04	260		0		**2.3E-03**
10003	660		0		0	0.00E+00	150	2.08E-04	89	1.24E-04	160		240		**3.3E-04**
10004	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10006	0		31		38	2.00E-06	42	5.83E-05	0	0.00E+00	0		0		**6.0E-05**
10014	20000		5900		560	2.95E-05	22000	3.06E-02	3000	4.17E-03	0		0		**3.5E-02**
10015	16		0		0	0.00E+00	7.8	1.08E-05	0.52	7.22E-07	0		0		1.2E-05
10021	1.3		0.88		0	0.00E+00	2.1	2.92E-06	0.3	4.17E-07	0		0		3.3E-06
10022	17		3.6		0	0.00E+00	8.2	1.14E-05	1.2	1.67E-06	0.56		0		1.3E-05
10023	14		4.5		0.27	1.42E-08	8.5	1.18E-05	1.1	1.53E-06	0		0		1.3E-05
10025	12		3.3		0	0.00E+00	5.7	7.92E-06	0.44	6.11E-07	0		0		8.5E-06
10026	2.5		0.46		0	0.00E+00	1.5	2.08E-06	0	0.00E+00	0		0		2.1E-06
10027	200		0		0	0.00E+00	85	1.18E-04	0	0.00E+00	160		0		**1.2E-04**
10096	560		530		0	0.00E+00	1500	2.08E-03	240	3.33E-04	170		0		**2.4E-03**
10097	600		64		170	8.95E-06	94	1.31E-04	0	0.00E+00	120		240		**1.4E-04**
10098	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10099	0		0		77	4.05E-06	0	0.00E+00	0	0.00E+00	32		0		4.1E-06

Table C-3

Sample-by-Sample Cancer Risk Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE ILCR
May 2009 Sample Identification	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	
Cancer Risk-Based RSL:	**NA**		**NA**		**19**		**0.72**		**0.72**		**NA**		**NA**		
10100	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10101	140		0		230	1.21E-05	58	8.06E-05	0	0.00E+00	260		300		**9.3E-05**
10102	700		430		26000	1.37E-03	480	6.67E-04	96	1.33E-04	6400		2900		**2.2E-03**
10102dup	0		0		26000	1.37E-03	0	0.00E+00	0	0.00E+00	0		0		**1.4E-03**
10103	340		310		0	0.00E+00	1300	1.81E-03	160	2.22E-04	0		0		**2.0E-03**
10104	15000		0		380	2.00E-05	14000	1.94E-02	2000	2.78E-03	0		0		**2.2E-02**
10105	0		440		0	0.00E+00	1900	2.64E-03	220	3.06E-04	270		380		**2.9E-03**
10106	27000		4700		280	1.47E-05	15000	2.08E-02	2000	2.78E-03	0		0		**2.4E-02**
10106dup	27000		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10107	5900		0		0	0.00E+00	7600	1.06E-02	1100	1.53E-03	0		0		**1.2E-02**
10108	9100		3400		0	0.00E+00	7400	1.03E-02	1200	1.67E-03	0		0		**1.2E-02**
10109	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10110	1.2		0		1.5	7.89E-08	1.5	2.08E-06	0.26	3.61E-07	0.68		0		2.5E-06
10111	12		5.4		0	0.00E+00	14	1.94E-05	1.9	2.64E-06	2.3		0		**2.2E-05**
10112	2.2		0		0	0.00E+00	9.8	1.36E-05	1.0	1.39E-06	0		0		**1.5E-05**
10113	0.88		0.41		0	0.00E+00	1.3	1.81E-06	0.26	3.61E-07	0.27		0.25		2.2E-06
10114	7.7		2		0	0.00E+00	4.7	6.53E-06	0.46	6.39E-07	0		0		7.2E-06
10115	10		2.0		0	0.00E+00	4.0	5.56E-06	0.48	6.67E-07	0.42		0		6.2E-06
10116	7.7		2.1		0	0.00E+00	2.7	3.75E-06	0.21	2.92E-07	0.03		0		4.0E-06
10117	400		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10118	82		0		0	0.00E+00	79	1.10E-04	0	0.00E+00	0		0		**1.1E-04**
10119	530		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10120	420		0		0	0.00E+00	270	3.75E-04	71	9.86E-05	81		0		**4.7E-04**
10121	620		0		0	0.00E+00	50	6.94E-05	0	0.00E+00	59		0		**6.9E-05**
10122	400		79		0	0.00E+00	82	1.14E-04	0	0.00E+00	83		100		**1.1E-04**
10123	1400		130		0	0.00E+00	310	4.31E-04	110	1.53E-04	200		220		**5.8E-04**
10124	1700		460		63	3.32E-06	420	5.83E-04	0	0.00E+00	380		480		**5.9E-04**
60-Foot Step-Out															
10137	0		0		0	0	0	0	0	0	0		0		0.0E+00
10129	0.21		0		0.76	4.00E-08	0.32	4.44E-07	0.32	4.44E-07	0.45		0.66		9.3E-07
10157	2.2		0.026		0	0	0	0	0	0	0		0		0.0E+00
90-Foot Step-Out															
10182	3.2		1.2		10	5.26E-07	1.6	2.22E-06	0.46	6.39E-07	1.1		1.2		3.4E-06
10069	0		0		0	0	0	0	0	0	0		0		0.0E+00
10089	0		0		0	0	0	0	0	0	0		0		0.0E+00
10196	1.5		0.42		0.14	7.37E-09	1.6	2.22E-06	0.21	2.92E-07	0.30		0		2.5E-06
MAXIMUM	27000		5900		26000		22000		3000		6400		2900		
MAXIMUM minus 30' step-outs	3.2		1.2		10		1.6		0.46		1.1		1.2		

RSL = U.S. EPA November 2012 Regional Screening Level; 2-ADNT = 2-amino-4,6-dinitrotoluene; 4-ADNT = 4-amino-2,6-dinitrotoluene; mg/kg = concentration in milligrams per kilogram; ILCR = incremental lifetime cancer risk;
NA = not applicable; dup = duplicate sample; dil = sample run as a dilution; "0" = analyte was not detected in associated sample.

NOTE: Bold, shaded values indicate that the sample ILCR value exceeds 1E-5 (rounded to one significant figure).

Source of Analytical Data: McTech Corp, 2009, Non-Time Critical Removal Action Report, Soil Excavation, Composting, and Disposal, Pentolite Road Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio, April.

Table C-4

Sample-by-Sample Noncancer Hazard Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

May 2009 Sample Identification	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE HI
Noncancer Risk-Based RSL:	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	
Rows North and South of NTCRA Excavation	2200		6.1		36		120		61		150		150		
393	1.4	0.0006	0.51	0.0836	0	0.0000	0.37	0.0031	0	0.0000	0.084	0.0006	0	0.0000	0.088
394	7.0	0.0032	1.2	0.1967	0	0.0000	5.4	0.0450	0.56	0.0092	0.38	0.0025	0	0.0000	0.257
395	3.6	0.0016	0.58	0.0951	0	0.0000	2.9	0.0242	0.28	0.0046	0.36	0.0024	0	0.0000	0.128
396	7.8	0.0035	2.4	0.3934	0.26	0.0072	5.5	0.0458	0.6	0.0098	0.77	0.0051	0	0.0000	0.465
397	5.6	0.0025	1.6	0.2623	0.52	0.0144	5.8	0.0483	0.75	0.0123	0.76	0.0051	0	0.0000	0.345
398	7.0	0.0032	0	0.0000	4.5	0.1250	19	0.1583	2.4	0.0393	0	0.0000	0	0.0000	0.326
399	3.2	0.0015	2.2	0.3607	0	0.0000	4.1	0.0342	0.58	0.0095	0.37	0.0025	0	0.0000	0.408
400	0.39	0.0002	0	0.0000	0	0.0000	2.1	0.0175	0.23	0.0038	0	0.0000	0	0.0000	0.021
401	18	0.0082	5.4	0.8852	0	0.0000	17	0.1417	1.9	0.0311	1.6	0.0107	0	0.0000	1.077
402	9.9	0.0045	3.4	0.5574	0	0.0000	9.6	0.0800	1.2	0.0197	0.74	0.0049	0	0.0000	0.666
403	0.099	0.0000	0.058	0.0095	0	0.0000	0.8	0.0067	0	0.0000	0.098	0.0007	0.11	0.0007	0.018
404	2.2	0.0010	1.4	0.2295	0	0.0000	2.6	0.0217	0.33	0.0054	0.39	0.0026	0	0.0000	0.260
405	28	0.0127	12	1.9672	0.1	0.0028	33	0.2750	3.6	0.0590	2.0	0.0133	0	0.0000	**2.330**
405dup	27	0.0123	0	0.0000	0	0.0000	30	0.2500	0	0.0000	0	0.0000	0	0.0000	0.262
406	18	0.0082	7.6	1.2459	0	0.0000	18	0.1500	1.8	0.0295	0.98	0.0065	0	0.0000	1.440
407	0.39	0.0002	0.29	0.0475	0.074	0.0021	0.88	0.0073	0	0.0000	0.21	0.0014	0	0.0000	0.059
408	2.3	0.0010	1.3	0.2131	0	0.0000	2.8	0.0233	0.39	0.0064	0.38	0.0025	0	0.0000	0.246
409	0.92	0.0004	0.62	0.1016	0.1	0.0028	1.5	0.0125	0.19	0.0031	0	0.0000	0	0.0000	0.120
410	8.3	0.0038	3.6	0.5902	0	0.0000	8.7	0.0725	0.89	0.0146	0	0.0000	0	0.0000	0.681
411	9.8	0.0045	3.6	0.5902	0	0.0000	6	0.0500	0.8	0.0131	0	0.0000	0	0.0000	0.658
412	9.1	0.0041	3.3	0.5410	0	0.0000	5.7	0.0475	0.67	0.0110	0	0.0000	0	0.0000	0.604
413	12	0.0055	4.9	0.8033	0	0.0000	5.7	0.0475	0.95	0.0156	1.1	0.0073	0	0.0000	0.879
414	1.8	0.0008	0.46	0.0754	0	0.0000	1.3	0.0108	0.23	0.0038	0	0.0000	0	0.0000	0.091
415	3.2	0.0015	1.0	0.1639	0	0.0000	4	0.0333	0.61	0.0100	0	0.0000	0	0.0000	0.209
416	19	0.0086	0	0.0000	0	0.0000	16	0.1333	2.6	0.0426	0	0.0000	0	0.0000	0.185
417	7.2	0.0033	3.0	0.4918	0	0.0000	7.5	0.0625	1.1	0.0180	0	0.0000	0	0.0000	0.576
418	22	0.0100	7.8	1.2787	0	0.0000	19	0.1583	3.1	0.0508	2.0	0.0133	0	0.0000	**1.511**
419	3.9	0.0018	2.4	0.3934	0	0.0000	4.6	0.0383	0.85	0.0139	0	0.0000	0	0.0000	0.447
420	10	0.0045	4.1	0.6721	0	0.0000	10	0.0833	1.4	0.0230	0	0.0000	0	0.0000	0.783
421	10	0.0045	3.7	0.6066	0	0.0000	9.7	0.0808	1.2	0.0197	0	0.0000	0	0.0000	0.712
422	14	0.0064	6	0.9836	0.054	0.0015	16	0.1333	2.5	0.0410	0	0.0000	0	0.0000	1.166
423	31	0.0141	15	2.4590	0.13	0.0036	27	0.2250	3.4	0.0557	1.9	0.0127	0	0.0000	**2.770**
423dil	29	0.0132	0	0.0000	0	0.0000	26	0.2167	0	0.0000	0	0.0000	0	0.0000	0.230
424	1.5	0.0007	0.77	0.1262	0.04	0.0011	2.9	0.0242	0.46	0.0075	0	0.0000	0	0.0000	0.160
425	2.4	0.0011	0.44	0.0721	0	0.0000	1.8	0.0150	0.36	0.0059	0.19	0.0013	0	0.0000	0.095
426	0	0.0000	0.086	0.0141	0.71	0.0197	0.21	0.0018	0.036	0.0006	0.23	0.0015	0	0.0000	0.038
427	0	0.0000	0.011	0.0018	0.31	0.0086	0.12	0.0010	0.031	0.0005	0.25	0.0017	0.22	0.0015	0.015
428	0.32	0.0001	0.033	0.0054	0.16	0.0044	0.14	0.0012	0.038	0.0006	0.25	0.0017	0.31	0.0021	0.016
429	0.86	0.0004	0	0.0000	0	0.0000	0.062	0.0005	0	0.0000	39	0.2600	0.088	0.0006	0.261
430	4.5	0.0020	2.2	0.3607	0	0.0000	8.9	0.0742	1.3	0.0213	0	0.0000	0	0.0000	0.458
431	1.9	0.0009	0	0.0000	0	0.0000	4.1	0.0342	0.66	0.0108	0.49	0.0033	0	0.0000	0.049
432	0.067	0.0000	0	0.0000	0	0.0000	0.16	0.0013	0	0.0000	0	0.0000	0	0.0000	0.001
433	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
434	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
435	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000

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May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

May 2009 Sample Identification	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE HI
Noncancer Risk-Based RSL:	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	
Rows North and South of NTCRA Excavation	2200		6.1		36		120		61		150		150		
436	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
437	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
438	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
439	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
440	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
441	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
442	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
443	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
444	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
445	0	0.0000	0	0.0000	0	0.0000	0.052	0.0004	0	0.0000	0	0.0000	0	0.0000	0.0004
446	6.7	0.0030	0	0.0000	0	0.0000	1.3	0.0108	0.26	0.0043	0.4	0.0027	0	0.0000	0.021
447	0.3	0.0001	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.063	0.0004	0.082	0.0005	0.001
448	0.078	0.0000	0.019	0.0031	0.49	0.0136	0.067	0.0006	0	0.0000	0.046	0.0003	0.46	0.0031	0.021
449	0	0.0000	0.036	0.0059	0	0.0000	0.16	0.0013	0	0.0000	0.038	0.0003	0	0.0000	0.007
450	0.071	0.0000	0	0.0000	0	0.0000	0.11	0.0009	0	0.0000	0.075	0.0005	0.12	0.0008	0.002
451	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
452	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
453	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
454	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
455	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
456	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
457	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
458	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
459	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
460	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.060	0.0004	0.000
461	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
462	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
463	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
30-Foot Step-Out		0		0		0		0		0.0000		0		0.0000	0
10001	1800	0.8182	50	8.1967	0	0.0000	43	0.3583	0	0.0000	99	0.6600	0	0.0000	**10.03**
10002	1200	0.5455	77	12.6230	0	0.0000	1400	11.6667	280	4.5902	260	1.7333	0	0.0000	**31.16**
10003	660	0.3000	0	0.0000	0	0.0000	150	1.2500	89	1.4590	160	1.0667	240	1.6000	**5.68**
10004	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10006	0	0.0000	31	5.0820	38	1.0556	42	0.3500	0	0.0000	0	0.0000	0	0.0000	**6.49**
10014	20000	9.0909	5900	967.2131	560	15.5556	22000	183.3333	3000	49.1803	0	0.0000	0	0.0000	**1224.37**
10015	16	0.0073	0	0.0000	0	0.0000	7.8	0.0650	0.52	0.0085	0	0.0000	0	0.0000	0.08
10021	1.3	0.0006	0.88	0.1443	0	0.0000	2.1	0.0175	0.3	0.0049	0	0.0000	0	0.0000	0.17
10022	17	0.0077	3.6	0.5902	0	0.0000	8.2	0.0683	1.2	0.0197	0.56	0.0037	0	0.0000	0.69
10023	14	0.0064	4.5	0.7377	0.27	0.0075	8.5	0.0708	1.1	0.0180	0	0.0000	0	0.0000	0.84
10025	12	0.0055	3.3	0.5410	0	0.0000	5.7	0.0475	0.44	0.0072	0	0.0000	0	0.0000	0.60
10026	2.5	0.0011	0.46	0.0754	0	0.0000	1.5	0.0125	0	0.0000	0	0.0000	0	0.0000	0.09
10027	200	0.0909	0	0.0000	0	0.0000	85	0.7083	0	0.0000	160	1.0667	0	0.0000	**1.87**
10096	560	0.2545	530	86.8852	0	0.0000	1500	12.5000	240	3.9344	170	1.1333	0	0.0000	**104.71**
10097	600	0.2727	64	10.4918	170	4.7222	94	0.7833	0	0.0000	120	0.8000	240	1.6000	**18.67**
10098	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00

Table C-4

Sample-by-Sample Noncancer Hazard Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

May 2009 Sample Identification	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE HI
Noncancer Risk-Based RSL:	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	
Rows North and South of NTCRA Excavation	2200		6.1		36		120		61		150		150		
10099	0	0.0000	0	0.0000	77	2.1389	0	0.0000	0	0.0000	32	0.2133	0	0.0000	**2.35**
10100	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10101	140	0.0636	0	0.0000	230	6.3889	58	0.4833	0	0.0000	260	1.7333	300	2.0000	**10.67**
10102	700	0.3182	430	70.4918	26000	722.2222	480	4.0000	96	1.5738	6400	42.6667	2900	19.3333	**860.61**
10102dup	0	0.0000	0	0.0000	26000	722.2222	0	0.0000	0	0.0000	0	0.0000	0	0.0000	**722.22**
10103	340	0.1545	310	50.8197	0	0.0000	1300	10.8333	160	2.6230	0	0.0000	0	0.0000	**64.43**
10104	15000	6.8182	0	0.0000	380	10.5556	14000	116.6667	2000	32.7869	0	0.0000	0	0.0000	**166.83**
10105	0	0.0000	440	72.1311	0	0.0000	1900	15.8333	220	3.6066	270	1.8000	380	2.5333	**95.90**
10106	27000	12.2727	4700	770.4918	280	7.7778	15000	125.0000	2000	32.7869	0	0.0000	0	0.0000	**948.33**
10106dup	27000	12.2727	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	**12.27**
10107	5900	2.6818	0	0.0000	0	0.0000	7600	63.3333	1100	18.0328	0	0.0000	0	0.0000	**84.05**
10108	9100	4.1364	3400	557.3770	0	0.0000	7400	61.6667	1200	19.6721	0	0.0000	0	0.0000	**642.85**
10109	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10110	1.2	0.0005	0	0.0000	1.5	0.0417	1.5	0.0125	0.26	0.0043	0.68	0.0045	0	0.0000	0.06
10111	12	0.0055	5.4	0.8852	0	0.0000	14	0.1167	1.9	0.0311	2.3	0.0153	0	0.0000	1.05
10112	2.2	0.0010	0	0.0000	0	0.0000	9.8	0.0817	1.0	0.0164	0	0.0000	0	0.0000	0.10
10113	0.88	0.0004	0.41	0.0672	0	0.0000	1.3	0.0108	0.26	0.0043	0.27	0.0018	0.25	0.0017	0.09
10114	7.7	0.0035	2	0.3279	0	0.0000	4.7	0.0392	0.46	0.0075	0	0.0000	0	0.0000	0.38
10115	10	0.0045	2.0	0.3279	0	0.0000	4.0	0.0333	0.48	0.0079	0.42	0.0028	0	0.0000	0.38
10116	7.7	0.0035	2.1	0.3443	0	0.0000	2.7	0.0225	0.21	0.0034	0.03	0.0002	0	0.0000	0.37
10117	400	0.1818	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.18
10118	82	0.0373	0	0.0000	0	0.0000	79	0.6583	0	0.0000	0	0.0000	0	0.0000	0.70
10119	530	0.2409	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.24
10120	420	0.1909	0	0.0000	0	0.0000	270	2.2500	71	1.1639	81	0.5400	0	0.0000	**4.14**
10121	620	0.2818	0	0.0000	0	0.0000	50	0.4167	0	0.0000	59	0.3933	0	0.0000	1.09
10122	400	0.1818	79	12.9508	0	0.0000	82	0.6833	0	0.0000	83	0.5533	100	0.6667	**15.04**
10123	1400	0.6364	130	21.3115	0	0.0000	310	2.5833	110	1.8033	200	1.3333	220	1.4667	**29.13**
10124	1700	0.7727	460	75.4098	63	1.7500	420	3.5000	0	0.0000	380	2.5333	480	3.2000	**87.17**
60-Foot Step-Out														0.0000	
10137	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
10129	0.21	0.0001	0	0.0000	0.76	0.0211	0.32	0.0027	0.32	0.0052	0.45	0.0030	0.66	0.0044	0.037
10157	2.2	0.0010	0.026	0.0043	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.005
90-Foot Step-Out														0.0000	
10182	3.2	0.0015	1.2	0.1967	10	0.2778	1.6	0.0133	0.46	0.0075	1.1	0.0073	1.2	0.0080	0.51
10069	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10089	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10196	1.5	0.0007	0.42	0.0689	0.14	0.0039	1.6	0.0133	0.21	0.0034	0.30	0.0020	0	0.0000	0.09

RSL = U.S. EPA November 2012 Regional Screening Level; 2-ADNT = 2-amino-4,6-dinitrotoluene; 4-ADNT = 4-amino-2,6-dinitrotoluene; mg/kg = concentration in milligrams per kilogram; HQ = hazard quotient; HI = hazard index; NA = not applicable; dup = duplicate sample; dil = sample run as a dilution; "0" = analyte was not detected in associated sample.

NOTE: Bold, shaded values indicate that the sample HI value exceeds 1 (rounded to one significant figure).

Source of Analytical Data: McTech Corp, 2009, Non-Time Critical Removal Action Report, Soil Excavation, Composting, and Disposal, Pentolite Road Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio, April.

FIGURES

FIGURE 1-1
PBOW VICINITY MAP

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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

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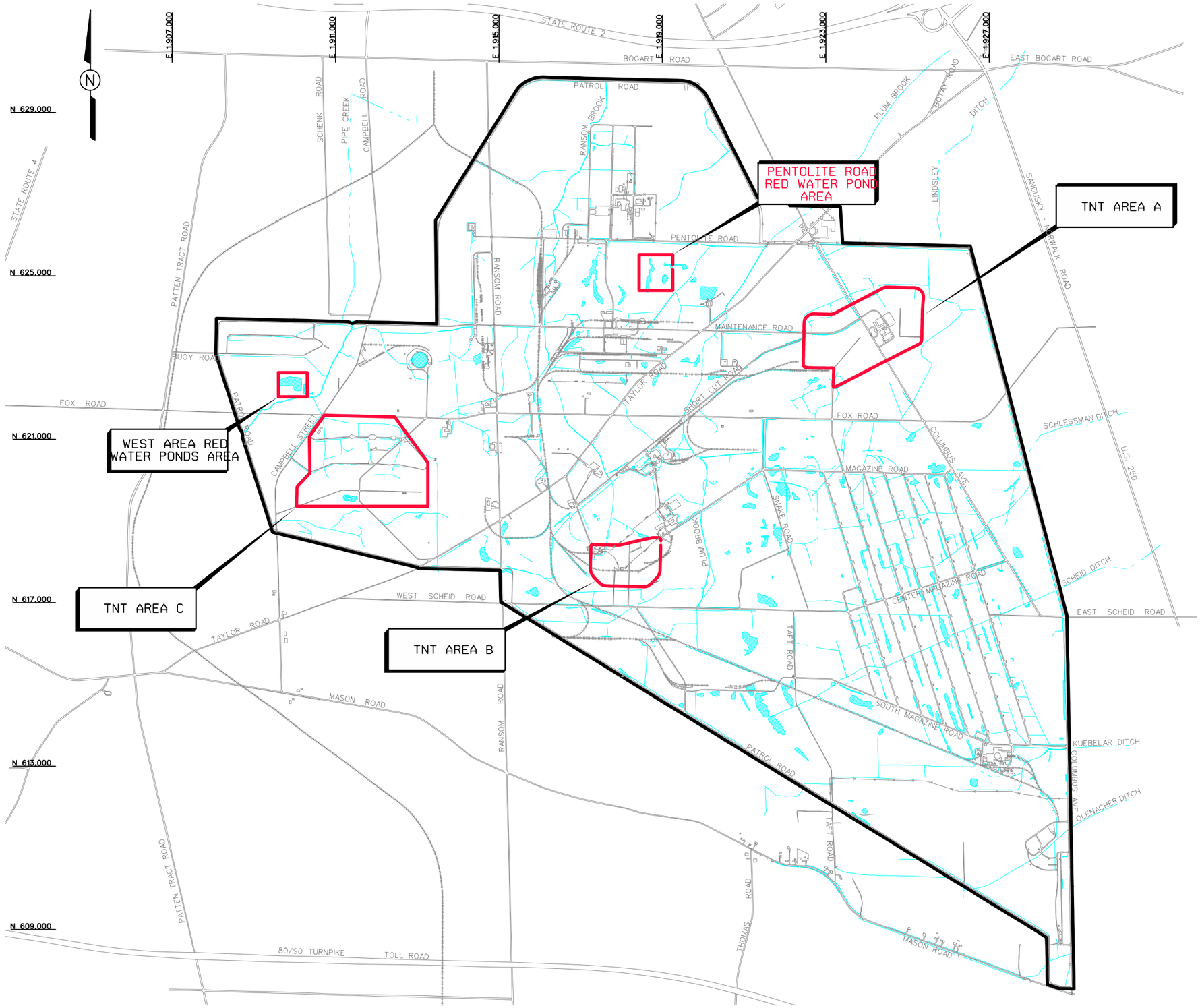

LEGEND:

- AREA OF CONCERN
- POND
- CREEK, DITCH, CONVEYANCE
- RAILROAD
- PBOW BOUNDARY

NOTES:

1. COORDINATES ARE OHIO STATE PLANE COORDINATE SYSTEM, 3401 OHIO NORTH, NAD83.

SCALE

0 2500 5000 FEET

FIGURE 1-2
LOCATION MAP

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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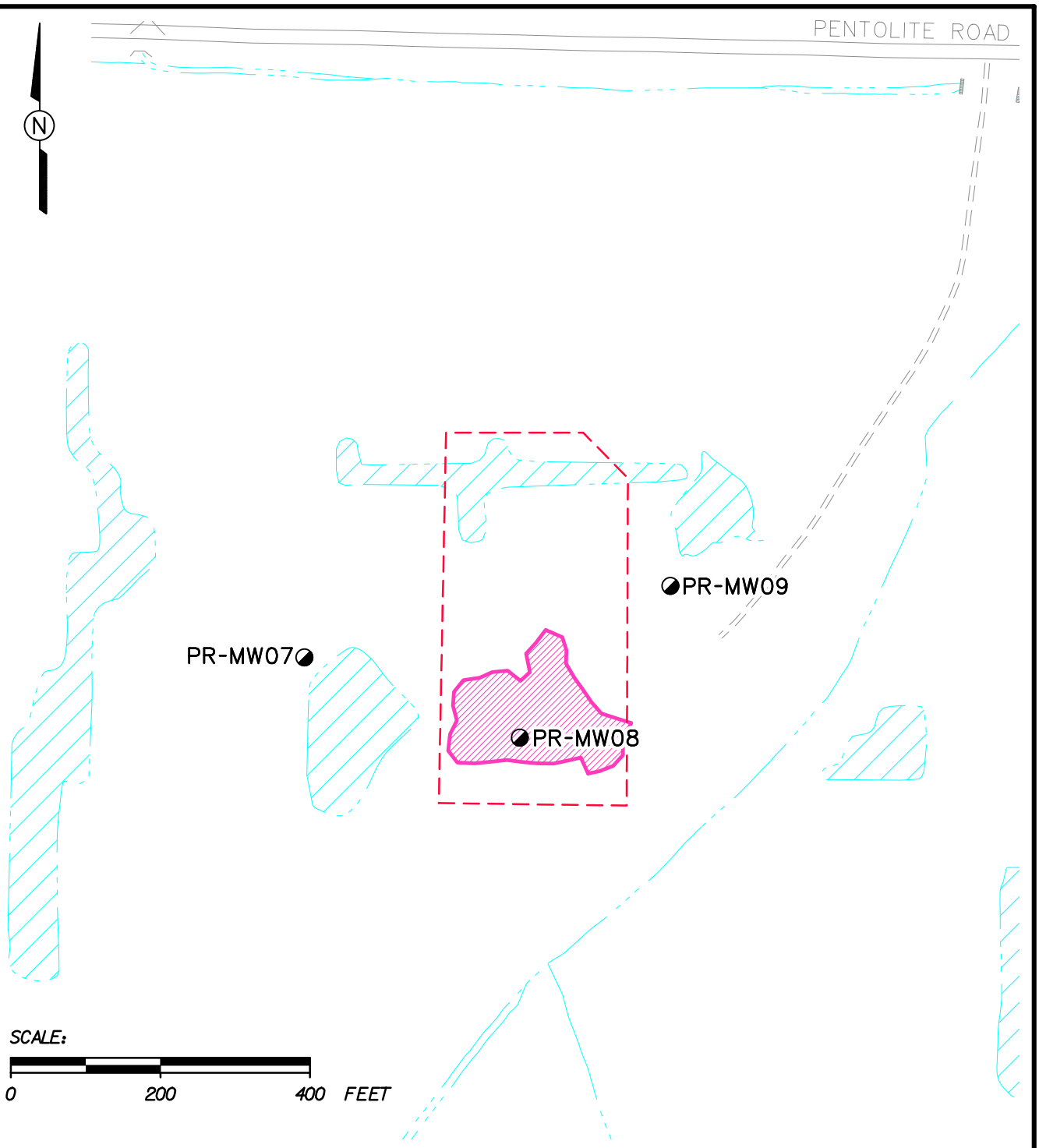

LEGEND

- APPROXIMATE HISTORICAL LOCATION OF POND
- CREEK, DITCH, CONVEYANCE
- POND, SURFACE WATER
- OVERBURDEN/SHALE MONITORING WELL LOCATION
- COMPLETED TNT SOIL REMEDIATION AREA

FIGURE 1-3
LOCATION OF THE NONTIME CRITICAL REMOVAL ACTION EXCAVATION

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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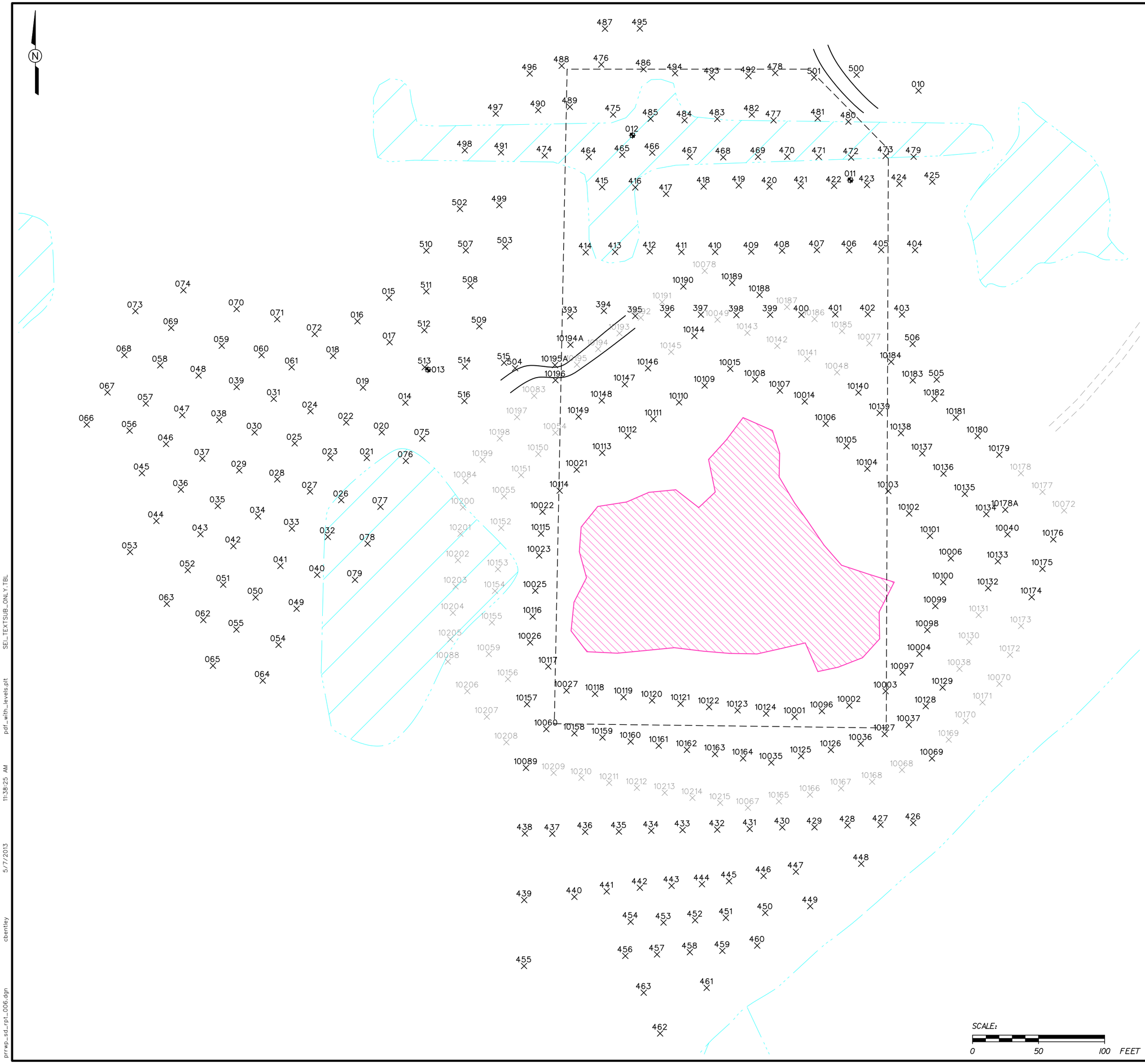

LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- TEST PIT AND/OR SOIL BORING LOCATION
- STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 4)
- SOIL BERMS

NOTES:

1. LOCATION OF TEST PIT 10194A IS APPROXIMATE.
2. SAMPLES COLLECTED WITHIN THE THREE CONCENTRIC RINGS ENCIRCLING THE EXCAVATION WERE FROM TEST PITS. OTHER SAMPLES WERE COLLECTED FROM SOIL BORINGS.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.

FIGURE 3-1
SAMPLING LOCATIONS

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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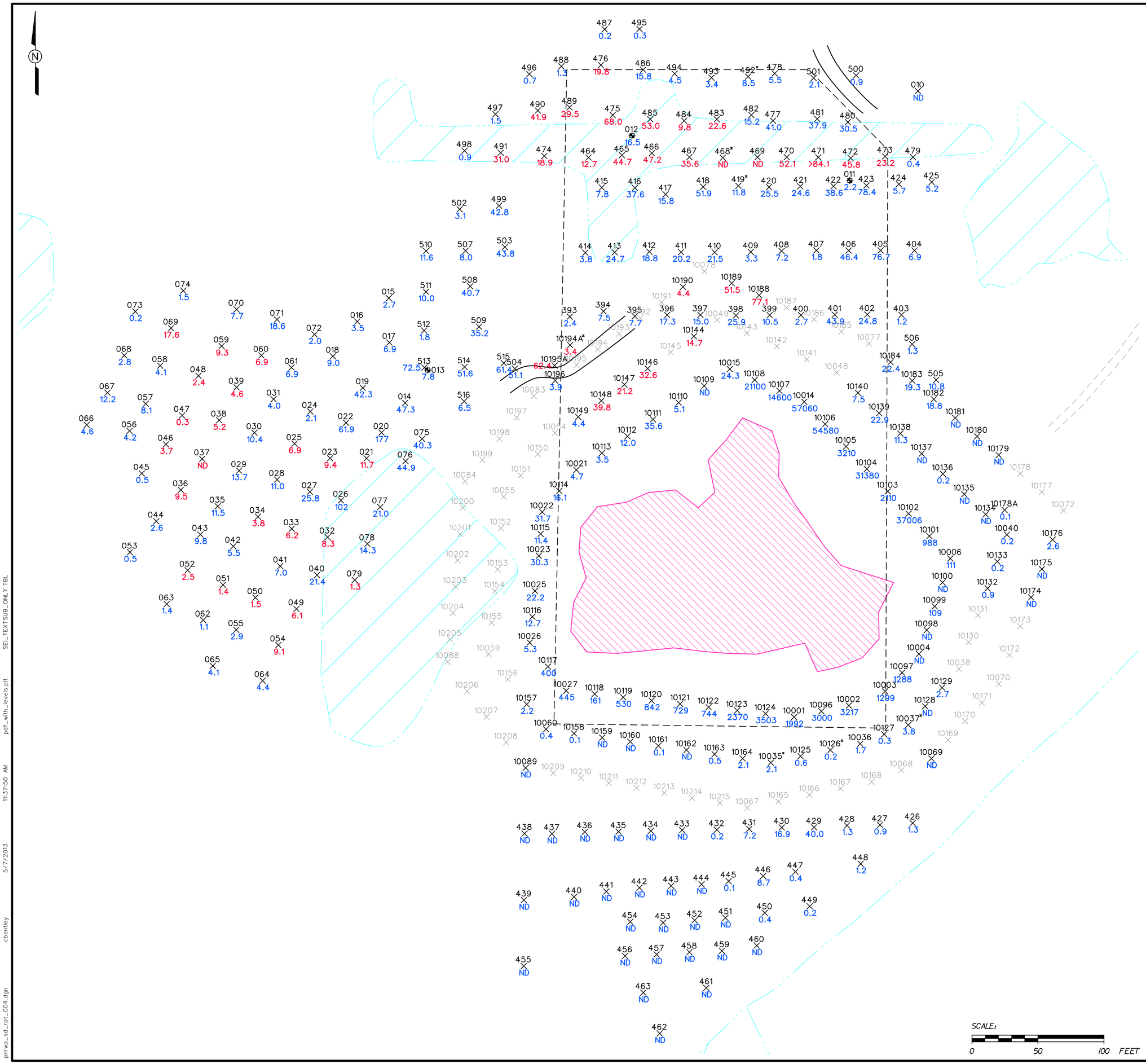

LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- TEST PIT AND/OR SOIL BORING LOCATION
- STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 2)
- 23.2 ANALYTICAL RESULT FOR TOTAL NITROAROMATICS - SCREENING DATA (mg/kg)
- 30.5 ANALYTICAL RESULT FOR TOTAL NITROAROMATICS - LAB DATA (mg/kg)
- ND NON-DETECT
- SOIL BERMS

NOTES:

1. LOCATION OF TEST PIT 10194A IS APPROXIMATE.
2. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. SAMPLE 471 RESULT (>84.1 mg/kg) INDICATES THAT THE RESULT EXCEEDED THE CALIBRATION OF THE FIELD SCREENING KIT AFTER ONE DILUTION.
5. ASTERISKS INDICATE THAT THE FOLLOWING WERE FOUND AT THE ASSOCIATED TEST PITS:
   - 4-INCH CLAY DRAIN TILE PIPE (419, 468, 492, 10035, AND 10126)
   - 4-INCH PLASTIC CORRUGATED PIPE (492)
   - 8-INCH CLAY PIPE (10194A)
   - 12-INCH WOOD-STAVE PIPE (10037)

FIGURE 5-1
TOTAL NITROAROMATICS IN SOIL SAMPLES

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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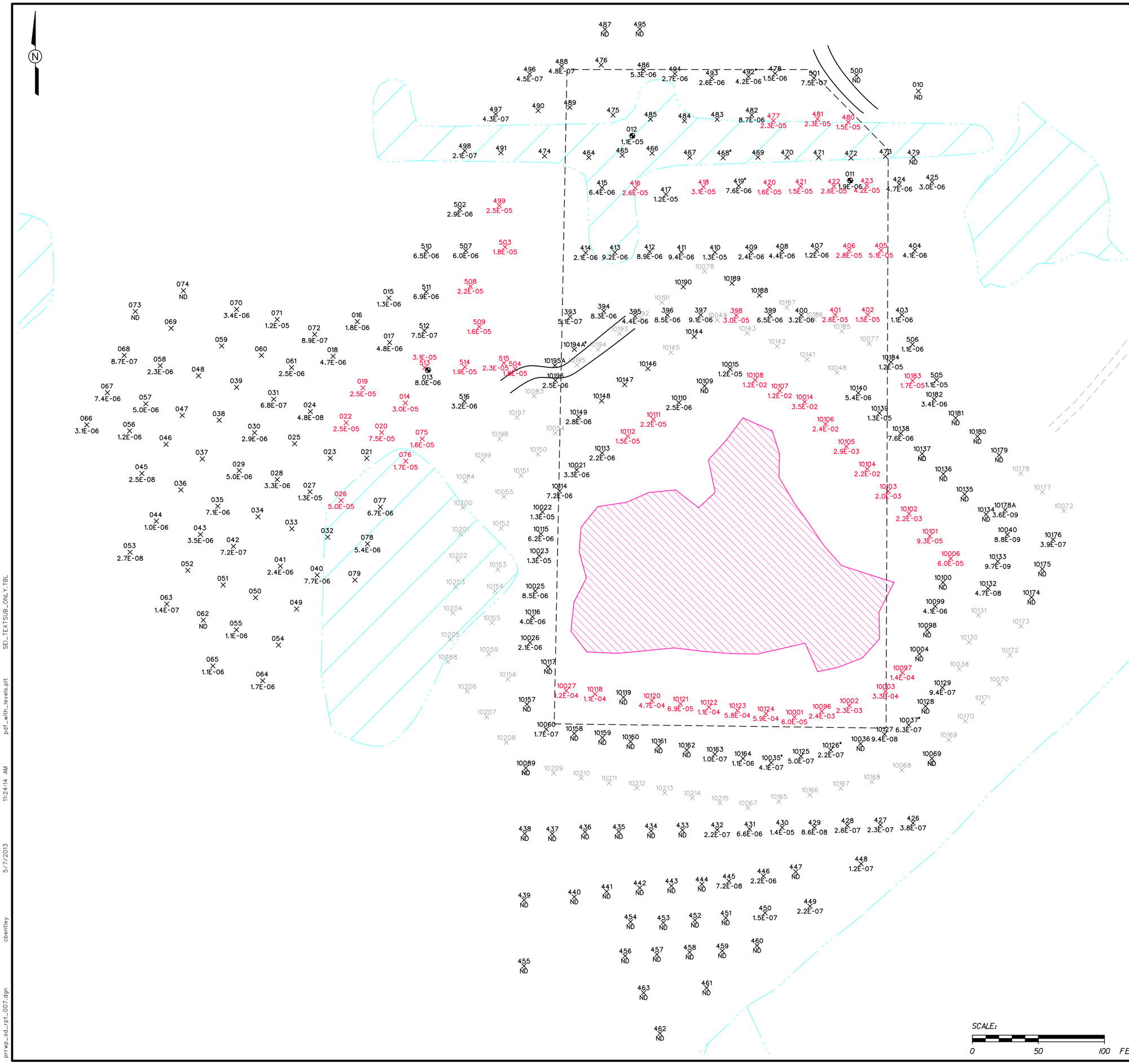

LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- 419 × 7.6E-06 — TEST PIT AND/OR SOIL BORING ID AND ASSOCIATED ILCR VALUE OF ANALYTICAL RESULTS BASED ON A SINGLE TEST PIT AND/OR SOIL BORING LOCATION (BLACK RESULTS, SEE NOTE 4)
- 10108 × 1.2E-02 — TEST PIT AND/OR SOIL BORING ID AND ASSOCIATED ILCR VALUE OF ANALYTICAL RESULTS BASED ON A SINGLE TEST PIT AND/OR SOIL BORING LOCATION (RED RESULTS, SEE NOTE 5)
- × — SAMPLING LOCATION (WITHOUT ILCR VALUE) ANALYZED USING FIELD SCREENING ONLY (SEE NOTE 6)
- × — STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 2)
- ND — NON-DETECT FOR CARCINOGENIC NITROAROMATICS
- SOIL BERMS

NOTES:

1. LOCATION OF TEST PIT 10194A IS APPROXIMATE.
2. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. THE ANALYTICAL RESULTS OF SAMPLES FROM LOCATIONS SHOWN IN BLACK DID NOT EXCEED THE INCREMENTAL LIFETIME CANCER RISK (ILCR) GOAL OF 1E-5 (ROUNDED TO ONE SIGNIFICANT FIGURE), BASED ON RESIDENTIAL USE.
5. THE ANALYTICAL RESULTS OF SAMPLES FROM LOCATIONS SHOWN IN RED EXCEED THE ILCR GOAL OF 1E-5, BASED ON RESIDENTIAL USE.
6. IT IS NOT APPROPRIATE TO CALCULATE ILCR VALUES BASED ON SCREENING DATA ONLY.
7. ASTERISKS INDICATE THAT THE FOLLOWING WERE FOUND AT THE ASSOCIATED TEST PITS:
   - 4-INCH CLAY DRAIN TILE PIPE (419, 468, 492, 10035, AND 10126)
   - 4-INCH PLASTIC CORRUGATED PIPE (492)
   - 8-INCH CLAY PIPE (10194A)
   - 12-INCH WOOD-STAVE PIPE (10037)

FIGURE 5-2
INCREMENTAL LIFETIME CANCER RISK RESULTS FOR SOIL SAMPLES

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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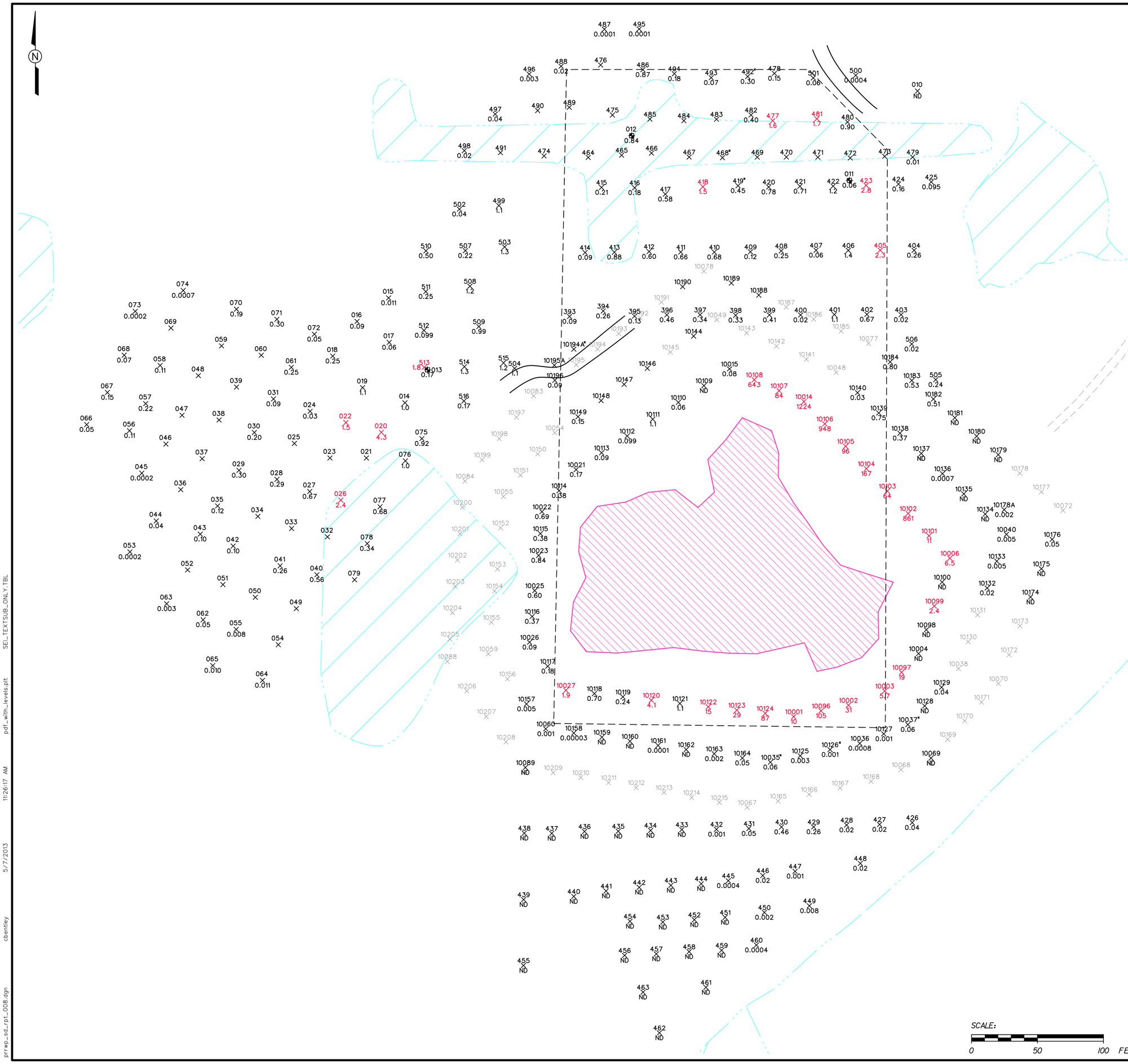

LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- 419 × 0.45 — TEST PIT AND/OR SOIL BORING ID AND ASSOCIATED HI VALUE OF ANALYTICAL RESULTS BASED ON A SINGLE TEST PIT AND/OR SOIL BORING LOCATION (BLACK RESULTS, SEE NOTE 4)
- 10108 × 643 — TEST PIT AND/OR SOIL BORING ID AND ASSOCIATED HI VALUE OF ANALYTICAL RESULTS BASED ON A SINGLE TEST PIT AND/OR SOIL BORING LOCATION (RED RESULTS, SEE NOTE 5)
- × — SAMPLING LOCATION (WITHOUT HI VALUE) ANALYZED USING FIELD SCREENING ONLY (SEE NOTE 6)
- × — STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 2)
- ND — NON-DETECT FOR NONCARCINOGENIC NITROAROMATICS
- SOIL BERMS

NOTES:

1. LOCATION OF TEST PIT 10194A IS APPROXIMATE.
2. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. THE ANALYTICAL RESULTS OF SAMPLES FROM LOCATIONS SHOWN IN BLACK DID NOT EXCEED THE HAZARD INDEX (HI) CRITERION OF 1 (ROUNDED TO ONE SIGNIFICANT FIGURE), BASED ON RESIDENTIAL USE.
5. THE ANALYTICAL RESULTS OF SAMPLES FROM LOCATIONS SHOWN IN RED EXCEED THE HI CRITERION OF 1, BASED ON RESIDENTIAL USE.
6. IT IS NOT APPROPRIATE TO CALCULATE HI VALUES BASED ON SCREENING DATA ONLY.
7. ASTERISKS INDICATE THAT THE FOLLOWING WERE FOUND AT THE ASSOCIATED TEST PITS:
   - 4-INCH CLAY DRAIN TILE PIPE (419, 468, 492, 10035, AND 10126)
   - 4-INCH PLASTIC CORRUGATED PIPE (492)
   - 8-INCH CLAY PIPE (10194A)
   - 12-INCH WOOD-STAVE PIPE (10037)

FIGURE 5-3
NONCANCER HAZARD INDEX RESULTS FOR SOIL SAMPLES

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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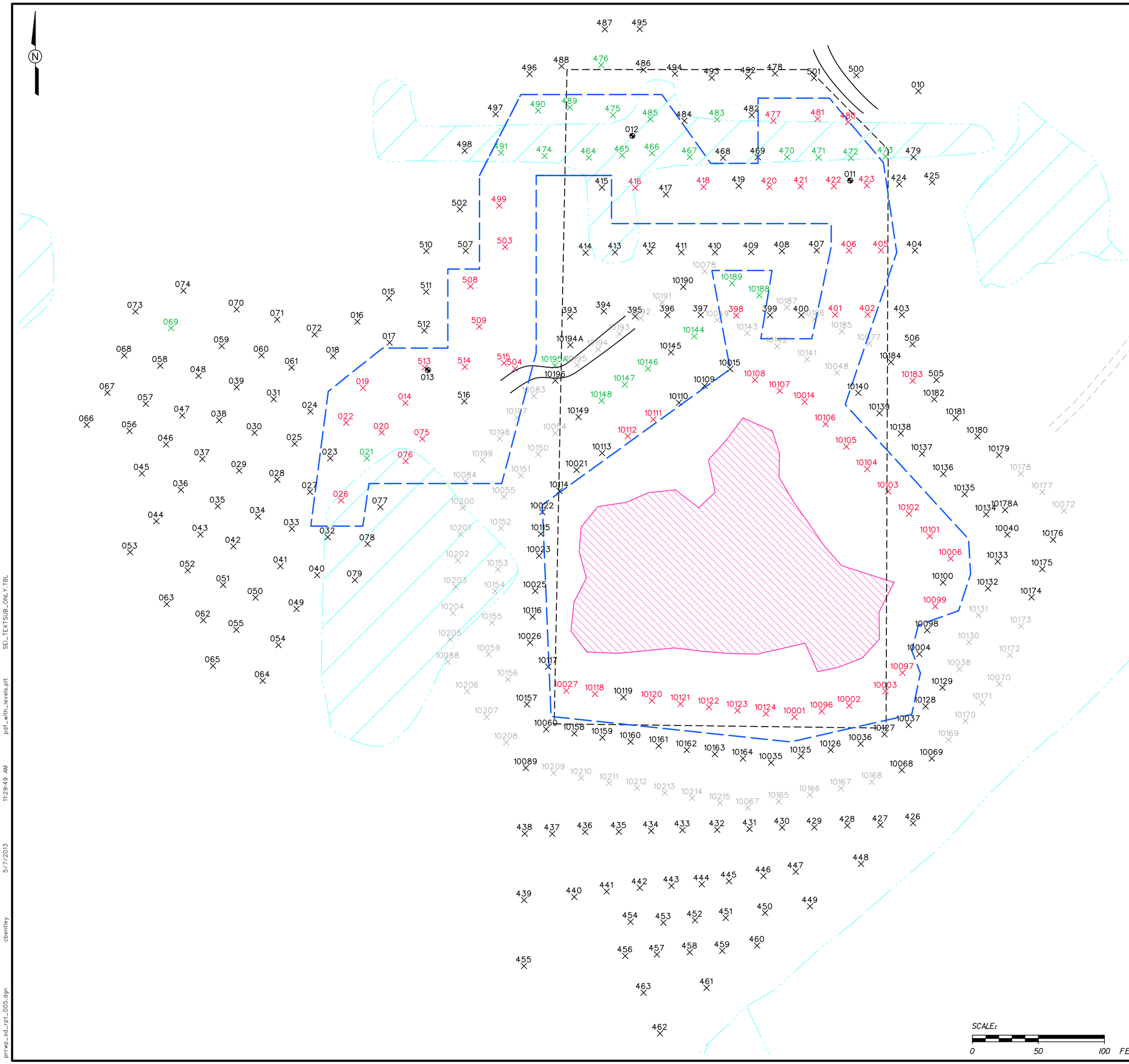

LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 2)
- SAMPLE LOCATION THAT DID NOT EXCEED RISK, HAZARD, OR TOTAL NITROAROMATICS CRITERIA (SEE NOTES 4 AND 5)
- SAMPLE LOCATION THAT EXCEEDS THE RESIDENTIAL CANCER RISK GOAL (ILCR >1E-5) AND/OR THE NONCANCER HAZARD GOAL (SEE NOTE 4)
- ONLY SCREENING DATA WERE COLLECTED AND THE TOTAL NITROAROMATICS CONCENTRATION EXCEEDS 10 mg/kg (SEE NOTE 5)
- SOIL BERMS
- ESTIMATED EXTENT OF SOIL CONTAMINATION

NOTES:

1. LOCATION OF SAMPLE 10194A IS APPROXIMATE.
2. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. THE PBOW GOAL FOR INCREMENTAL LIFETIME CANCER RISK (ILCR) IS ≤1E-5 AND THE HAZARD INDEX (HI) IS ≤1. PLEASE REFERENCE FIGURES 5-2 AND 5-3 FOR THE SAMPLE-SPECIFIC ILCR AND HI VALUES
5. BASED ON COMPARISON OF SCREENING DATA TO ILCR AND HI VALUES ASSOCIATED WITH LAB DATA FROM THE SAME LOCATION, CONCENTRATIONS GREATER THAN 10 MILLIGRAMS PER KILOGRAM (mg/kg) WERE IDENTIFIED AS MORE LIKELY TO HAVE ELEVATED RISKS/ HAZARDS. THIS 10 mg/kg VALUE IS NOT REGARDED AS A "BRIGHT LINE" CRITERION, BUT IS A GENERAL OBSERVATION.
6. TEST KIT RESULTS FOR TOTAL NITROAROMATICS CONCENTRATIONS ARE PRESENTED ON FIGURE 5-1.

FIGURE 6-1
ESTIMATED EXTENT OF SOIL CONTAMINATION

PENTOLITE ROAD RED WATER POND AREA
SITE DELINEATION REPORT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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APPENDIX A

SOIL BORING LOGS, TEST PIT LOGS, AND SAMPLE COLLECTION LOGS

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 464
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625229.8	Easting 1919226.7
Date Started 7/21/09	Date Completed 7/21/09	Surface Elevation NA	
Total Depth of Excavation 7.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered ~6.0'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Ground Surface

0 — Light brn. silty clay, med. stiff.

1.8' — V. dark brown silty clay, moist, medium stiff. 0815 Sample

3.8' — Dark yellowish brown mottled gray clay, moist, medium stiff

6.0' ▽ REDWATER.

7.0' TD

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 46S
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625231.5	Easting 1919251.9
Date Started 7/21/09	Date Completed 7/21/09	Surface Elevation NA	
Total Depth of Excavation 8.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 4.0'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Samples
0	Light brown, silty clay, medium stiff	
1.2'	Very dark brown, silty clay, moist, medium stiff	0850 Sample
2.8'	Dark brown silty clay, moist, medium stiff	
4.0'	▽ Perched red water	
8.0'	TD	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 466
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625233.1	Easting 1919274.6
Date Started 7/21/09	Date Completed 7/21/09	Surface Elevation NA	
Total Depth of Excavation 7.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.0'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0 — light brown, silty clay, moist, medi stiff

1.4' — Very dark brown silty clay, moist, medium stiff

0900 Sample

3.0' — Brown silty clay, moist, medium stiff

5.0' — ▽ Red water

TD 7.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 467
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625-230.1	Easting 1919303.1
Date Started 7/21/09	Date Completed 7/21/09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.2'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0

Light brown silty clay, moist med. stiff

2.0'

Black silty clay, moist, med. stiff — 0915 Sampled.

3.0'

Yellowish brown, silty clay, moist, med stiff

6.2' ▽ Perched H2O

8.0'

Brown silty clay, moist, med stiff.

9.5'

Gray silty clay, moist, med. stiff

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 468
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625299.6	Easting 1919328.4
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 4.3'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 4.0'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0

1.0' — light brown silty clay, moist, stiff

0930 Sampled

2.0' —

Dk. brown silty clay, moist, med stiff

3.0'

4.0' — 4" Clay Pipe contains redwater

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 469
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625230.0	Easting 1919354.7
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening) X	Nitroaraomatics (confirmation)	Other NA

1.0	Light brown silty clay, moist, med stiff	
2.0	Black silty clay, moist, med stiff	0945 Sampled
3.0		
3.5'		
4.0		
5.0	Brown silty clay moist, med stiff	H_2O slowly seeps into pit near base.
6.0		
7.0		
7.5'		
8.0	Brown, mottled gray silty clay, moist, med stiff	
9.0		
9.5'	Gray silty clay, moist, med stiff	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 470
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625230.1	Easting 1919376.8
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 7.5'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Samples
0.0 – 1.0'	Light brown silty clay, moist, mod stiff.	Sampled 0955
1.0' – 2.0'	Black silty clay, moist, mod stiff	
2.0' – 7.5'	Brown silty clay, mod stiff, moist	
5.0'	▽ Red water seeping into pit	
7.5'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 471
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625230.0	Easting 1919400.6
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 7.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 4.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	
0' – 1.0'	Light brown silty clay, moist, med stiff.	1005 Sampled
1.0' – 2.6'	Black silty clay, moist, med stiff	
2.6' – 3.0'	Brown silty clay moist, med stiff	
3.0' – 4.0'	Redwater seeping into pit	
4.0' – 7.0'	Same as above	

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 472
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625229.4	Easting 1919425.2
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.3'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
0.0' – 1.3'	Light brown silty clay, moist, med stiff	Sampled 1015
1.3' – 2.5'	Black silty clay, moist, med stiff	
2.5' – 6.3'	Brown silty clay, moist, med stiff	
6.3'	Red water seeping into hole	
6.3' – 7.5'	Same as above	
7.5' – 9.0'	Brown mottled gray silty clay, moist, med stiff	
9.0' – 10.0'	Gray silty clay, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 473
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625230.7	Easting 1919451.3
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Samples
0.0		
1.0'	Light brown silty clay, moist, med stiff	Sampled 1030
2.0'		
3.0'		
4.0'		
5.0'	▽ Red water seeping into hole	
6.0'		
7.0'	Brown mottled gray silty clay, moist, med stiff	
8.0'		
9.0'	Gray silty clay, moist, med stiff	
10.0'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10190
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625132.0	Easting 1919298.2
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 8.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
~~10.0' TMB~~	X		NA

0.0

1.0' Dark brown silty clay with organics (roots), moist, med stiff — Sampled 1120

2.0'

3.0' Black silty clay, moist, med stiff

4.0'

5.0'

6.0' Dark yellowish brown, silty clay, moist, med stiff

7.0'

8.0'

8.5' ▼ Redwater seeping into pit

9.0' Same as above.

10.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10189
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625134.6	Easting 1919335.1
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Samples
0.0' – 1.0'	Light brown silty CLAY, moist, medium stiff with organics, roots	
1.0' – 1.5'		
1.5' – 3.0'	Black silty CLAY with very fine grained sand, moist, med stiff	Sampled 1135
3.0' – 4.0'		
4.0' – 6.0'	Dark brown silty CLAY, moist, med stiff	
6.0' – 7.5'		
7.5'	▽ Red water seeping into pit	
7.5' – 8.0'		
8.0' – 9.5'	Brown mottled gray silty CLAY moist, med stiff	
9.5' – 10.0'	Gray silty CLAY, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10188
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625125.5	Easting 1919355.9
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0

1.0' Yellowish brown silty CLAY with very fine sand, moist, med stiff

2.0'

3.0' Black silty CLAY, moist, med stiff

4.0'

5.0' Brown silty clay, moist, med stiff

6.0'

7.0'

7.5' ▽ Red water seeping into pit

8.0'

Brown mottled gray silty CLAY, moist, med stiff

9.0'

9.5'

10.0 Gray silty CLAY, moist, med stiff

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville		Hole Number: 10140
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc		Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond		
Project No. 132458				
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi		
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625051.7	Easting 1919430.7	
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA		
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 8.5'	Logged by: E. Weaver	
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other	
	X		NA	

0.0'

Light yellowish brown very fine grained sand with silt, moist, loose. Roots noted 0-1'

Sampled 1410

1.0'

2.0'

3.0'

4.5'

4.0'

Black silty clay, moist, med stiff

5.0'

6.0'

7.0'

Brown mottled gray CLAY, moist, med stiff

8.0'

Redwater seeping into pit

9.0'

9.5'

Gray silty clay moist, med stiff

10.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10139
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 6250363	Easting 1919446.8
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 8.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0'

1.0' – 2.0' – 3.0' – 4.5'

Light yellowish brown very fine grained sand with silt, moist, loose.

Sampled 1420

4.0' – 5.0' – 6.0'

Black silty CLAY, moist, med stiff.

7.0' – 8.0' – 8.5' – 9.0' – 10.0'

Brown silty clay with very fine grained sand, moist, soft

Redwater seeping into pit

Brown, mottled gray silty CLAY, med stiff

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10138
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625620.9	Easting 1919462.9
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0'

1.0' – Light yellowish brown very fine grained sand with silt, moist, loose. Sampled 1430

2.0'

3.0'

4.0' – Black silty clay, moist, medium stiff

5.0'

6.0'

7.0'

7.5' – ▽ Red water seeping into pit

8.0' – Brown mottled gray silty CLAY, wet, med stiff

9.0'

9.5' – Gray silty CLAY, med stiff

10.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville		Hole Number: 10136
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc		Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond		
Project No. 132458				
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi		
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624990.3	Easting 1919495.1	
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA		
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver	
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other NA	

Depth	Description	Samples
0.0		
1.0'	Brown silty CLAY with very fine grained sand, moist, med stiff	Sampled 1440
2.0'		
2.5'		
3.0'	Brown mottled gray CLAY with silty med stiff	
4.0'		
5.0'		
6.0'		
7.0'		
8.0'		
8.5'		
9.0'	Gray silty clay	
10.0'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 16135
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624975.0	Easting 1919511.2
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0

1.0' Light brown fine grained SAND with silt, moist, loose

2.0'

Yellowish brown fine grained SAND with silty, moist, loose

3.0'

3.5'

4.0' Brown mottle gray silty CLAY, moist, med stiff

5.0'

6.0'

7.0'

7.5'

8.0' Gray, silty CLAY, moist, med stiff.

9.0'

10.0'

Sampled 1500

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10134
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624959.7	Easting 1919527.4
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0' Light brown silty CLAY, moist, soft

1.0' Yellowish brown very fine grained SAND with silt, moist, loose.

2.0'

3.0'

4.0' Brown mottled gray silty CLAY, moist, med stiff.

5.0'

6.0'

7.0' Gray silty CLAY, moist, med stiff

8.0'

9.0'

10.0'

Sampled 15-10

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10184
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625074.9	Easting 1919455.4
Date Started 7-21-09	Date Completed 7-21-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 8.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0' – Yellowish brown very fine grained sand with silt, moist, loose — Sampled 1525

2.0'

3.0'

4.0'

4.5' — Black silty clay, moist, med stiff

5.0'

5.5'

6.0' — Brown mottled gray silty CLAY, moist, med stiff

7.0'

8.0' — Redwater seeping into pit

9.0'

10.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 478
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625293.4	Easting 1919367.7
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered ~~NA~~ 6.0'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	
1.0'	Brown silty CLAY, with organics (roots, plants) moist, med stiff	0810 Sampled
2.0'	Black silty CLAY, moist, med stiff	
3.0'	Yellowish brown-mottled gray silty CLAY, moist, med stiff.	
4.0'		
5.0'		
6.0'	▽ Orangish H20 seeping into pit	
7.0'		
8.0'		
9.0'		
10.0'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 477
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625 2376	Easting 1919 366.4
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Light brown silty CLAY, moist, med stiff, noted organics (roots, weeds)	Sampled 0840
1.5		
2.0	Black silty CLAY, moist, med stiff	
2.5		
3.0	Yellowish brown, silty CLAY, moist, med stiff	
4.0		
5.0	Yellowish brown mottled gray silty CLAY, moist, med stiff	
6.0	▽ Redwater seeping into pit	
7.0		
8.0		
9.0		
9.5		
10.0	Gray silty CLAY, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 476
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625299.8	Easting 1919236.0
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.0'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	✓		NA

Depth	Description	Sample
0.0	Light brown silty CLAY, moist, med stiff with roots, weeds	
1.0'	Brown silty CLAY, moist, med stiff	Sampled 0905
2.0'		
3.0'	Yellowish brown silty CLAY, with gray moist, med stiff	
4.0'		
5.0'	Red water seeping into pit Sidewalls caving	
6.0'	Same as above	
7.0'		
8.0'	Gray silty CLAY, moist, med stiff	
9.0'		
10.0'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 474
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625230.95	Easting 1919193.20
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	✓		NA

Depth	Description	Sampled
1.0	Light brown SAND with silt, dry, loose.	Sampled 0940
1.3'		
2.0	Black silty CLAY, moist, med stiff	
3.0		
4.0	Yellowish brown with gray SILT and SAND, moist, med dense.	
5.0		
5.5'	Redwater seeping into pit, sidewalls collapsing	
6.0	Same as above	
7.0		
8.0		
8.5		
9.0	Gray SILT, moist, med stiff	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 475
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625261.94	Easting 1919245.0
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.0	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0 Light brown SILT with sand, moist, med stiff

1.0

1.5'

2.0 Dark brown with black silty CLAY, moist, med stiff

3.0

4.0 Yellowish brown with gray silty CLAY moist, med stiff

5.0 Red-orange H2O seeping into pit

Same As above

6.0

7.0

7.5'

8.0 Yellowish brown mottled gray silty CLAY, moist, med stiff

9.0

10.0

Sampled 1025

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10144
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625094.45	Easting 1919306.51
Date Started	Date Completed	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0 Brown very fine SAND with silt, moist, med dense.

1.0' Black CLAY with silt, moist, med stiff

2.0' Brown very fine SAND with silt, moist, med. dense.

3.0'

3.5' Black CLAY with silt, moist, med stiff.

4.0

5.0

5.5' Redwater seeping into pit.

6.0' Yellowish brown-gray CLAY, moist, med stiff

7.0

8.0'

9.0'

10.0

Sampled 1115

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10146
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625076.1	Easting 1919271.5
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 8.5'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
			NA

Depth	Description	Sample
1.0	Brown very fine grained SAND, with silt, moist, med dense	Sampled 1140
2.0		
3.0	Black silty CLAY, moist and stiff	
4.0		
4.5'		
5.0	Yellowish brown mottled gray silty CLAY, moist, med stiff	
6.0		
7.0		
8.0		
8.5'	▼ Red water seeping into pit	
9.0		
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10147
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625057.96	Easting 1919253.85
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0' — Light brown w. fine grained ~~sa~~ SAND with s. lt, moist, med dense — Sampled 1330

2.0'

2.7'

3.0' — Black s. lty CLAY, moist, med stiff

4.0'

5.0' — Yellowish brown mottled gray s. lty CLAY, med stiff

6.0'

7.0' — ▽ Red water seeping into excavation

8.0'

9.0'

10.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10148
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625645.67	Easting 1919236.42
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 7.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5'	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
1.0	Light brown very fine SAND w/silt, moist, med dense	
1.6'		
2.0	Black silty CLAY, moist, med. stiff	1355
3.0		
4.0	Yellowish brown mottled gray silty CLAY, moist, med stiff.	
5.0		
5.5'	Redwater seeping into pit	
6.0		
7.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10149
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625033.45	Easting 1919218.91
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 8.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
	Light brown very fine grained SAND w/silt, moist, med dense.	
1.0'		Sampled 1405
	Black silty CLAY, moist, med stiff	
2.0'		
3.0'		
	Yellowish brown mottled gray silty CLAY with very fine grained SAND, moist, med stiff	
4.0'		
5.0'		
5.5'	▽ Redwater flowing into pit.	
6.0'		
7.0'		
	TD @ 8.0'	
8.0'		
9.0'		
10.0'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 480
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625256.61	Easting 1919423.10
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.0'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening) X	Nitroaraomatics (confirmation)	Other NA

Depth	Description	Sample
	Dark brown silty CLAY, moist, med stiff	
1.0		Sampled 1445
	Yellowish brown with gray SILT, trace clay, moist med. dense	
2.0		
3.0		
4.0		
5.0	Redwater seeping into pit	
	Same as above	
6.0		
7.0		
8.0		
9.0	Gray silty, moist, med dense	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville		Hole Number: 479
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc		Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond		
Project No. 132458				
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi		
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625230.06	Easting 1919472.47	
Date Started 7-22-09	Date Completed 7-22-09	Surface Elevation NA		
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.0'	Logged by: E. Weaver	
Samples for Chemical Analysis	Nitroaromatics (field screening) X	Nitroaraomatics (confirmation)	Other NA	

1.0 — Yellowish brown with gray SILT, moist, med. stiff — Sampled 1600

2.0

3.0

4.0

5.0 — ▽ Redwater seeping into pit

6.0 — Same as above.

7.0

8.0

Gray SILT, moist, med. stiff

9.0

10.0

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 487
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625326.9	Easting 1919238.9
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	✓		NA

Depth	Description	Samples
1.0	Dark brown silty CLAY, moist, med stiff	
2.0'	Yellowish brown CLAY, moist, med stiff	Sampled 0800
3.0'		
4.0	Yellowish brown with gray SILT, moist, med stiff	
5.0		
6.0	Red water seeps into pit	
7.0		
8.0	Gray w/ yellowish brown SILT, moist, med stiff	
9.0		
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 486
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625296.24	Easting 1919268.04
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0 Brown silty CLAY, noted roots, moist, med. stiff

1.0' Yellowish brown silty CLAY, moist, med stiff — Sampled 0835

2.0'

Brown silty clay CLAY, moist, med stiff

3.0'

3.5'

4.0' Yellowish brown w/gray SILT, moist, med stiff

5.0'

5.5' Redwater seeping into pit.

6.0' Same as above.

7.0'

8.0' Gray with yellowish brown SILT, moist, med stiff

9.0'

10.0'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 488
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625298.85	Easting 1919206.08
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0

Brown very fine SAND w/silt, moist, med dense

1.0

2.0

Yellowish brown fine SAND w/silt, moist, med. dense

Sampled 0906

3.0

3.5

4.0

Yellowish brown with gray SILT w/ very fine sand

5.0

5.5 Redwater seep into pit

6.0

Same as above

7.0

8.0

Gray with yellowish brown SILT, moist, med stiff

9.0

9.5

Gray SILT, moist, med stiff

10.0

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 490
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625265.35	Easting 1919188.32
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
	Light brown silty CLAY, moist, med. stiff	
1.0		
1.5		0944
2.0	Yellowish brown silty CLAY, with very fine sand, moist, med stiff	
3.0		
3.5		
4.0	Yellowish brown very fine grained SAND, moist, med dense.	
5.0		
5.5	▽ Redwater seeping into pit	
6.0	Same as above	
7.0		
8.0		
	Gray with yellowish brow SILT, moist, stiff	
9.0		
9.5	Gray SILT, moist, med stiff	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 489
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625267.74	Easting 1919212.31
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
0.0 – 1.0	Light brown silty CLAY with very fine sand, moist, med. stiff	
1.0 – 1.5		
1.5 – 3.0	Brown silty CLAY, moist, med stiff	Sampled 1005
3.0 – 6.5	Yellowish brown silty CLAY, moist, med stiff	
6.5 – 8.0	Yellowish brown with gray SILT, moist, med stiff	
8.0 – 9.5	Gray with yellowish brow SILT, moist, med stiff	
9.5 – 10.0	Gray SILT, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 491
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625233.44	Easting 1919160.17
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.5	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Light brown very fine SAND, dry, loose	
1.7		
2.0	Yellowish brown with gray SILT, w/clay, moist, med stiff	Sampled 1030
3.0		
4.0		
5.0		
6.0	▽ Water seeping into hole	
7.0	Gray with yellowish brown SILT, moist, med stiff	
8.0		
8.5		
9.0	Gray SILT, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 485
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625258.78	Easting 1919273.41
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 8.0	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description
	Light brown very fine grained SAND, moist, loose.
1.0	Yellowish brown very fine grained SAND, w/silt, moist, med stiff
2.0	Black silty CLAY, moist, med stiff
3.0	Yellowish brown with gray SILT, moist, med stiff
4.0	
5.0	
6.0	
7.0	
8.0	Redwater seeping into hole
8.5	
9.0	Gray with yellowish brown SILT, moist, med stiff

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 484
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625 257.63	Easting 1919299.13
Date Started 7-23-09	Date Completed	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
1.0	Yellowish brown with fine grained SAND, with silt, moist, med dense	11 30
1.5		
2.0	Black silty CLAY, moist, med stiff	
3.0		
4.0	Yellowish brown with gray SILT, trace very fine grained Sand, moist, med stiff	
5.0		
5.5	Red water seeping into pit	
6.0	Same as above	
7.0		
8.0		
8.5		
9.0	Gray SILT, moist, med stiff w/yellowish brown	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 483
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625258.71	Easting 1919323.85
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Light brown very fine SAND, w/silt, moist, med dense	
1.5		Sampled 1155
2.0	Black silty CLAY, moist, med stiff	
3.0		
4.0	Yellowish brown with gray SILT, trace clay moist med stiff	
5.0		
6.0	▽ Redwater seeping into pit	
7.0	Same as above	
8.0		
9.0	Gray SILT, moist, med stiff with yellowish brown	

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10176
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624940.54	Easting 1919578.16
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
	Brown silty CLAY, moist, med stiff	
1.0		
	Black silty CLAY, moist, med stiff (noted roots)	Sample 1350
2.0		
	Yellowish brown very fine SAND moist, med dense (noted roots)	
3.0		
4.0		
5.0	Sidewalls caving	
6.0		
7.0		
8.0		
9.0	Gray SILT, moist, med stiff	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10175
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624918.32	Easting 1919570.00
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0 –
2.0 – Yellowish brown very fine SAND, moist and dense — Sampled 1415
3.0 –
4.0 –
5.0 –
6.0 –
7.0 – ▽ Water seeping into pit
8.0 – Gray SILT with very fine sand, moist, med dense
9.0 –

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG

		District: USACE Nashville	Hole Number: 10174
Company Name	Shaw E&I	Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project	Plum Brook Ordnance Works - Sandusky, Ohio	Location	Pentolite Road Redwater Pond
Project No.	132458		
Name of Operator	James Mills	Manufacturer's Designation of Excavator	Takeuchi
Sizes and Types of Excavating and Sampling Equipment	Takeuchi 145	Northing 625896.91	Easting 1919561.82
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0 – Yellowish brown very fine SAND, moist, med dense

2.0 –

Sampled 1440

3.0 –

4.0 –

5.0 –

6.6 – ∇ Water seeping into pit

6.5 –

7.0 – Gray SILT with fine SAND, moist, med dense

8.0 –

9.0 –

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10184
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 6250744.94	Easting 1919455.41
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0 –
Yellowish brown fine SAND, moist, med dense
2.0 – Sampled 1510
3.0 –
4.0 –
5.0 –
6.0 –
6.5 – ▽ Water seeping into pit
7.0 – Gray SILT with fine SAND, moist, med stiff
8.0 –
9.0 –

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10195A
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625072.46	Easting 1919201.00
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0 Yellowish brown very fine SAND, moist, med dense

1.0

1.7' Black silty CLAY, moist, med stiff

2.0

2.7' Yellowish brown with gray SILT, moist, med stiff

3.0

4.0

5.0

6.0

7.0

8.0

8.5' Gray SILT, moist, med stiff with yellowish brown

9.0

Sampled 15-50

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10194A
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625084.58	Easting 1919233.72
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Samples
1.0	Yellowish brown very fine SAND, moist, med dense. H.t 12" clay pipe @ ~~1.6~~ 1.6'	Sampled 1615
1.6		
2.0	Black Silty CLAY, moist, med stiff	
2.6		
3.0	Yellowish brown with gray SILT, moist, med stiff	
4.0		
5.0		
6.0		
7.0	Water seeping into pit	
8.0		
9.0		
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10035
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624771.79	Easting 1919364.71
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
			NA

Depth	Description	Samples
1.0	Yellowish brown SILT with clay, moist, med stiff	
2.0		Sampled 1650
3.0	Yellowish brown with gray SILT, moist, med stiff	
4.0		
5.0		
5.5	Water seeping into pit	
6.0		
7.0		
8.0	Gray with yellowish brown SILT, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10126
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624781.33	Easting 1919409.86
Date Started 7-23-09	Date Completed 7-23-09	Surface Elevation NA	
Total Depth of Excavation 5.5'	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0 – Brown - yellowish brown and black silty CLAY, moist med stiff — Sampled 1705

2.0 –

3.0 –

3.5'

4.0 – Yellow brown with gray SILT, moist, med stiff

5.0 –

5.5'

Hit clay pipe filled with red water @ 5' - 5.2'

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville		Hole Number: 10127
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc		Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond		
Project No. 132458				
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi		
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624793.30	Easting 1919450.58	
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA		
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver	
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other	
	x		NA	

Depth	Description	Samples
	Yellowish brown very fine SAND, moist dense, trace silt (noted roots)	
1.0	Brown - dark brown silty CLAY, moist, med stiff	Sampled 0820
2.0	Yellowish brown with gray SILT, trace very fine SAND, moist, med stiff to stiff	
3.0		
4.0		
5.0		
6.0		
7.0		
8.0	Gray with yellowish brown SILT, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10128
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624814.43	Easting 1919481.61
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0 – 2.0 – 2.5'	Yellowish brown and brown very fine SAND, with clay SILT + GRAVEL moist, med dense to dense	Sampled 0850
3.0 – 4.0 – 5.0	Grey silty CLAY, moist, stiff (noted roots)	
6.0 – 7.0 – 7.5'	Yellowish brown with gray SILT, moist, med stiff	
8.0 – 9.0	Grey with yellowish brown SILT, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville		Hole Number: 10163
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc		Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond		
Project No. 132458				
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi		
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624778.20	Easting 1919322.14	
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA		
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver	
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other	
	X		NA	

1.0 — Very dark brown SAND with silt and clay, moist, med. dense (noted roots — Sampled 0915

2.0 — Yellowish brown with gray SILT, moist, med. stiff

3.0 —

4.0 —

5.0 —

6.0 —

7.0 — Gray with yellowish brown SILT, trace very fine sand and clay, moist, med. stiff

8.0 —

9.0 —

10.0

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10161
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624784.49	Easting 1919279.57
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
	Very dark brown SAND with s. lty + clay, moist, med dense (noted roots)	
1.0		Sample 0945
2.0	Yellowish brown with gray SILT, trace very fine sand, moist, med. stiff	
3.0		
4.0		
5.0		
6.0		
7.0		
8.0	Gray with yellowish brown SILT, trace very fine sand and clay, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10159
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624790.96	Easting 1919237.08
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening) X	Nitroaraomatics (confirmation)	Other NA

Depth	Description	Sample
1.0	Dark brown SAND with silt + clay, med stiff, noted roots	Sample 10.15
1.7'		
2.0	Yellowish brown very fine SAND w/silt, moist, loose.	
2.7'		
3.0	Yellowish brown with gray SILT, moist, med stiff	
4.0		
5.0		
6.0		
7.0		
8.0	Gray with yellowish brown SILT trace very fine sand, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10066
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624797.06	Easting 1919194.45
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 16.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

0.0 — Dark brown SAND with silt & clay, moist, med dense (moted roots

1.0 — Sampled 1050

2.0 — Yellowish brown very fine SAND w/silt, moist, med dense

2.7' —

3.0 — Yellowish brown with gray SILT, moist, med stiff

4.0 —

5.0 —

6.0 —

7.0 —

8.0 —

9.0 — Grey with yellowish brown SILT, trace very fine sand, moist, med stiff

water at bottom of pit

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10158
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624793.90	Easting 1919215.71
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Dark brown SAND with silt and clay, moist, med dense (noted roots)	
1.7		
2.0	Yellowish brown very fine SAND w/silt, moist, med stiff	1120
3.0		
4.0	Yellowish brown with gray SILT, moist, med stiff	
5.0		
6.0		
7.0		
8.0		
9.0	Grey with yellowish brown SILT, trace fine sand, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10166
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624787.66	Easting 1919258.31
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Dark brown fine SAND, with silt and clay, moist, med stiff (noted roots)	Sampled 1145
1.3		
2.0	Yellowish brown very fine SAND, w/silt, moist, med dense	
2.7'		
3.0	Yellowish brown with gray SILT, moist, med stiff	
4.0		
5.0		
6.0		
7.0		
8.0	Gray with yellowish brown SILT, trace very fine Sand, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10162
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624781.38	Easting 1919300.87
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	y		NA

Depth	Description	Sample
	Dark brown fine SAND with silt + clay moist, med stiff	
1.0		Sampled 1216
2.0	Yellowish brown very fine SAND with silt, moist med dense.	
3.0		
3.7		
4.0	Yellowish brown with gray SILT, moist, med stiff	
5.0		
6.0		
7.0		
8.0	Gray with yellowish brown SILT, trace very fine Sand, moist, med stiff.	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10164
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624774.95	Easting 1919343.41
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
1.0	Dark brown SAND with s. H & clay, moist, med dense (noted roots and organics).	
1.7		
2.0	Yellowish brown with gray SILT, moist, med stiff	1410
3.0		
4.0		
5.0		
6.0	▽ Water seeping into pit	
7.0		
8.0		
9.0	Gray with yellowish brown SILT, trace very fine sand, moist, med. stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10125
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624776.66	Easting 1919387.27
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Yellowish brown very fine SAND with silt + clay moist, med dense	
1.5		
2.0	Yellowish brown with gray SILT, moist, med stiff	Sample 1430
3.0		
4.0		
5.0	Water seeping into pit	
5.5		
6.0	Same as above	
7.0		
7.5		
8.0	Gray with yellowish brown SILT, w/clay, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville		Hole Number: 10036
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc		Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond		
Project No. 132458				
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi		
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624786.10	Easting 1919432.43	
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA		
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.5	Logged by: E. Weaver	
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other	
	X		NA	

Depth	Description	Sampled
	Yellowish brown very fine SAND w/silt, moist med dense	
1.0	Black silty CLAY, moist, med stiff	Sampled 1455
2.0	Yellowish brown with gray SILT, moist, med stiff	
3.0		
4.0		
5.0		
6.0	Water seeping into pit	
7.0		
8.0	Gray with yellowish brown SILT, trace very fine SAND, moist, med stiff	
9.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 10037
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 624800.31	Easting 1919468.83
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation NA	
Total Depth of Excavation 8.5'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.0'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
0.0 – 1.5'	Brown fine SAND w/ silt and clay, moist, med stiff	Sampled 1520
1.5' – 8.0	Yellowish brown with gray SILT, moist, med stiff	
7.0	H.I apparent wooden sewer line @ 7.0' bgs, redwater running into excavation	
8.0 – 8.5'	Gray with yellow brown SILT, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 500
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625292.00	Easting 1919429.33
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 7.0	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Brown very fine SAND w/silt, noted roots, moist, med dense	Sampled 1620
2.0	Yellow brownish gray SILT, moist, med. stiff	
3.0		
4.0		
5.0		
6.0		
7.0	H2O seeping into pit	
8.0		
8.5	Gray with yellowish brown SILT, moist, med stiff	
9.0		
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 501
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625296.01	Easting 1919397.16
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Brown fine SAND w/silt, moist, med dense	
		1.2'
2.0	Dark brown to black SILT w/clay, moist, med stiff	
		2.4'
3.0	Yellowish brown SILT, moist, med stiff	Sampled 1645
4.0		
5.0		
6.0	H2O Seeping into pit	
7.0	Same as above	
8.0		
8.5'		
9.0	Gray with yellowish brown SILT, moist, med stiff	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 492
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625291.06	Easting 1919347.51
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

1.0 — Brown fine SAND w/silt, moist, med dense.

2.0 — H.t 4" clay pipe @ 3 ft bgs

Sampled 1700

3.0 — H.t black plastic corrugated pipe @ 3.5' bgs, redwater seeping from pipe

4.0

4.5' — Yellowish brown with gray SILT, moist, med stiff

5.0

6.0

7.0

8.0

8.5 — Gray with yellowish brown SILT

9.0

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by: [signature]

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 493
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625290.21	Easting 1919319.80
Date Started 7-24-09	Date Completed 7-24-09	Surface Elevation	
Total Depth of Excavation 10.0'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 4.5'	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other NA

1.0	Brown fine grained SAND w/silt, moist, med dense
1.3'	
2.0	Black silty CLAY, moist, med stiff
2.3'	
3.0	Yellowish brown with gray SILT, moist, med stiff
4.0	Red water seeping into pit
5.0	
6.0	Same as above
7.0	
8.0	
8.5'	
9.0	Gray with yellow brown SILT, moist, med stiff

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 494
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625293.21	Easting 1919291.88
Date Started 7-27-09	Date Completed 7-27-09	Surface Elevation	
Total Depth of Excavation 9.5'	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
1.0	Brown very fine SAND w/silt, trace clay, moist, med dense.	Sampled 0830
2.0	Black silty CLAY, moist, med stiff	
3.0	Yellowish brown with gray SILT, trace clay, moist, med stiff	
4.0		
5.0		
6.0	▽ Water entering pit	
7.0	Same as above	
8.0	Gray with yellow brown SILT, moist, med stiff	
9.0		
9.5'		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 495
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625327.07	Easting 1919265.27
Date Started 7-27-09	Date Completed 7-27-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 5.5	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Dark brown silty SAND, moist, mod dense	Sampled 0850
1.3	Yellowish brown very fine SAND moist, mod. dense	
2.0		
2.7	Yellowish brown with gray SILT, moist, med stiff	
3.0		
4.0		
5.0	Water entering pit	
6.0		
7.0	Gray yellowish brown SILT, moist, med stiff	
8.0		
9.0		
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio
Penotlite Road Redwater Pond Delineation

Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 496
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625292.98	Easting 1919181.91
Date Started 7-27-09	Date Completed 7-27-09	Surface Elevation	
Total Depth of Excavation 10.00	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver
Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
1.0	Brown very fine SAND, w/s. lt, moist, mod dense	Sampled 0910
1.3		
2.0	Yellowish brown very fine SAND w/s. lt, moist, mod dense	
3.0		
3.5		
4.0	Yellowish brown with gray SILT, trace clay, moist, med stiff	
5.0		
6.0		
6.5		
7.0	Gray with yellowish brown SILT, tr. clay, moist, med stiff	
8.0		
9.0		
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 497
Company Name Shaw E&I		Excavation Subcontract MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625262.63	Easting 1919156.20
Date Started 7-27-09	Date Completed 7-27-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
1.0 – 3.2	Yellowish brown and brown fine grained SAND w/silt, moist, med dense	Sampled 0930
3.2 – 6.5	Brown fine SAND w/silt, moist, med dense	
6.5 – 8.0	Yellowish brown with gray SILT, trace clay, moist, mod stiff	
8.0 – 10.0	Gray with yellowish brown SILT, trace clay	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 798
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625234.94	Easting 1919132.77
Date Started 7-27-09	Date Completed 7-27-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered NA	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sampled
1.0	Brown very fine SAND, w/silt, moist, med dense	
1.3		Sampled 0950
2.0	Yellowish brown fine SAND w/silt, moist, med dense	
3.0		
4.0	Yellowish brown with gray SILT, moist, med stiff	
5.0		
6.0		
7.0		
8.0		
9.0	Gray with yellowish brown SILT, moist, med stiff	
10.0		

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

HTRW EXCAVATION LITHOLOGIC LOG		District: USACE Nashville	Hole Number: 495
Company Name Shaw E&I		Excavation Subcontractor MHM Services, Inc	Sheet 1 of 1
Project Plum Brook Ordnance Works - Sandusky, Ohio		Location Pentolite Road Redwater Pond	
Project No. 132458			
Name of Operator James Mills		Manufacturer's Designation of Excavator Takeuchi	
Sizes and Types of Excavating and Sampling Equipment Takeuchi 145		Northing 625193.38	Easting 1919158.92
Date Started 7-27-09	Date Completed 7-27-09	Surface Elevation	
Total Depth of Excavation 10.0	Disposition of Hole: Backfilled	Depth Groundwater Encountered 6.0	Logged by: E. Weaver

Samples for Chemical Analysis	Nitroaromatics (field screening)	Nitroaraomatics (confirmation)	Other
	X		NA

Depth	Description	Sample
0.0–1.0	Brown, very fine SAND, moist, loose.	Sampled 1025
1.0–3.6	Black silty clay, moist, med stiff	
3.6–6.0	Yellowish brown with gray SILT, trace clay, moist med stiff	
6.0	Water seeping into pit	
6.0–8.0	Same as above	
8.0–10.0	Gray with yellowish brown SILT, moist, med stiff	

Project: Plum Brook Ordnance Works, Sandusky, Ohio Penotlite Road Redwater Pond Delineation	Reviewed by:

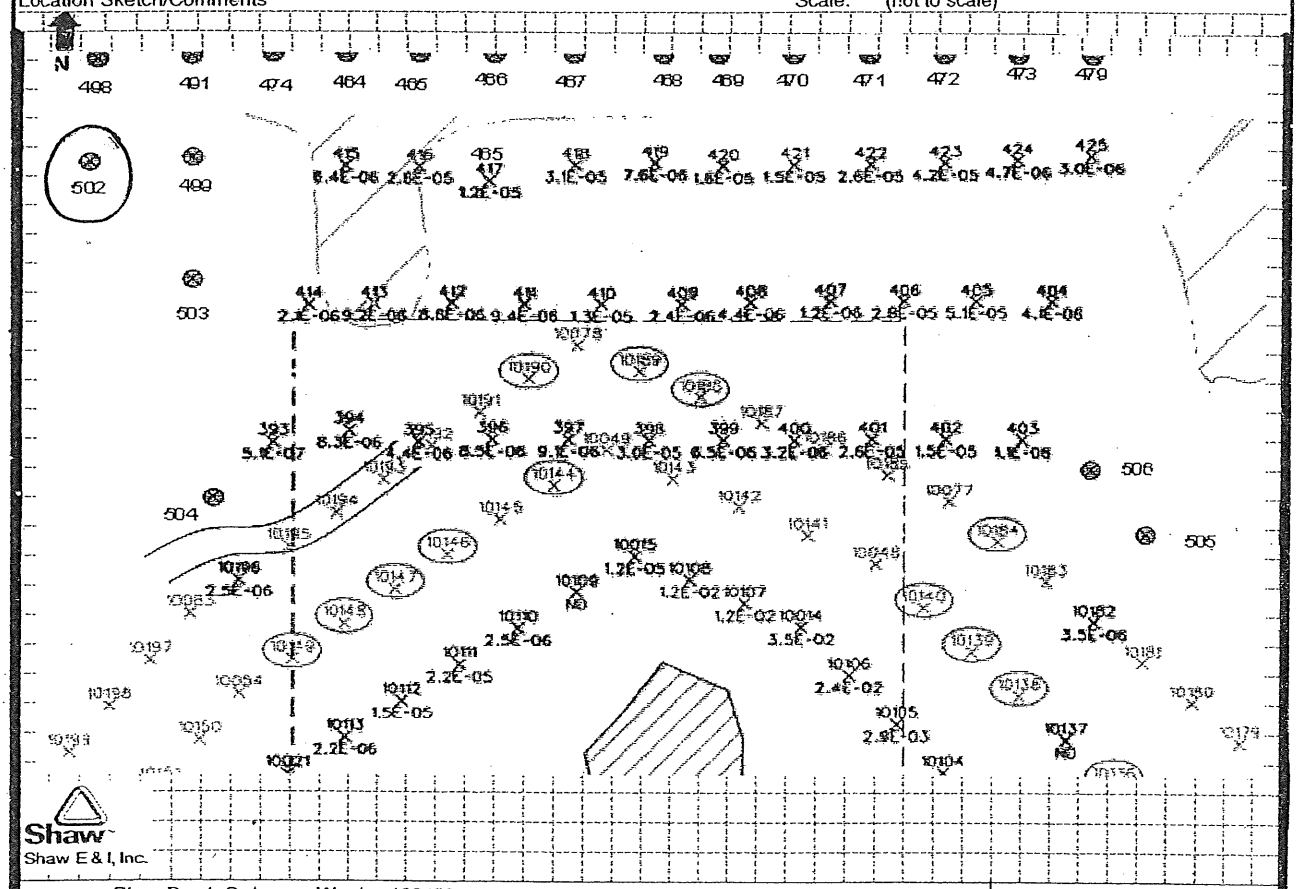
HTRW DRILLING LOG	District USACE Nashville	Hole Number: PR00502
Company Name Shaw E+I	Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works-Sandusky, OH	Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching	Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment: 2" OD X 24" Long Split Spoon Sampler	Northing / Easting / NAD / NGVD	
	Surface Elevation	
	Date Started 8-18-09	Date Completed 8-18-09
Overburden Thickness NA	Depth Groundwater Encountered 6.5 ft.	
Depth to Bedrock NA / Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.	Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Nitros	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	~~NA~~ yes	NA	TEST PIT	Eric W. Weaver

Location Sketch/Comments — Scale: (not to scale)



Shaw
Shaw E & I, Inc.

Project	Hole Number
Plum Brook Ordnance Words - 132458 Pentolite Road Redwater Pond Delineation Sampling	PR00502

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00502

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	~~Geotech. Sample or Core Box No.~~ Sample No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown very fine grain SAND with Silt, moist, med dense.	SP	NA	1 (0-2)	1340	0.2	
	1							
	2							
	3				2 (2-4)	1345	2.0	
		4.0'						
	4	Yellowish brown with gray SILT, with very fine grain Sand, moist, medium stiff.	ML					
	5				3 (4-6)	1350	2.0'	
	6							
		6.5'						
	7	Gray SILT with very fine grain sand ~~and~~ trace clay, moist med. stiff,	ML		4 (6-8)	1355	2.0	6.5' - wet
	8							
	9				5 (8-10)	1400	2.0	
	10	Boring Complete						

Project: PBOW | Hole Number: PR 00502

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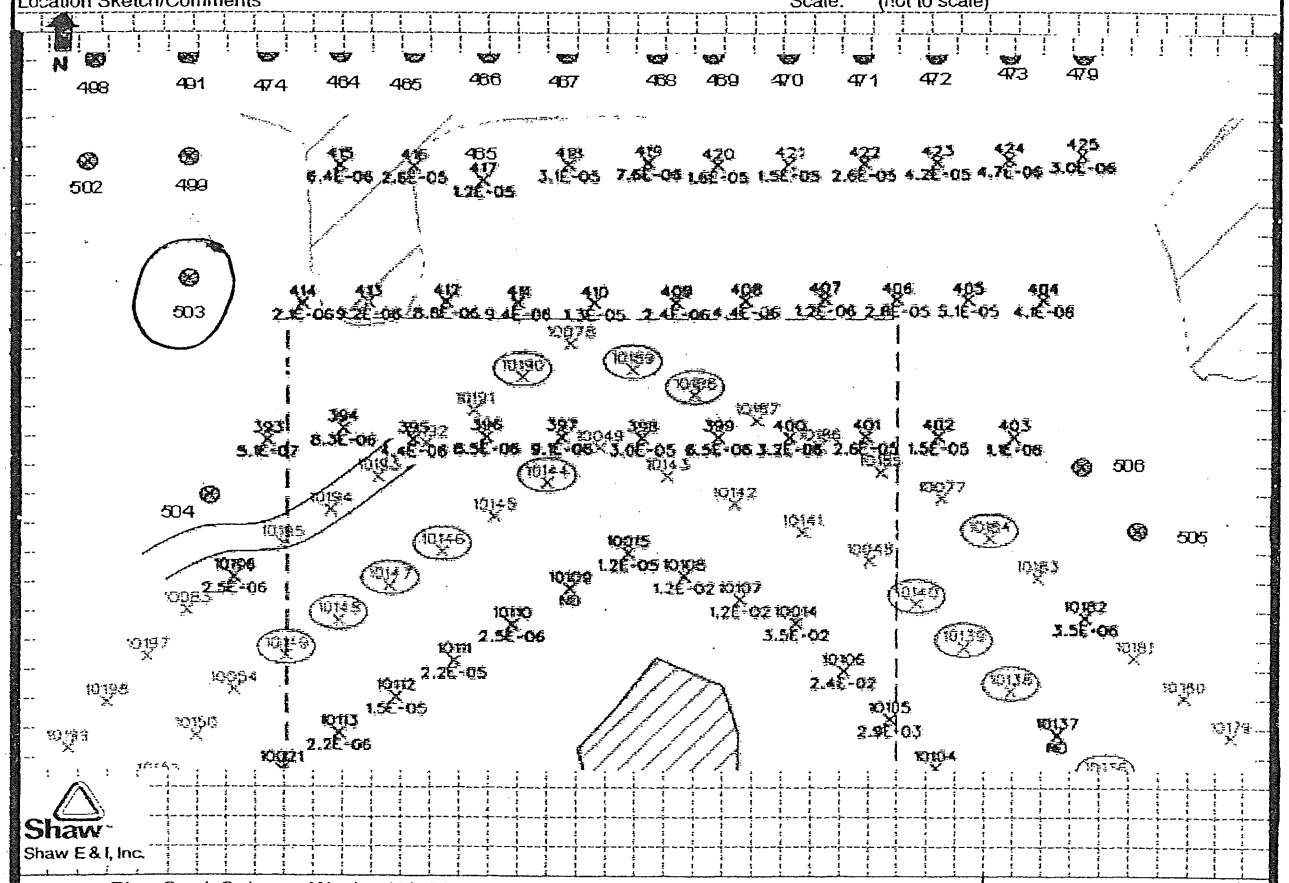
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR00503
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works-Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD X 24" Long Split Spoon Sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-18-09	Date Completed 8-18-09
Overburden Thickness NA		Depth Groundwater Encountered 5 ft.	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	~~NA~~ yes	NA	TEST PIT	Eric W. Weaver

Location Sketch/Comments Scale: (not to scale)



Shaw
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Project	Hole Number
Plum Brook Ordnance Words - 132458 Pentolite Road Redwater Pond Delineation Sampling	PR00503

Shaw
Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00503

Project: PBOW | Geologist: | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Yellowish brown Very fine grain sand, light, moist, loose.	SP		1 (0-2)	PR0051 1418	2.0'	
		1.5' Dark brown very fine grain SAND with SILT, moist, med. ~~dense~~ stiff.	SP		2 (2-4)	1422	1.0'	
	3							
	4							
	5	5.0' Brown SILT with clay, wet, soft	ML		3 (4-6)	1425	1.3'	5.0' water
	6	- grading to with yellowish brown SILT						
	7				4 (6-8)	1429	2.0	
	8							
	9				5 (8-10)	1433	1.8	
	10							

Project: PBOW Boring Complete | Hole Number: PR00503

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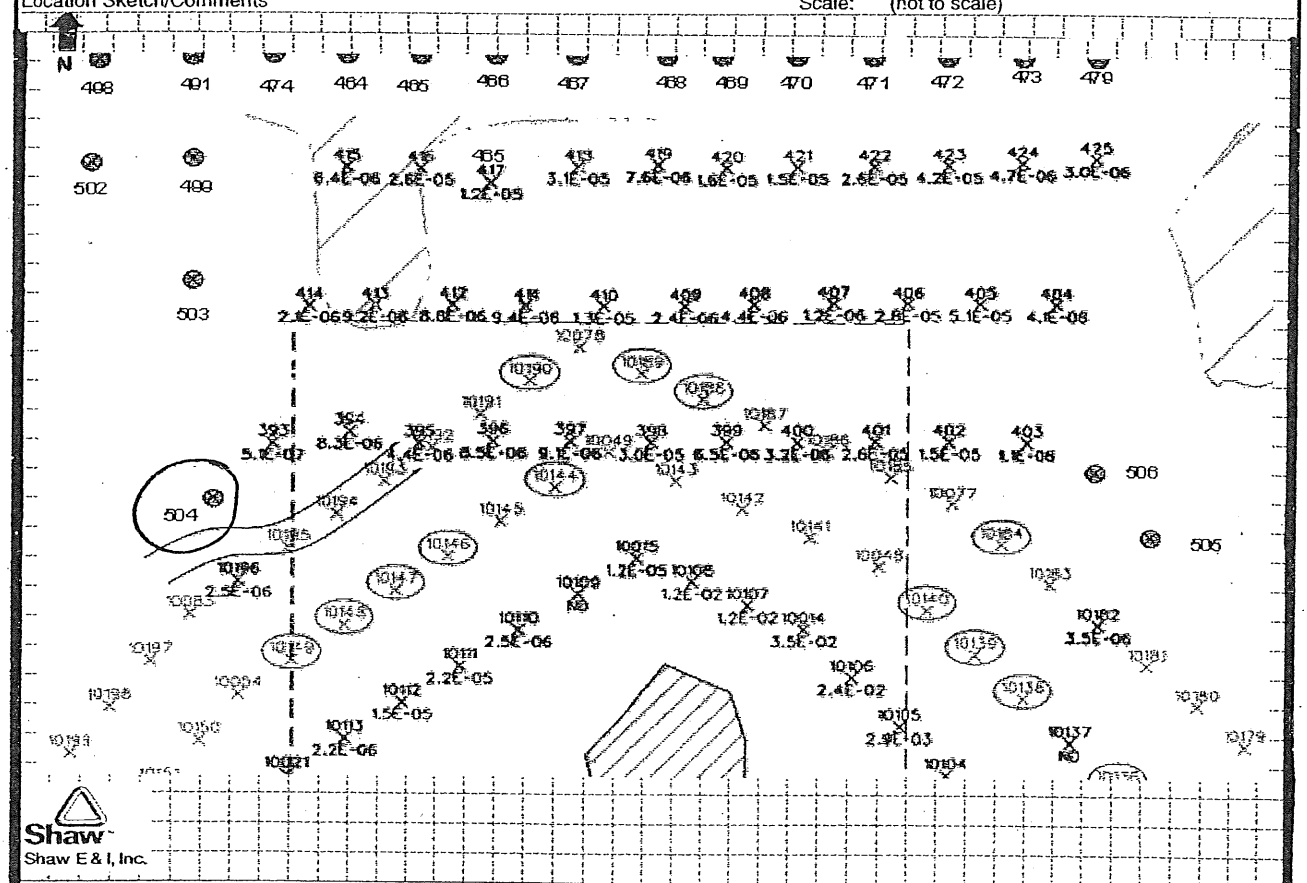
HTRW DRILLING LOG	District USACE Nashville	Hole Number: PR00504
Company Name: Shaw E+I	Drilling Subcontractor: Tri State Drilling	Sheet 1 of 2 Sheets
Project: Plum Brook Ordnance Works-Sandusky, OH	Location: Pentolite Road Redwater Pond	
Name of Driller: Al Bisching	Manufacturer's Designation of Drill: CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment: 2" OD X 24" Long Split Spoon Sampler	Northing / Easting / NAD / NGVD	
	Surface Elevation	
	Date Started: 8-18-09	Date Completed: 8-18-09
Overburden Thickness: NA	Depth Groundwater Encountered: 5 ft.	
Depth to Bedrock: NA / Depth Drilled into Rock: NA	Depth to Water and Elapsed Time After Drilling Completed: —	
Total Depth of Hole: 10 ft.	Other Water Level Measurements (Specify): —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	E. W. Weaver

Location Sketch/Comments — Scale: (not to scale)



Shaw
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Project	Hole Number
Plum Brook Ordnance Words - 132458 Pentolite Road Redwater Pond Delineation Sampling	PR00504

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00 504

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No. PR-0052	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose	SP			1 0-2 1505	1.5	
	1							
		1.5' Dark Brown very fine grain SAND with SILT moist, med. ~~dense~~ dense	SP			2 2-4 1510	1.3	
	2							
	3							
		3.5' Yellowish brown with gray SILT, trace clay and very fine grain SAND moist, med. stiff	ML			3 4-6 1515	2.0	5.0' wet
	4							
	5							
		5.0 Gray with yellowish brown SILT, trace clay and very fine grain SAND moist, med. stiff.	ML			4 6-8 1520	2.0	
	6							
	7							
	8							
	9					5 8-10 1524	2.0	
	10	Boring Complete						

Project: PBOW

Hole Number: PR00504

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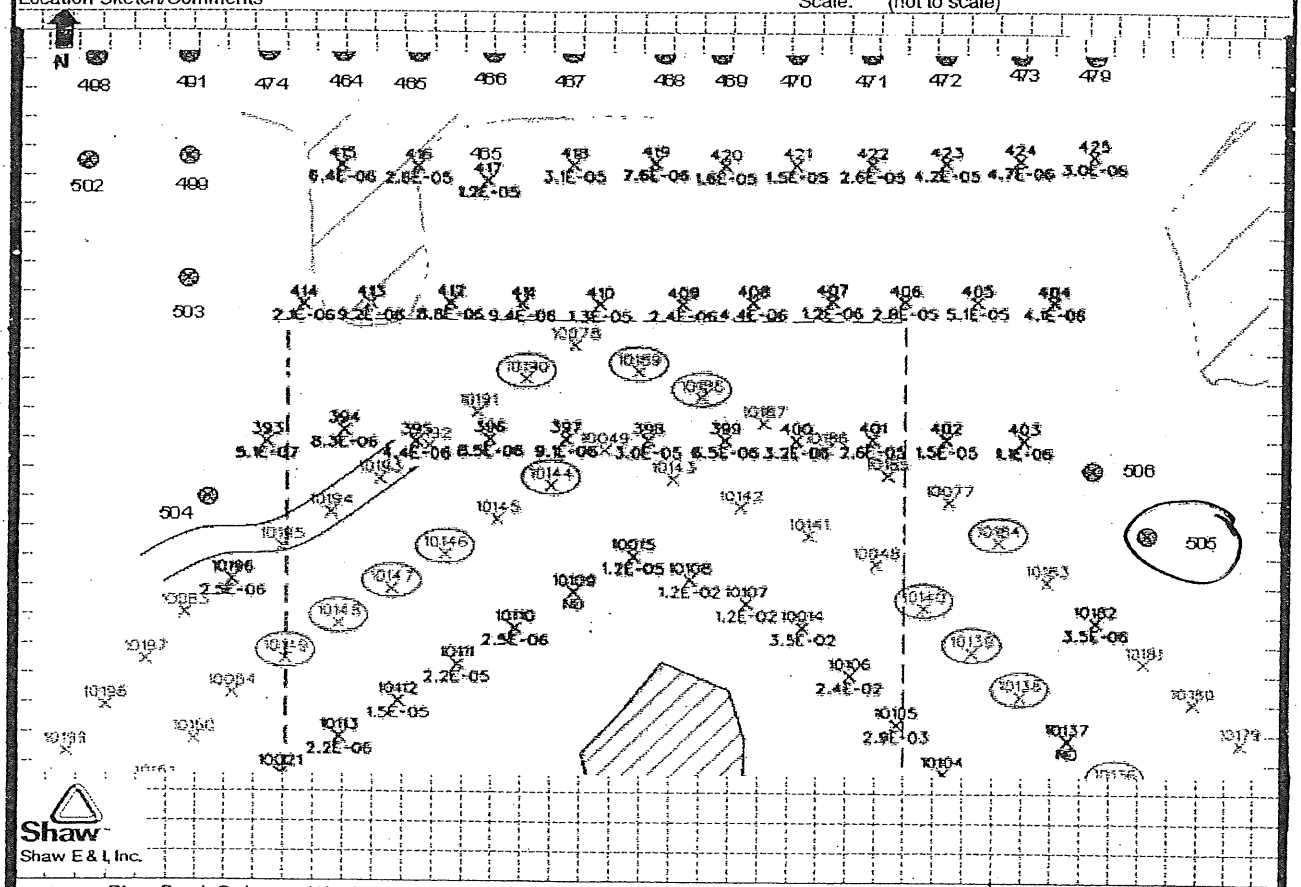
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR00505
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works-Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD X 24" Long Split Spoon Sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-18-09	Date Completed 8-18-09
Overburden Thickness NA		Depth Groundwater Encountered 5.5 ft.	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments Scale: (not to scale)



Shaw
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Project	Hole Number
Plum Brook Ordnance Words - 132458 Pentolite Road Redwater Pond Delineation Sampling	PR00505

Shaw
Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00505

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grained SAND, with SILT, moist, loose - (Noted organics 0-0.5')	SP		1 0-2 1610	PR-0053 PR-0053MS PR0053MSD PR0054 PR0055	2.0'	
	1							
	2							
	3				2 2-4 1615		2.0	
	4							
		- grading to with black SILT						
	5				3 4-6 1619		2.0'	
		5.5'						5.5' wet
		Yellowish brown with gray SILT, wet, medium stiff,	ML					
	6							
	7				4 6-8 1623		2.0'	
	8							
	9				5 8-10 1627		2.0'	
	10	Poorly graded						

Project: PBOW | Hole Number: PR00505

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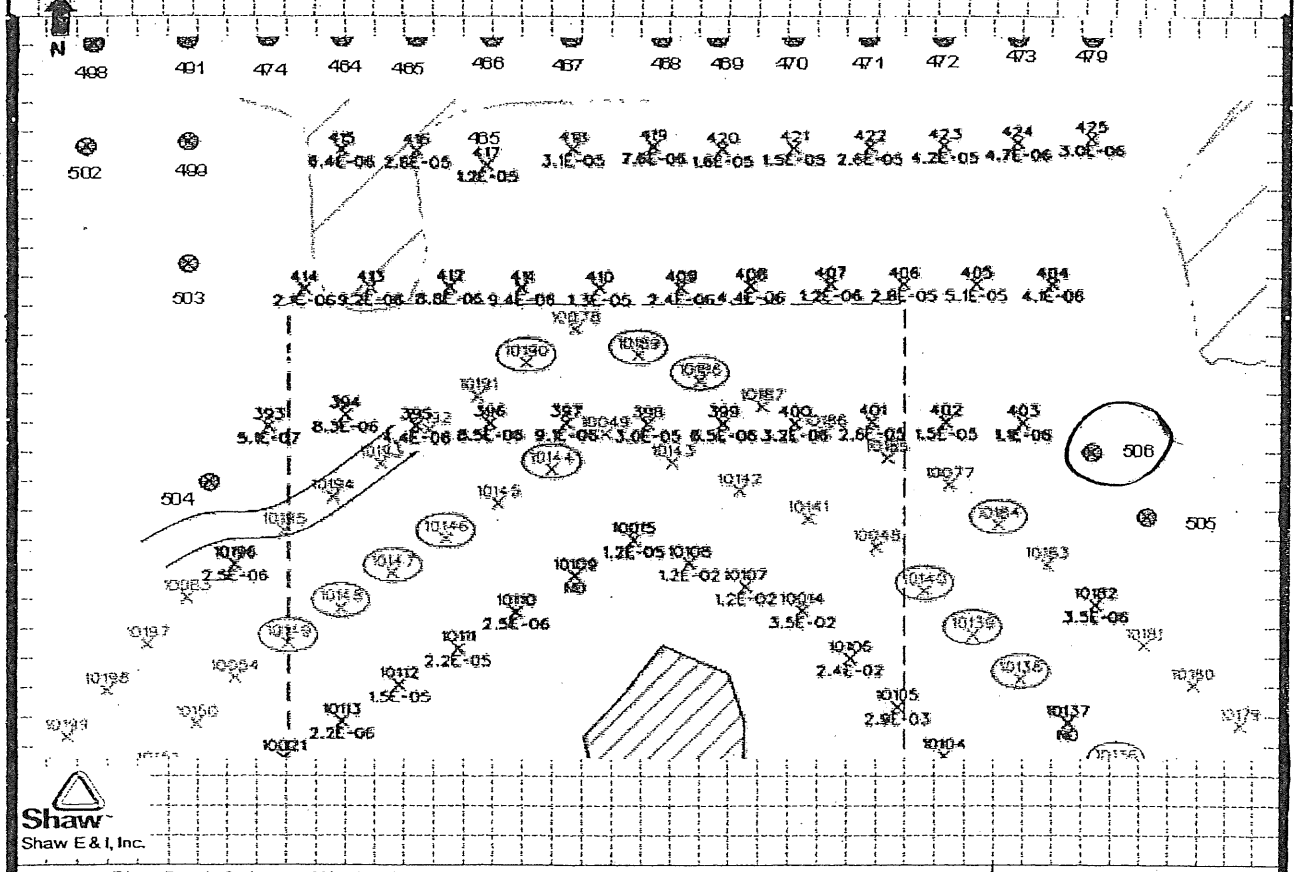
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR00506
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of Sheets
Project Plum Brook Ordnance Works-Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD X 24" Long Split Spoon Sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-18-09	Date Completed 8-18-09
Overburden Thickness NA		Depth Groundwater Encountered 5.5 ft.	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Emily Weaver

Location Sketch/Comments Scale: (not to scale)



Shaw
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Project Plum Brook Ordnance Words - 132458
Pentolite Road Redwater Pond Delineation Sampling

Hole Number PR00506

Shaw
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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00506

Project: PBOW

Geologist:

Sheet 2 of Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose.	SP			PR0056		
	1				1 0-2 1640		2.0	
	2							
	3				2 2-4 1651		2.0	
	4	-grading to with black SILT						
	5	5.0' Yellowish brown with gray SILT, moist, medium stiff trace clay and fine grain SAND.	ML		3 4-6 1654		2.0	-5.5 wet
	6							
	7				4 6-8 1701		2.0'	
	8							
	9				5 8-10 1706		2.0	
	10	Boring Complete						

Project: PBOW

Hole Number: PR00506

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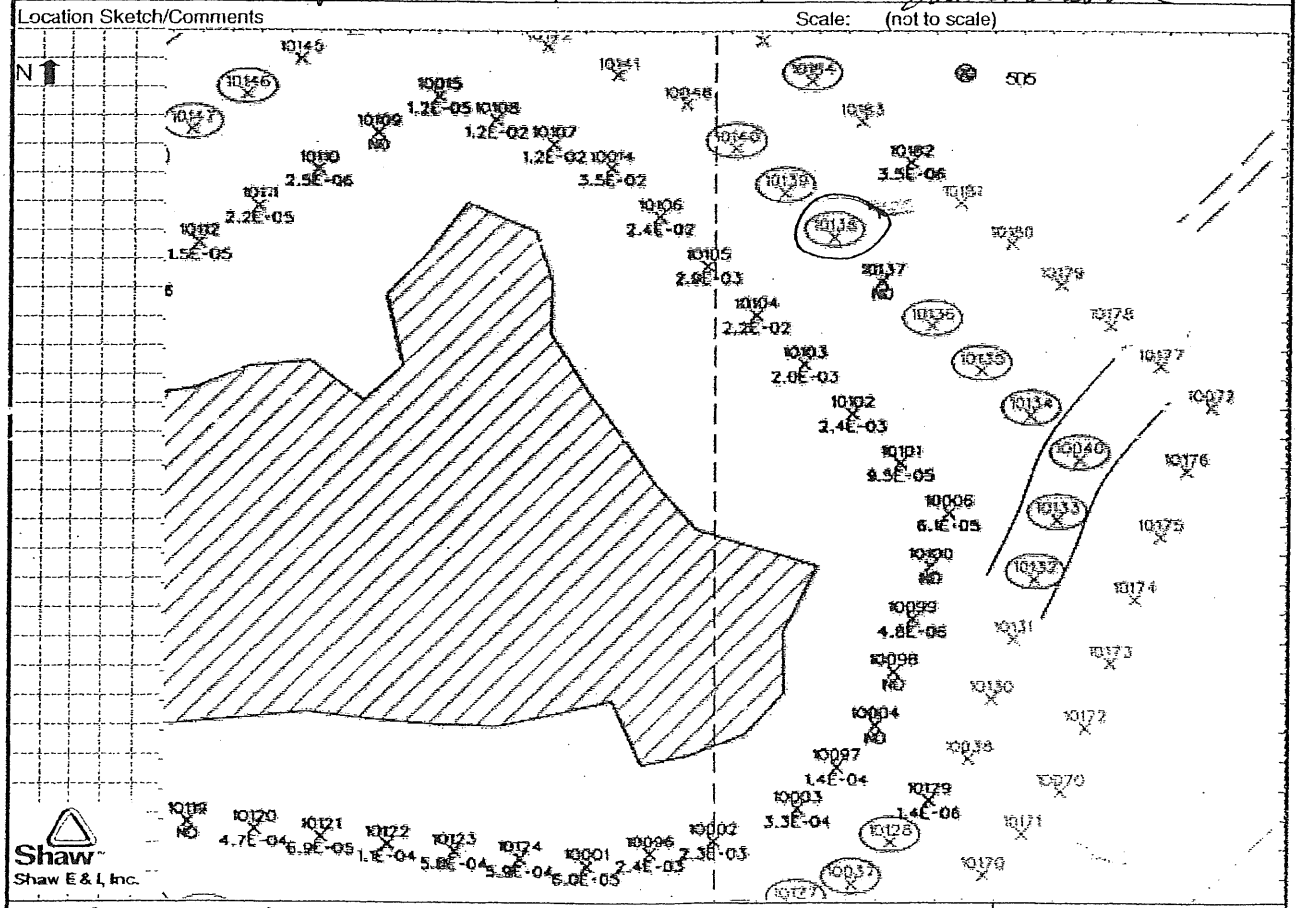
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR 10138
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD x 24" long split spoon sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA		Depth Groundwater Encountered 6.5 ft.	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
		—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	~~NA~~ Yes	NA	TEST PIT	Eric W. Weaver

Location Sketch/Comments Scale: (not to scale)



Shaw
Shaw E & I, Inc.

Project PBOW - 132458 PRRWP - Delineation Sampling	Hole Number PR 10138

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10138

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown and brown very fine grain SAND, moist, loose. (trace SILT)	SP	NA		PR-0057		
	1				1 0-2 0807		1.4	
	2							
	3				2 2-4 0812		2.0'	O2-20.8 H2S-0 CO-0 LEL-0 VOC-6
		3.9'						
	4	Dark gray with black SILT with very fine grain sand,	ML					
	4.5	noted organics (roots), moist, medium stiff.	ML					
	5				3 4-6 0816		2.0'	
		4.5' Yellowish brown and brown SILT, moist, medium stiff.						
	6							6.5' wet
		7.0						
	7	Yellowish brown with gray SILT, moist, medium stiff.	ML		4 6-8 0820		2.0'	
	8							
	9				5 8-10		1.0'	
	10	Boring Complete @ 10 ft						

Project: PBOW | Hole Number: PR-10138

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HTRW DRILLING LOG

District: USACE Nashville
Hole Number: PR10139

Company Name: Shaw E+I
Drilling Subcontractor: Tri State Drilling
Sheet 1 **of** 2 **Sheets**

Project: Plum Brook Ordnance Works - Sandusky, OH
Location: Pentolite Road Redwater Pond

Name of Driller: Al Bisching
Manufacturer's Designation of Drill: CME 55 Track

Sizes and Types of Drilling and Sampling Equipment: 2" OD x 24" Long split spoon sampler

Northing	Easting	NAD	NGVD

Surface Elevation:

Date Started	Date Completed
8-19-09	8-19-09

Overburden Thickness: NA
Depth Groundwater Encountered: None

Depth to Bedrock	Depth Drilled into Rock
NA	NA

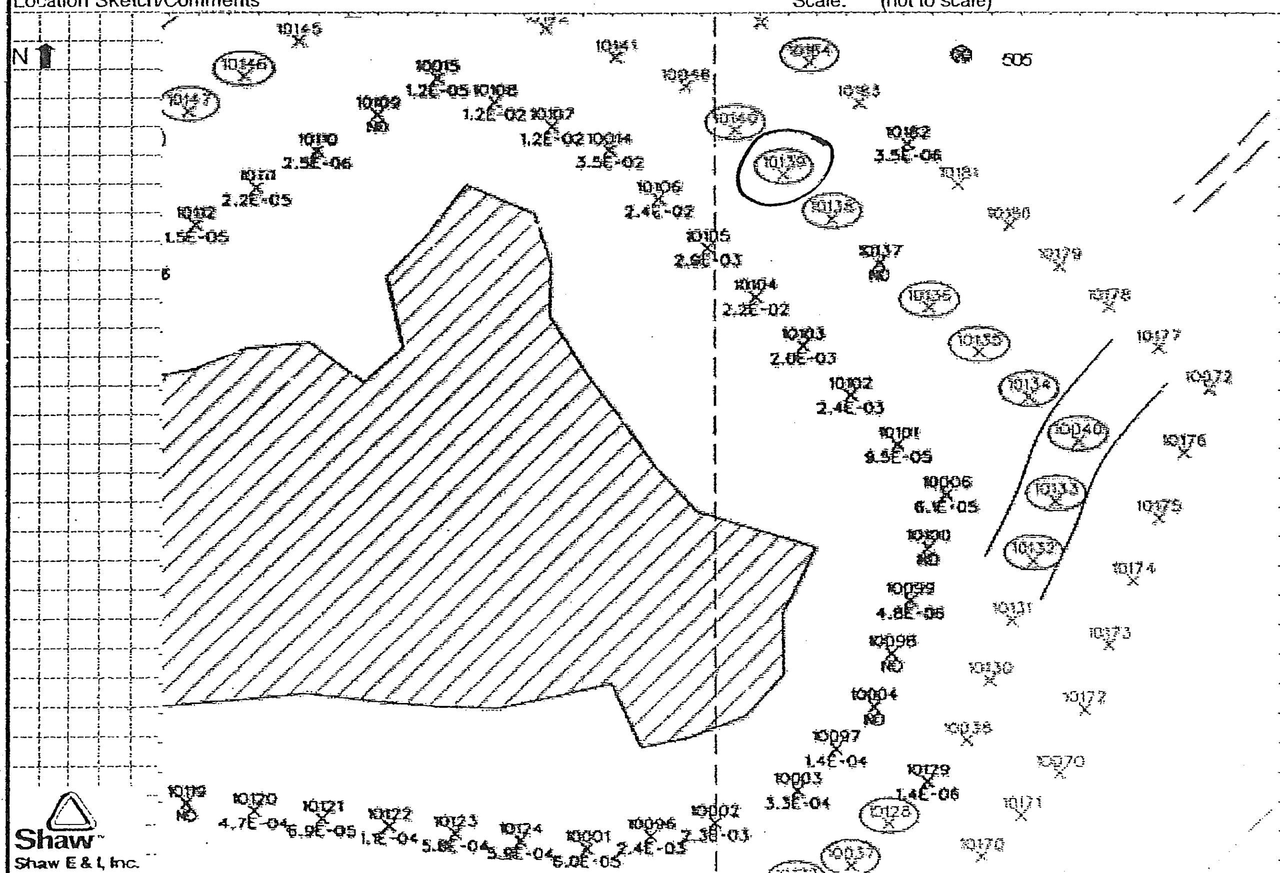
Depth to Water and Elapsed Time After Drilling Completed: —
Total Depth of Hole:
Other Water Level Measurements (Specify): —

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments Scale: (not to scale)



Shaw
Shaw E & I, Inc.

Project: PBOW - 132458
PRRWP - Soil Delineation

Hole Number: PR 10139

Shaw
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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10139

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose.	SP	NA		PR-0058		
	1				1 0-2 0836		2.0	
	2							
	3				2 2-4 0842		2.0	O_2-20.8 H_2S-0 CO-0 LEL-0 VOC-0
		3.5' Black SILT with organics, moist, stiff.	ML					
	4	4.0 Yellowish brown + brown SILT, moist, medium stiff.	ML					
	5				3 4-6 0846		2.0	
	6							
	7	grading to with gray silt.			4 6-8 0850		1.4	
	8							
	9				5 8-10		1.6	
	10	Boring Completed @ 10 ft						

Project: PBOW | Hole Number: PR-10139

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HTRW DRILLING LOG

Field	Entry
District	USACE Nashville
Hole Number	PR10140
Company Name	Shaw E+I
Drilling Subcontractor	Tri State Drilling
Sheet	1 of 2 Sheets
Project	Plum Brook Ordnance Works - Sandusky, OH
Location	Pentolite Road Redwater Pond
Name of Driller	Al Bisching
Manufacturer's Designation of Drill	CME 55 Track
Sizes and Types of Drilling and Sampling Equipment	2" OD x 24" Long split spoon sampler
Northing	
Easting	
NAD	
NGVD	
Surface Elevation	
Date Started	8-19-09
Date Completed	8-19-09
Overburden Thickness	NA
Depth Groundwater Encountered	None
Depth to Bedrock	NA
Depth Drilled into Rock	NA
Depth to Water and Elapsed Time After Drilling Completed	—
Total Depth of Hole	10 ft.
Other Water Level Measurements (Specify)	—

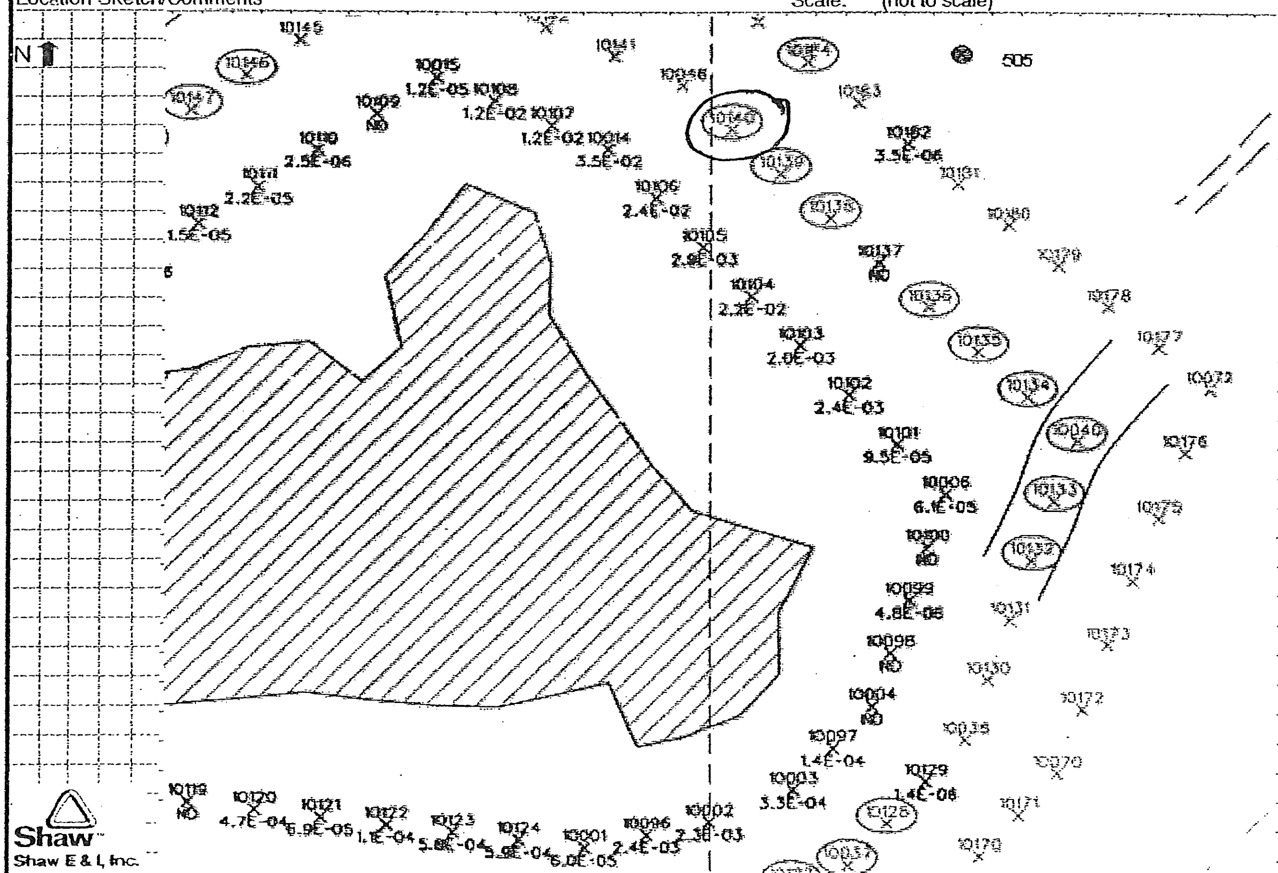
Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments

Scale: (not to scale)



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Project PBOW - 132458
PRRWP - Soil Delineation

Hole Number PR10140

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10140

Project: PBOW

Geologist: [illegible]

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown and brown very fine grain SAND, moist, loose.	SP	NA		PR0059		
	1				1 0-2 0900		2.0	
	2							
	3				2 2-4 0904		1.8	O_2 - 20.9 H_2S - 0 CO - 0 LEL - 0 VOC - 0
	4							
	5				3 4-6 0909		2.0	
		5.7 Black SILT with organics, moist, stiff	ML					
	6	6.1 Yellowish brown with gray SILT, moist, medium stiff,	ML					
	7				4 6-8 0913		2.0	
		EW						
	8	Black SILT with organics, moist, stiff						
	9				5 8-10 0916		1.4	
	10	Boring Complete @ 10 ft						

Project: PBOW

Hole Number: PR-10140

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HTRW DRILLING LOG

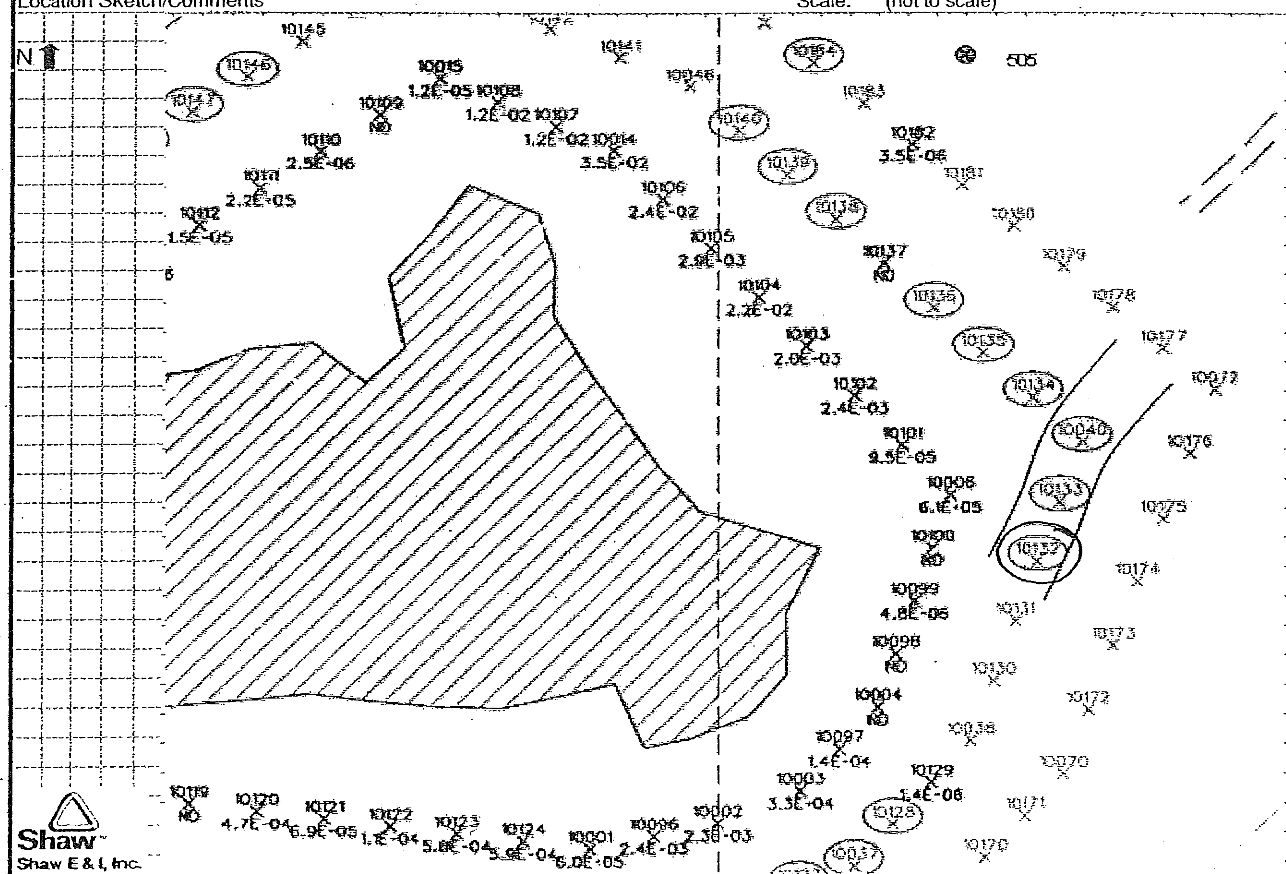
District: USACE Nashville	Hole Number: PR10132
Company Name: Shaw E+I	Drilling Subcontractor: Tri State Drilling
Sheet 1 of 3 Sheets	
Project: Plum Brook Ordnance Works - Sandusky, OH	Location: Pentolite Road Redwater Pond
Name of Driller: Al Bisching	Manufacturer's Designation of Drill: CME 55 Track
Sizes and Types of Drilling and Sampling Equipment: 2" OD x 24" long split spoon sampler	Northing: / Easting: / NAD: / NGVD:
	Surface Elevation:
	Date Started: 8-19-09 / Date Completed: 8-19-09
Overburden Thickness: NA	Depth Groundwater Encountered: 7 ft.
Depth to Bedrock: NA / Depth Drilled into Rock: NA	Depth to Water and Elapsed Time After Drilling Completed: —
Total Depth of Hole: 11 ft.	Other Water Level Measurements (Specify): —

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments Scale: (not to scale)



Project: PBOW 132458 PRRWP Soil Delineation	Hole Number: PR10132

Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10132

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 3 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown CLAY with SILT, moist, stiff.	CL			PR0060		
	1	Plastic liner at 1'.						
		Yellowish brown very fine grain SAND, moist, loose	SP		1 ~~[illegible]~~ 0-2 0945		2.0	
	2							
	3				2 ~~[illegible]~~ 2-4 0950		1.8	O_2 - 20.8 H_2S - 0 CO - 0 LEL - 0 VOC - 0
		3.9'						
	4	Gray fine grain SAND, moist, loose.	SP					
	5				3 ~~[illegible]~~ 4-6 0956		2.0	
		5.5'						
	6	Gray SILT with very fine grain SAND, moist, medium stiff.	ML					
	7				4 6-8 1001		2.0	7.0 - water
	8							
	9				5 8-10 1005		1.2'	
	10							

Project: PBOW | Hole Number: PR-10132

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10132

Project: PBOW | Geologist: E. Weaver | Sheet 3 of 3 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	10	Gray clay with silt and very fine grain SAND, moist, medium stiff	CL	NA	6 (10-11)	PR-0060	1.0	
	11	Barely Complete @ 11 ft			1012			
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							

Project: PBOW | Hole Number: PR-10132

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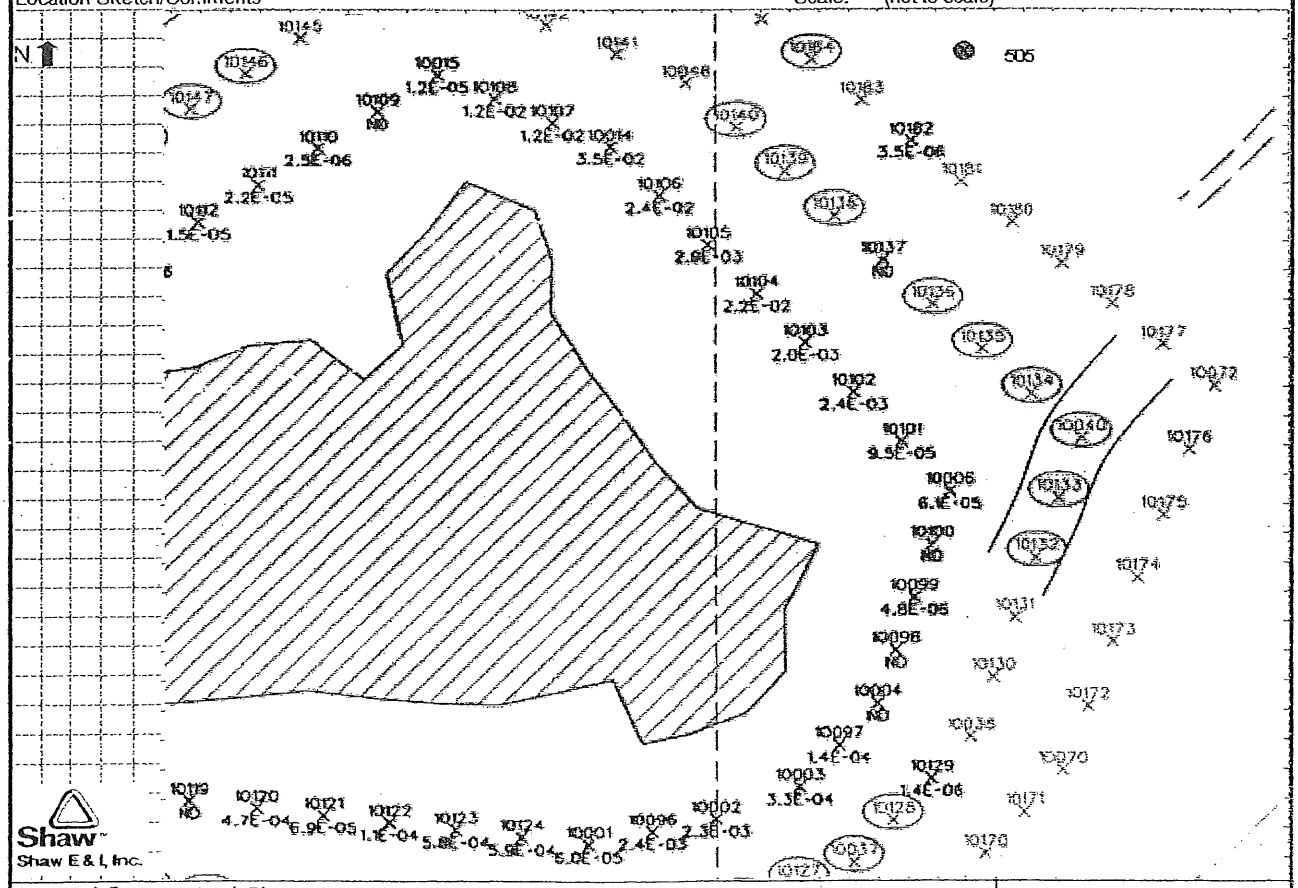
HTRW DRILLING LOG	District USACE Nashville	Hole Number: PR10133
Company Name: Shaw E+I	Drilling Subcontractor: Tri State Drilling	Sheet 1 of 3 Sheets
Project: Plum Brook Ordnance Works - Sandusky, OH	Location: Pentolite Road Redwater Pond	
Name of Driller: Al Bisching	Manufacturer's Designation of Drill: CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment: 2"OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
	Surface Elevation	
	Date Started: 8-19-09	Date Completed: 8-19-09
Overburden Thickness: NA	Depth Groundwater Encountered: None	
Depth to Bedrock: NA / Depth Drilled into Rock: NA	Depth to Water and Elapsed Time After Drilling Completed: —	
Total Depth of Hole: 14 ft.	Other Water Level Measurements (Specify): —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments — Scale: (not to scale)



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Project: PBOW 132458 PRRWP Soil Delineation	Hole Number: PR10133

Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number PR-10133

Project PBOW | Geologist E. Weaver | Sheet 2 of 3 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		No Recovery 0-2' (Brown CLAY with SILT, moist, mottled stiff, based on previous boring)	CL	NA	1 0-2 1044	PR-0061	NR	
	1							
	2	Brown CLAY with Silt, trace very fine grain SAND, moist stiff						
	3				2 2-4 1047		6.6'	
		4.0'						
	4	Yellowish brown, brown and gray very fine grain SAND, moist loose.	SP					
	5				3 4-6 1053		1.2	O_2-20.8 H_2S-0 CO-0 LEL-0 VOC-0
	6							
	7				4 6-8 1058		0.2	
	8							
	9				5 8-10 1103		0.2	
	10							

Project PBOW | Hole Number PR-10133

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10133

Project: PBOW

Geologist: E. Weaver

Sheet 3 of 3 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Light brown and gray very fine grain SAND, moist, loose.	SP	NA		PR-0061		
	11				6 (10-12) H09		1.0	
	12	12.0'						
		Gray SILT with clay and very fine grain SAND, moist, medium stiff	ML					
	13				7 (12-14) H16		2.0	
	14	14.0'						
		Boring Complete @ 14 ft						
	15							
	16							
	17							
	18							
	19							
	20							

Project: PBOW

Hole Number: PR-10133

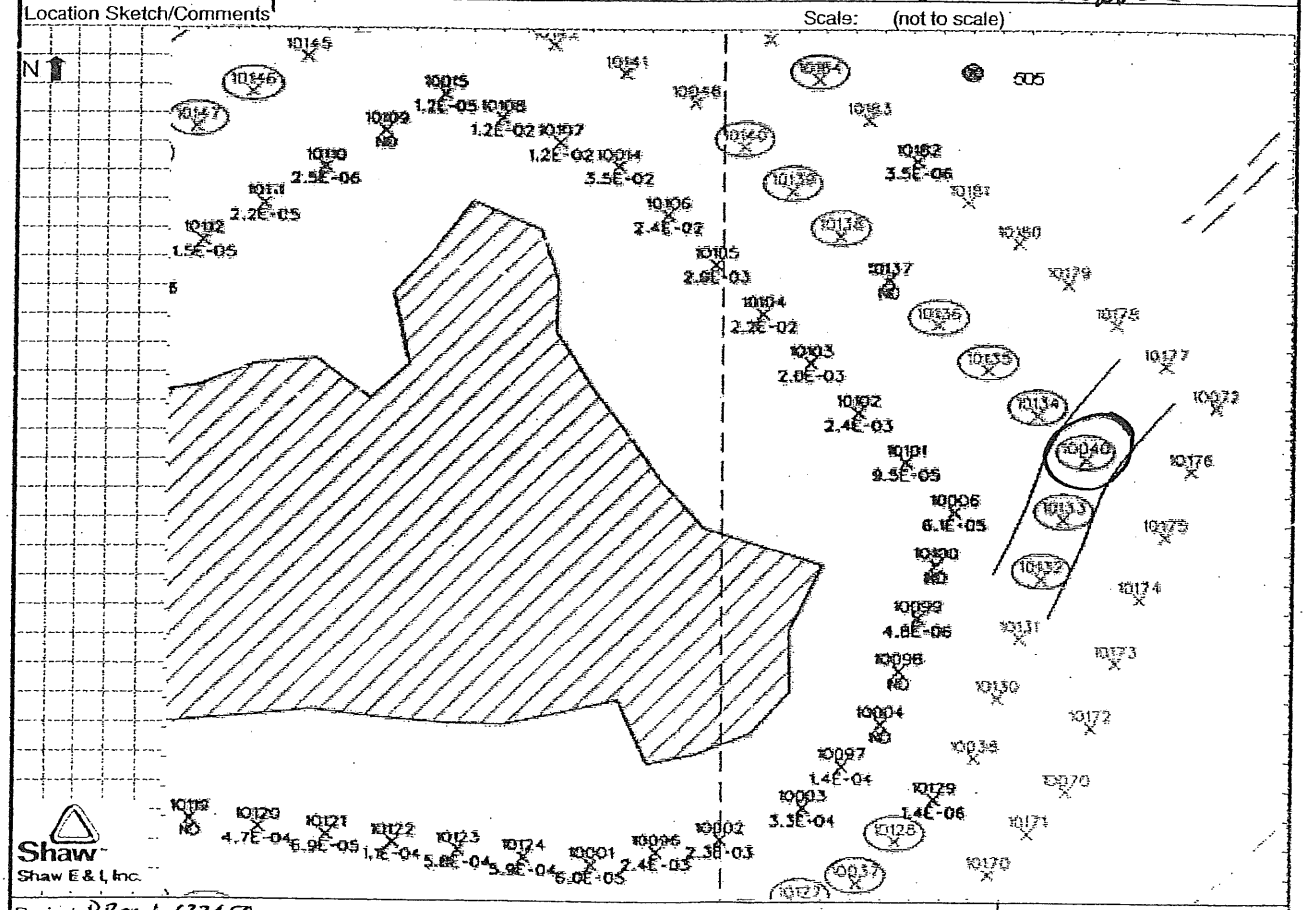
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR 10040
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 3 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD x 24" long split spoon sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA		Depth Groundwater Encountered None	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 12 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	E. W. Weaver

Location Sketch/Comments Scale: (not to scale)



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Project PBOW 132458
PRRWP Soil Delineation

Hole Number PR 10040

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10010

Project: PBOW

Geologist: Br Weaver

Sheet 2 of 3 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown clay with silt and very fine grain sandy moist, med. stiff	CL	NA	1 0-2 1124	PR-0068	1.5	
	1							
	2.0'							
	2	Yellowish brown very fine grain SAND, moist, loose	SP					
	3				2 2-4 1128		2.0'	O_2 - 20.8
								H_2S - 0
	4							CO - 0
								LEL - 0
								VOC - 0
	5				3 4-6 1133		2.0	
	6.0'							
	6	Gray with yellowish brown SILT, with very fine grain sand, moist, medium stiff.	ML					
	7				4 6-8 1137		2.0	
	8							
	9				5 8-10 1143		2.0'	
	10							

Project: PBOW

Hole Number: PR-10010

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10040

Project: PBOW

Geologist: B Weaver

Sheet 3 of 3 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Gray SILT, trace very fine grained sand, moist, med. stiff	ML	NA	6 10-12 HFS	PR-0068	2.0'	
	1							
	2	12.0' Boring Complete @ 12 ft						
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							

Project: PBOW

Hole Number: PR-10040

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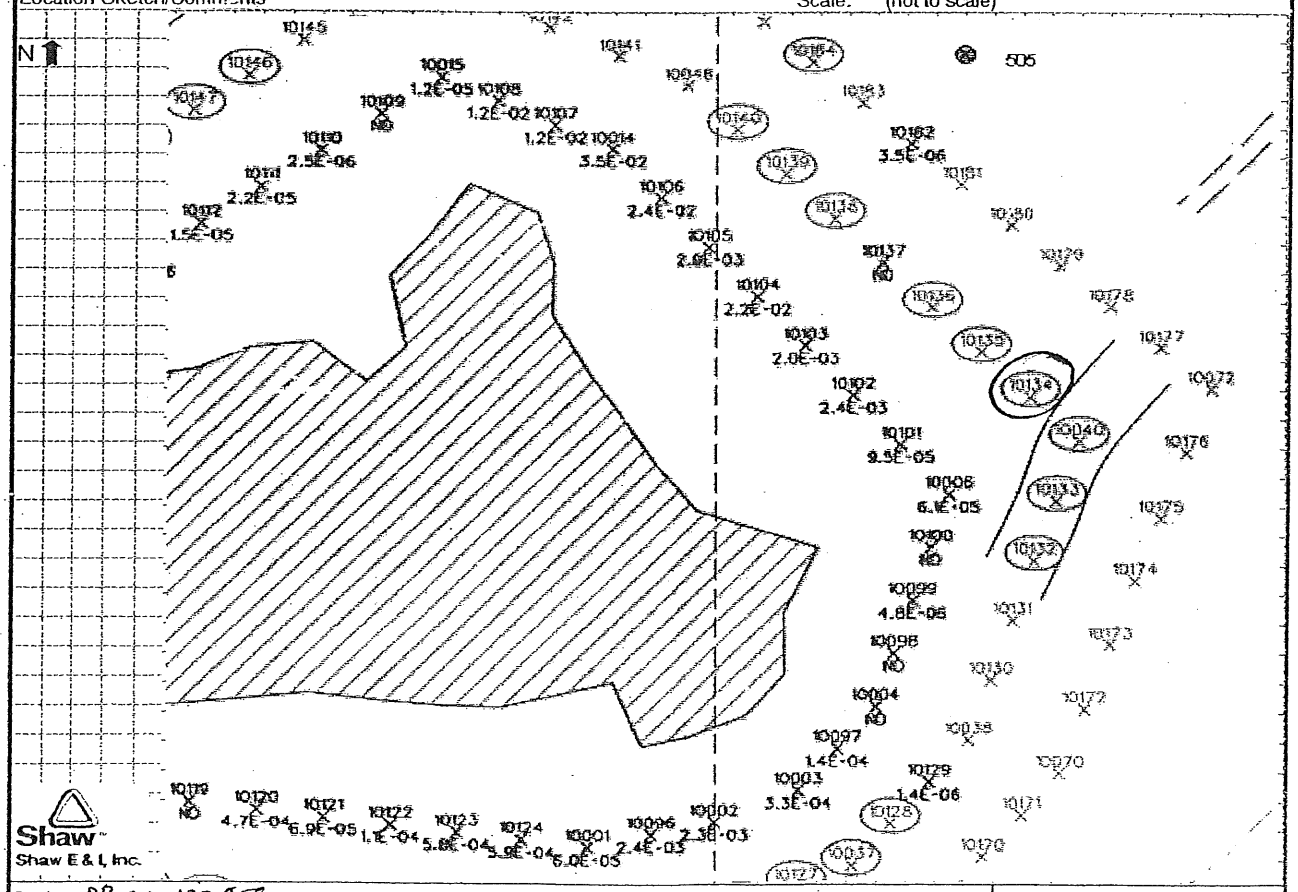
HTRW DRILLING LOG	District USACE Nashville	Hole Number: PR10134
Company Name Shaw E+I	Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH	Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching	Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment: 2" OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
	Surface Elevation	
	Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA	Depth Groundwater Encountered None	
Depth to Bedrock NA / Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft	Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	E. W. Weaver

Location Sketch/Comments Scale: (not to scale)



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Project PBOW 132458 PRRWP So. 7 Delineation	Hole Number PR10134

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10134

Project: PBOW | Geologist: E Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose	SP	NA		PR-0062		
	1				1 0-2 1304		1.2'	
	2							
	3	3.0' Yellowish brown with gray SILT, trace very fine grain sand, moist to med. stiff	ML		2 2-4 1308		1.4'	O_2 - 20.8 H_2S - 0 CO - 0 LEL - 0 VOC - 0
	4							
	5				3 4-6 1312		2.0	
	6	grading to with gray CLAY.						
	7				4 6-8 1317		2.0	
	8							
	9	9.0' Gray SILT, moist, medium stiff,	ML		5 8-10 1321		2.0'	
	10							

Project: PBOW Partially Completed 1004 | Hole Number: PR-10134

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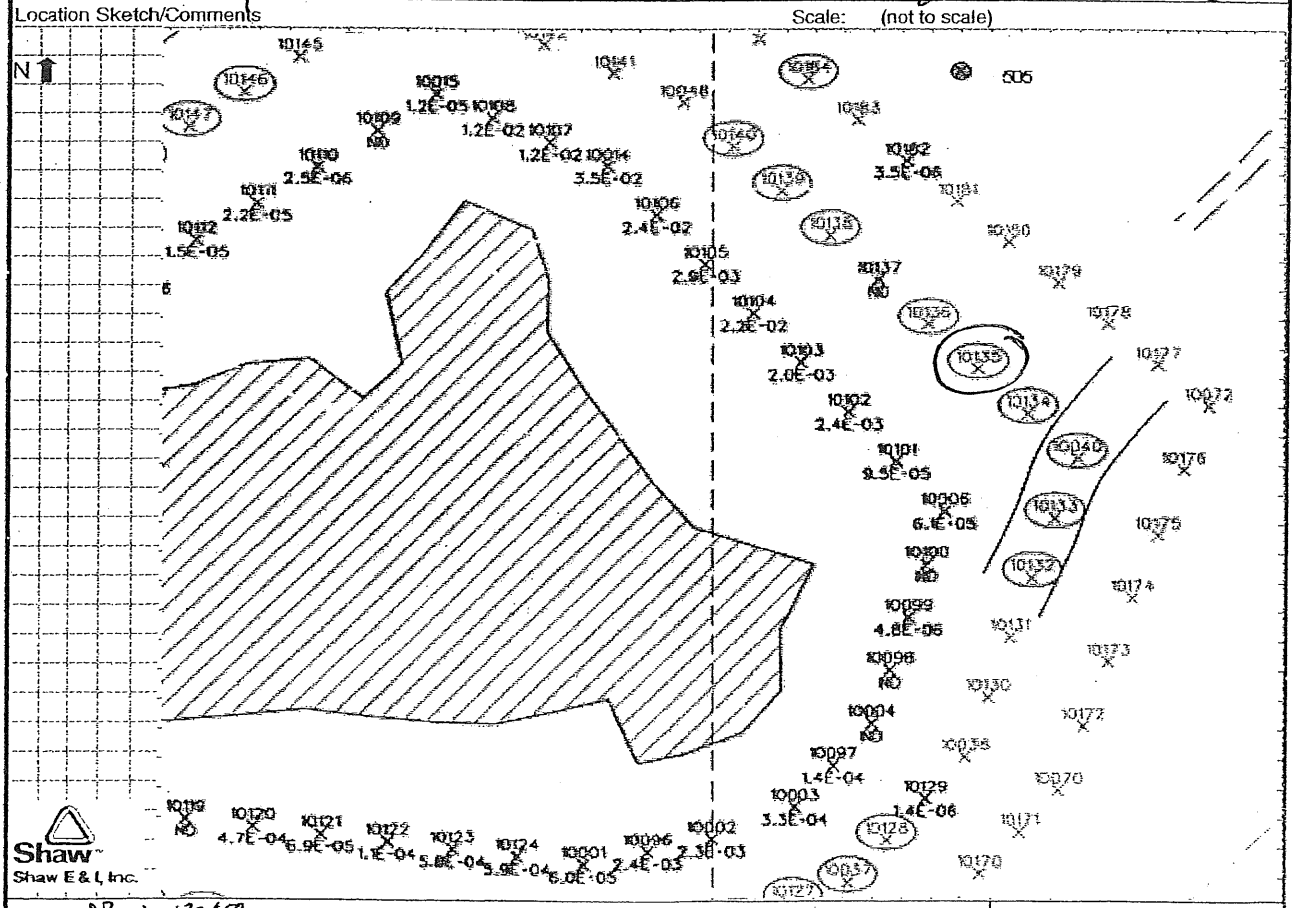
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR10135
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2"OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA		Depth Groundwater Encountered None	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Erin W. Weaver

Location Sketch/Comments Scale: (not to scale)



Project PBOW 132458 PARWP Soil Delineation	Hole Number PR10135

Shaw
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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10135

Project: PBOW | Geologist: D Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, with SILT, moist, loose.	SP	NA		PR0063		
	1				1 0-2 1328		1.3	
	2							
	3				2 2-4 1332		1.0	
	4	4.0'						
		Yellowish brown with gray SILT, moist, medium stiff.	ML					
	5				3 4-6 1335		1.1	O_2 - 20.8 H_2S - 0 CO - 0 LEL - 0 VOC - 0
	6							
	7				4 6-8 1338		1.1	
	8	8.5'						
		Gray SILT with very fine grain SAND, moist, medium stiff.	ML					
	9				5 8-10 1341		1.2	
	10							

Project: PBOW Boring Complete @ 10 ft | Hole Number: PR-10135

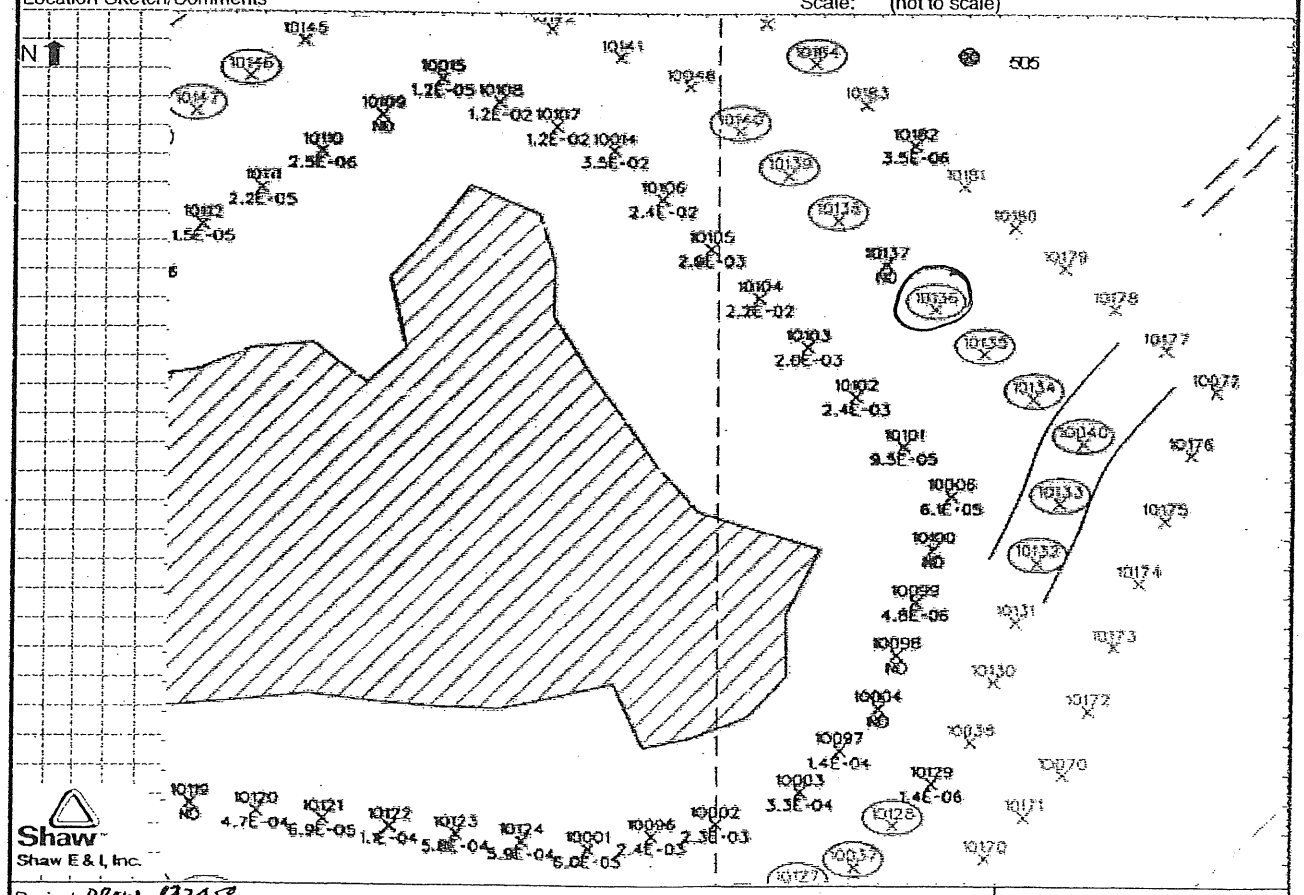
HTRW DRILLING LOG	District USACE Nashville	Hole Number: PR10136
Company Name: Shaw E+I	Drilling Subcontractor: Tri State Drilling	Sheet 1 of 2 Sheets
Project: Plum Brook Ordnance Works - Sandusky, OH	Location: Pentolite Road Redwater Pond	
Name of Driller: Al Bisching	Manufacturer's Designation of Drill: CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment: 2" OD x 24" long split spoon sampler	Northing / Easting / NAD / NGVD	
	Surface Elevation	
	Date Started: 8-19-09	Date Completed: 8-19-09
Overburden Thickness: NA	Depth Groundwater Encountered: 7 ft.	
Depth to Bedrock: NA / Depth Drilled into Rock: NA	Depth to Water and Elapsed Time After Drilling Completed: —	
Total Depth of Hole: 10 ft.	Other Water Level Measurements (Specify): —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments — Scale: (not to scale)



Shaw
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Project PBOW 13245 PRRWP Soil Delineation.

Hole Number PR10136

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10136

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose	SP	NA	1 0-2 1359	PR-0072	1.5	
	1							
	2							
	3				2 2-4 1403		1.8	O_2 - 20.8 H_2S - 0 CO - 0 LEL - 0 VOC - 0
	4	Yellowish brown very fine grain SAND with SILT, moist, medium stiff.	SP					
	5	-grading to brown			3 4-6 1406		1.0	
	6	Yellowish brown with gray SILT, moist, medium stiff, trace fine grain SAND and organics.	ML					
	7				4 6-8 1409		2.0'	2.0' wet,
	8							
	9	Gray with yellowish brown SILT, trace very fine grain sand, moist, medium stiff	ML		5 8-10 1413		1.7	
	10	Boring Complete @ 10 ft						

Project: PBOW | Hole Number: PR-10136

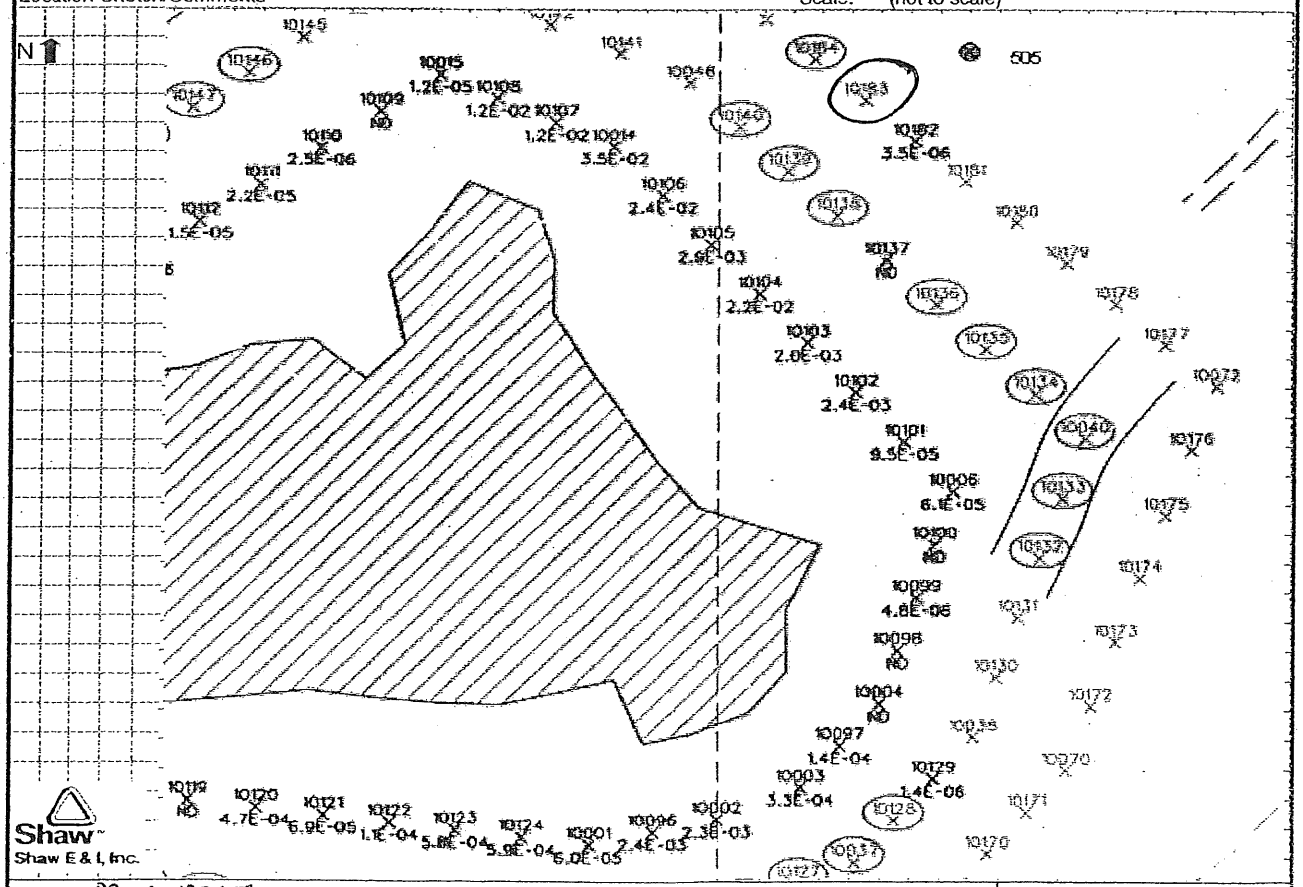
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR10183
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA		Depth Groundwater Encountered 7 ft.	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	E. W. Weaver

Location Sketch/Comments Scale: (not to scale)



Project PBOW 132458 PRRWP Soil Delineation	Hole Number PR10183

Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10183

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose	SP	NA		PR0065 PR0066 PR0067		
	1				1 (0-2) 1427		2.0	
	2							
	3				2 (2-4) 1431		2.0	O_2 ~ 20.8
		3.7'						H_2S ~ 0
	4	Brown SILT with very fine grain SAND, moist, medium stiff	ML					CO ~ 0
								LEL ~ 0
	5				3 (4-6) 1434		NR	VOC ~ 6
	6							
	7	-grading to yellowish brown			4 (6-8) 1437		2.0'	2.0' wet
	8							
	9				5 (8-10) 1440		2.0'	
		9.5'						
	0	Yellowish brown SILT with clay, moist, medium stiff	ML					

Project: PBOW Borehole Complete @ 10ft

Hole Number: PR-10183

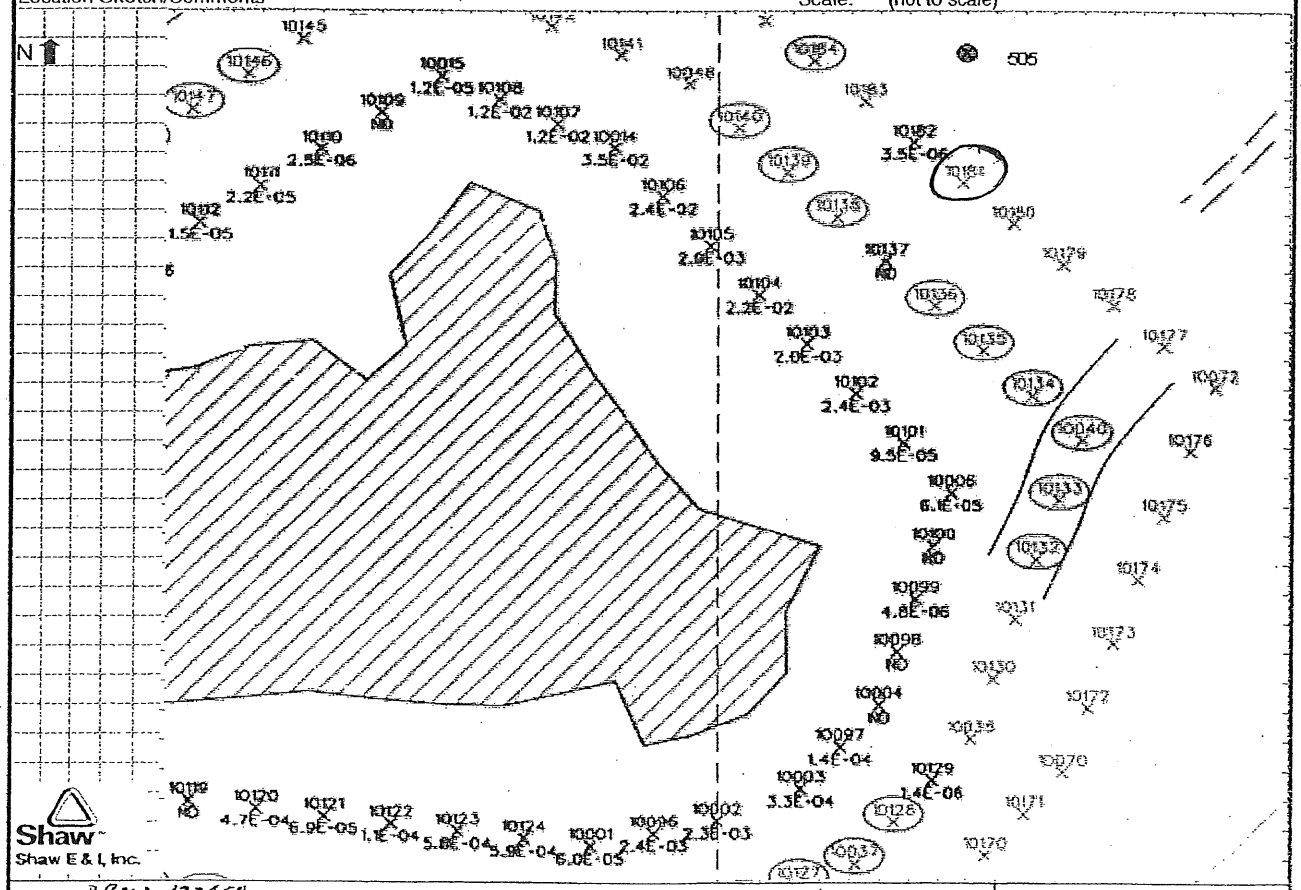
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR10181
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA		Depth Groundwater Encountered 7 ft.	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	E. W. Weaver

Location Sketch/Comments Scale: (not to scale)



Project PBOW 13245 PRRWP Soil Delineation	Hole Number PR10181

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Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10181

Project: PBOW

Geologist: B. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist, loose	SP			PR-0064		
	1				1 0-2 1451		2.0	
		2.0'						
	2	Black SILT with very fine grain SAND, moist, medium stiff	ML					
	3				2 2-4 1455		2.0	O_2 ~ 20.0 H_2S - 0 CO - 0 LEL - 0 VOC - 0
		4.0'						
	4	Yellowish brown with gray SILT, trace very fine grain SAND, moist, medium stiff	ML					
	5				3 4-6 1502		2.0	
	6							
	7				4 6-8 1507		2.0	7.0' wet
	8							
	9				5 8-10 1511			
	10	Boring Complete @ 10 ft						

Project: PBOW

Hole Number: PR-10181

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HTRW DRILLING LOG

District: USACE Nashville	Hole Number: PR10180
Company Name: Shaw E+I	Drilling Subcontractor: Tri State Drilling
Sheet 1 of 2 Sheets	
Project: Plum Brook Ordnance Works - Sandusky, OH	Location: Pentolite Road Redwater Pond
Name of Driller: Al Bisching	Manufacturer's Designation of Drill: CME 55 Track
Sizes and Types of Drilling and Sampling Equipment: 2" OD x 24" Long split spoon sampler	Northing: / Easting: / NAD: / NGVD:
	Surface Elevation:
	Date Started: 8-19-09 / Date Completed: 8-19-09
Overburden Thickness: NA	Depth Groundwater Encountered: None
Depth to Bedrock: NA / Depth Drilled into Rock: NA	Depth to Water and Elapsed Time After Drilling Completed: —
Total Depth of Hole: 10 ft.	Other Water Level Measurements (Specify): —

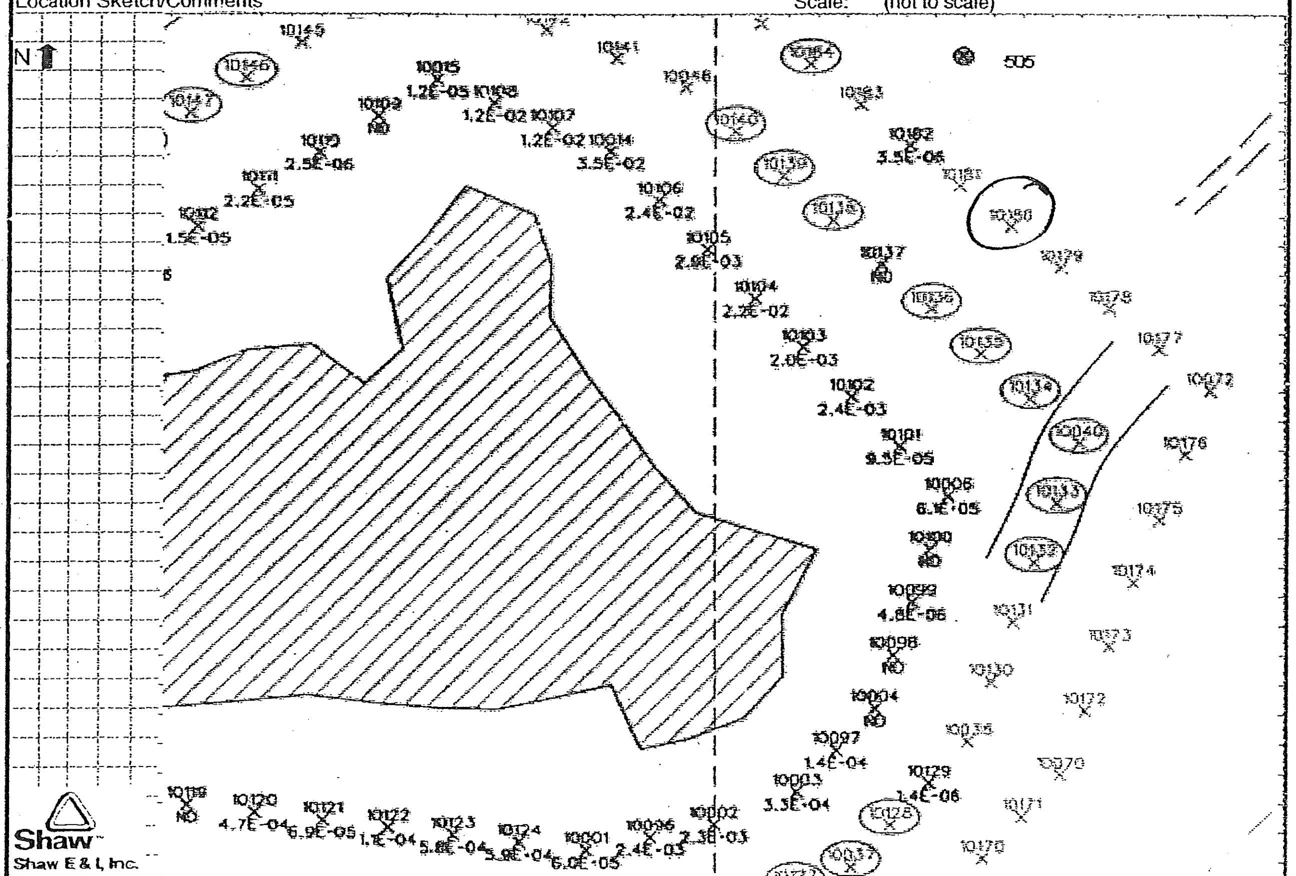
Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	[signature]

Location Sketch/Comments

Scale: (not to scale)



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Project PBOW 132458 PRRWP Soil Delineation	Hole Number PR10180

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Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10180

Project: PBOW | Geologist: E. Wilson | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown very fine grain SAND, moist loose	SP	NA		PR-0071		
	1	1.0' Black SILT, with very fine grain SAND, moist.	ML		1 (0-2) 1522		2.0	
		1.8' medium stiff. Yellowish brown ~~sandy~~ SILT with very fine grain SAND, moist ~~medium dense~~	ML					
	2							
	3				2 (2-4) 1525		1.7	O_2 - 20.8 H_2S - 0 CO - 0 LEL - 0 VOC - 0
	4							
	5				3 (4-6) 1533		1.7	
	6							
	7				4 (6-8) 1537		2.0	
	8	8.0' Gray SILT, trace very fine grain SAND, moist, ~~medium stiff~~	ML					
	9				5 (8-10)		2.0	
	10	Boring Complete @ 10 ft						

Project: PBOW | Hole Number: PR-10180

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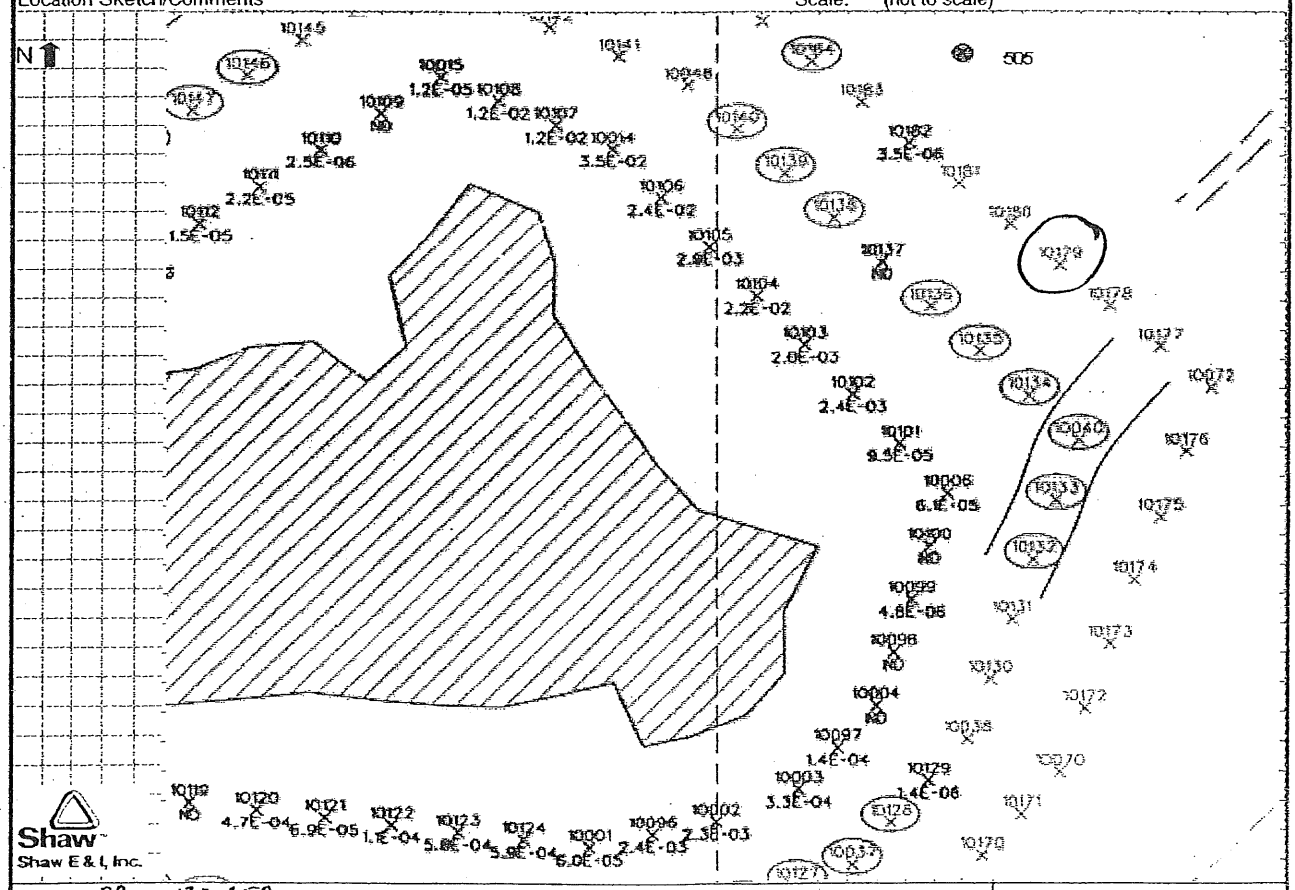
HTRW DRILLING LOG		District USACE Nashville	Hole Number: PR10179
Company Name Shaw E+I		Drilling Subcontractor Tri State Drilling	Sheet 1 of 2 Sheets
Project Plum Brook Ordnance Works - Sandusky, OH		Location Pentolite Road Redwater Pond	
Name of Driller Al Bisching		Manufacturer's Designation of Drill CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment	2" OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
		Surface Elevation	
		Date Started 8-19-09	Date Completed 8-19-09
Overburden Thickness NA		Depth Groundwater Encountered None	
Depth to Bedrock NA	Depth Drilled into Rock NA	Depth to Water and Elapsed Time After Drilling Completed —	
Total Depth of Hole 10 ft.		Other Water Level Measurements (Specify) —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	E. W. Weaver

Location Sketch/Comments Scale: (not to scale)



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Project PBOW 132458 PRRWP Soil Delineation	Hole Number PR10179

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HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10179

Project: PBOW | Geologist: [illegible] | Sheet 2 of 2 Sheets

Elev. (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown SILT, with Sand moist, med-dense.	ML	NA		PR-0070		
	1				1 (0-2) 1553		2.0	
	2	Yellowish brown very fine grain SAND, moist, loose.	SP					O_2 - 20.8
	3				2 (2-4) 1557		1.7	H_2S - 0 CO - 0 LEL - 0 VOC - 0
	4	Yellowish brown with gray SILT, trace very fine grain SAND, moist, medium stiff.	ML					
	5				3 (4-6) 1601		2.0	
	6							
	7				4 (6-8) 1605		2.0	
	8	Gray SILT with very fine grain SAND, moist, medium stiff,	ML					
	9				5 (8-10) 1609		1.2	
	10							

Project: PBOW Boring Complete @ 10 ft | Hole Number: PR-10179

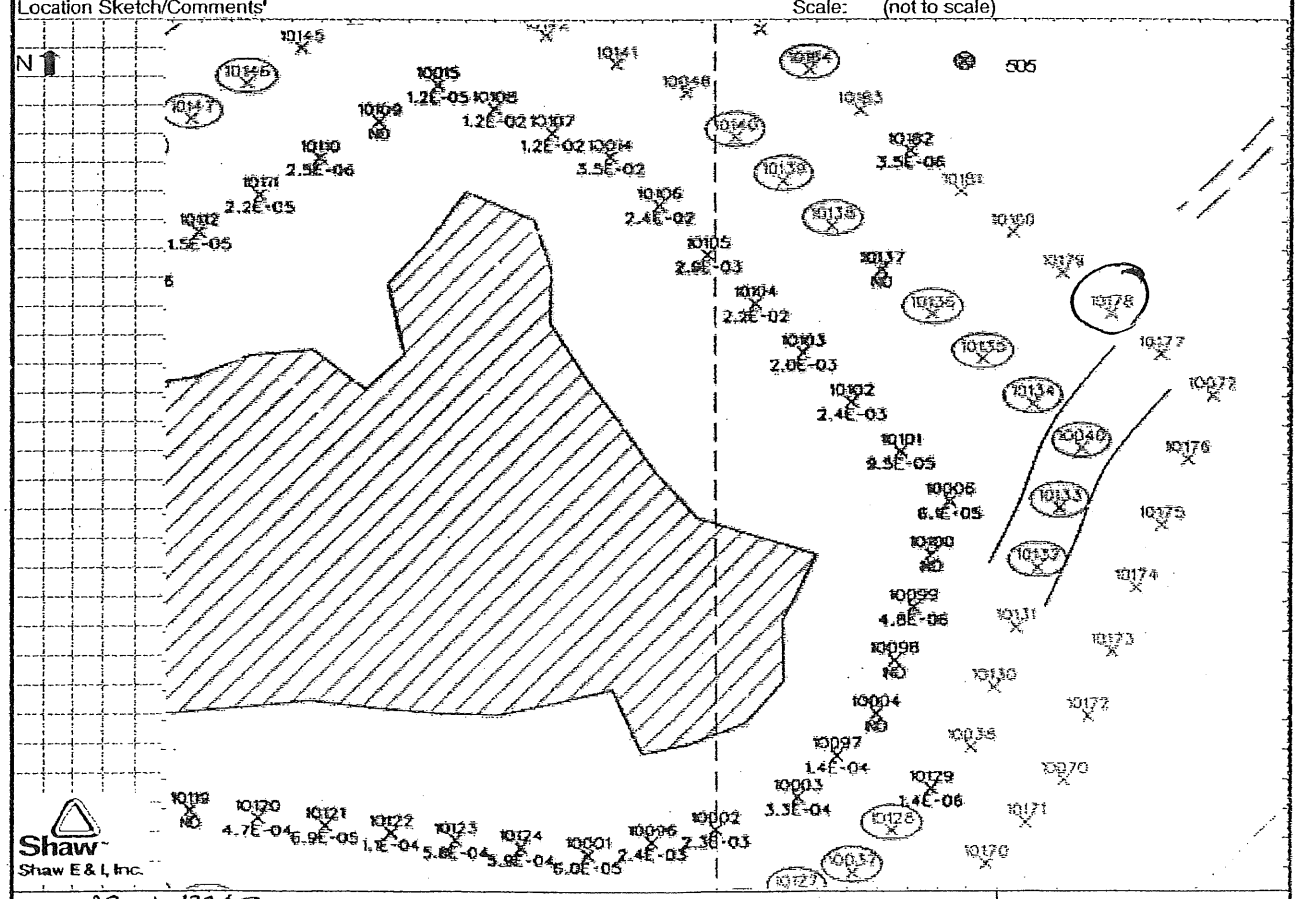
HTRW DRILLING LOG	District: USACE Nashville	Hole Number: PR10178A
Company Name: Shaw E+I	Drilling Subcontractor: Tri State Drilling	Sheet 1 of 2 Sheets
Project: Plum Brook Ordnance Works - Sandusky, OH	Location: Pentolite Road Redwater Pond	
Name of Driller: Al Bisching	Manufacturer's Designation of Drill: CME 55 Track	
Sizes and Types of Drilling and Sampling Equipment: 2" OD x 24" Long split spoon sampler	Northing / Easting / NAD / NGVD	
	Surface Elevation	
	Date Started: 8-19-09	Date Completed: 8-19-09
Overburden Thickness: NA	Depth Groundwater Encountered: None	
Depth to Bedrock: NA / Depth Drilled into Rock: NA	Depth to Water and Elapsed Time After Drilling Completed: —	
Total Depth of Hole: 10 ft.	Other Water Level Measurements (Specify): —	

Geotechnical Samples	Disturbed	Undisturbed	Total Number of Core Boxes
	—	—	—

Samples for Chemical Analysis	VOC	Metals	SVOCs	Lead	Other	Total Core Recovery
	—	—	—	—	Explosives	NA

Disposition of Hole	Backfilled	Monitoring Well	Other	Signature of Geologist
	yes	—	TEST PIT	Eric W. Weaver

Location Sketch/Comments Scale: (not to scale)



Project: PBOW 132458 PRRWP S.1 Delineation	Hole Number: PR10178A

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Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-10178A

Project: PBOW | Geologist: | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown fine grain SAND with SILT, moist, medium stiff	SP	NA		PR0073		
	1				1 (0-2) 1628		2.0	
		1.5' Yellowish brown/gray fine grain sand, moist, medium dense.	SP					
	2							
	3				2 (2-4) 1632		2.0	O_2 - 20.8
		3.5' Brown with yellowish brown very fine grain SAND, moist, medium dense.	SP					H_2S - 0
	4							CO - 0
	4.3	Yellowish brown with gray SILT, moist, medium stiff trace very fine grain sand	ML					LEL - 0
								VOC - 0
	5				3 (4-6) 1635		2.0	
	6							
	7				4 (6-8) 1639		2.0	
	8							
	9				5 (8-10) 1642		1.7	
		9.5' Gray SILT, trace very fine grain sand moist, medium stiff	ML					
	10							

Project: PBOW Boring Complete @ 10 Ft | Hole Number: PR-10178A

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HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PR-00507
SHEET / SHEETS	1 of 2
1. COMPANY NAME	Shaw EFI
2. DRILL SUBCONTRACTOR	Enviro Core
3. PROJECT	PBOW
4. LOCATION	PRRWP
5. NAME OF DRILLER	Jacob Gilliam
6. MANUFACTURER'S DESIGNATION OF DRILL	6620 DT Geoprobe
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	Geoprobe 6620 DT Rig 2.25" x 5' Long Macro Core with acetate liner
8. HOLE LOCATION	Westside of PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	10-21-09
11. DATE COMPLETED	10-21-09
12. OVERBURDEN THICKNESS	—
13. DEPTH DRILLED INTO ROCK	—
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	~5'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

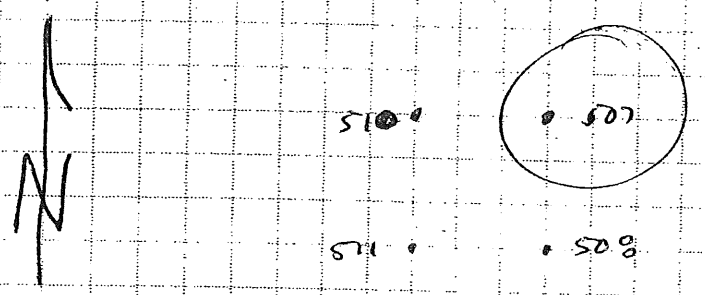
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	—	N. Inorganics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
backfilled	✓	—	—	[illegible]

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR00507

Shaw
Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR00507

Project: PBOW

Geologist: E. Werner

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	~~Geotech~~ Sample ~~or Core Box~~ No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark grayish brown (10YR 3/2) very fine grain SAND with Silt + trace organics (roots, weeds) moist,	SP		1 0-5' 1042		5'/5'	
	1							
		Dark yellowish brown (10YR 3/4) SILT w/very fine grain and medium grain sand, moist	ML					
	2							O_2 - 20.9%
								H_2S - 0
	3							CO - 0
		Dark yellowish brown (10YR, 3/4) CLAY with Silt and very fine grain Sand, moist, medium ~~dense~~ stiff,	CL					LEL - 0
								VOC - 0
	4							
	5							∇ groundwater
		Dark yellowish brown (10YR 3/4) SILT with fine grain sand and clay, ~~wet~~, ~~dense~~ stiff,			2 5-10' 1045		5'/5'	
	6							
	7							
	8							
	9							
	10							

Project: PBOW Boring Complete

Hole Number: PR-00507

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HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PR00508
SHEET / SHEETS	1 of 2
1. COMPANY NAME	Shaw E&I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW
4. LOCATION	PRRWP
5. NAME OF DRILLER	Jacob Gillam
6. MANUFACTURER'S DESIGNATION OF DRILL	6620 DT Geoprobe
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	6620 DT Geoprobe Rig. 2.25" x 5' Long Macro core with acetate liner
8. HOLE LOCATION	Westside of PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	10-21-09
11. DATE COMPLETED	10-21-09
12. OVERBURDEN THICKNESS	—
13. DEPTH DRILLED INTO ROCK	—
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	4'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

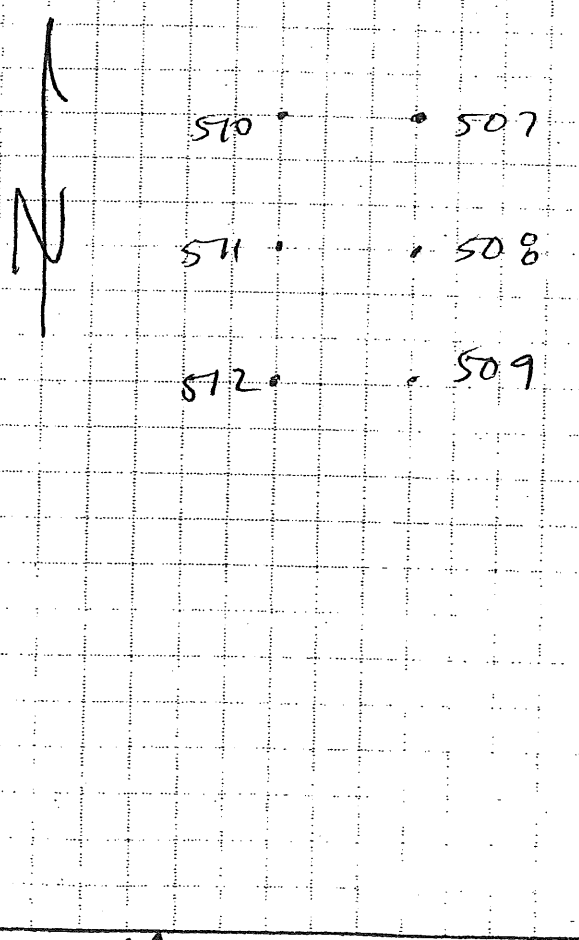
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	—	Nitroaromatics	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
backfilled	✓	—	—	L. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT	HOLE NO.
PBOW	PR-00508

Shaw
Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR 00508

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark grayish brown (10YR 3/2) very fine grain SAND with silt, moist, med. dense.	~~ML~~ SP		1 0-5' 1057			
	1	Very dark grayish brown (10YR 3/2) SILT with very fine gray sand, moist, medium stiff.	ML				2.6'/5.0'	
	2							O_2 - 20.8
								H_2S - 0
	3							CO - 0
								LEL - 0
								VOC - 0
	4	Dark yellowish brown (10YR 4/6) ~~Very~~ fine grain SAND with silt, trace clay, wet, medium dense.	SP					
	5				2 5'-10' 1059		5'/5'	
	6	Brown Silty CLAY (10YR 4/3) with fine grain Sand, wet, stiff. (intermittent sand lens to 10')						
	7							
	8							
	9							
	10							

Project: PBOW Boring Complete

Hole Number: PR-00508

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HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PR-00509
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW
4. LOCATION	PRRWP
5. NAME OF DRILLER	Jacob Gilliam
6. MANUFACTURER'S DESIGNATION OF DRILL	6620 DT Geoprobe
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	Geoprobe 6620 DT Rig 2.25" x 5' Long Macrocore with Acetate liner.
8. HOLE LOCATION	West side of PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	10-21-09
11. DATE COMPLETED	10-21-09
12. OVERBURDEN THICKNESS	—
13. DEPTH DRILLED INTO ROCK	—
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	~5'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

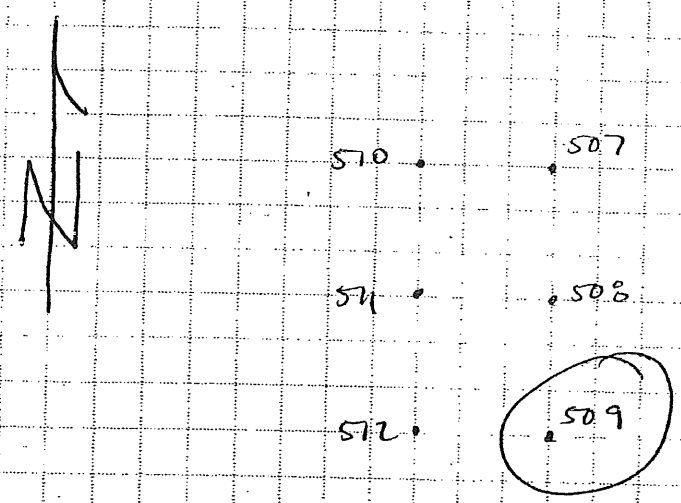
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	—	N. Aromatics	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Backfilled	✓	—	—	Eric W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00509

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00509

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Dark yellowish brown (10YR 4/4) fine grain SAND with silt, moist, ~~dry~~ loose.	SP		1 0-5' 1110		3.5' 5.0'	
	2	Very dark grayish brown (10YR 3/2) SILT with fine grain Sand, moist, medium stiff.	ML					O_2 - 20.8 H_2S - 0 CO - 0 LEL - 0 VOC - 0
	3 4 5	Dark yellowish brown (10YR 4/6) Silty CLAY with fine grain Sand, moist, medium stiff.	CL					
	6 7	Brown (10YR 4/3) Clayey SILT with fine grain Sand, wet, ~~[illegible]~~ stiff, (intermittent Sand lenses to 10')	ML		2 5'-10' 1114		5'/5'	
	8 9 10							

Project: PBOW Boring Complete

Hole Number: PR-00509

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HTRW DRILLING LOG

DISTRICT: Nashville		HOLE NUMBER: PR-00512
1. COMPANY NAME: Shaw E&I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW	4. LOCATION: PRRWP	
5. NAME OF DRILLER: Jacob Gilliam	6. MANUFACTURER'S DESIGNATION OF DRILL: 6620 DT Geoprobe	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620DT Rig 2.25"x5' Long MacroCore With Acetate Liner.	8. HOLE LOCATION: West side of PRRWP	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 10-21-09	11. DATE COMPLETED: 10-21-09
12. OVERBURDEN THICKNESS: —	15. DEPTH GROUNDWATER ENCOUNTERED: ~6'	
13. DEPTH DRILLED INTO ROCK: —	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

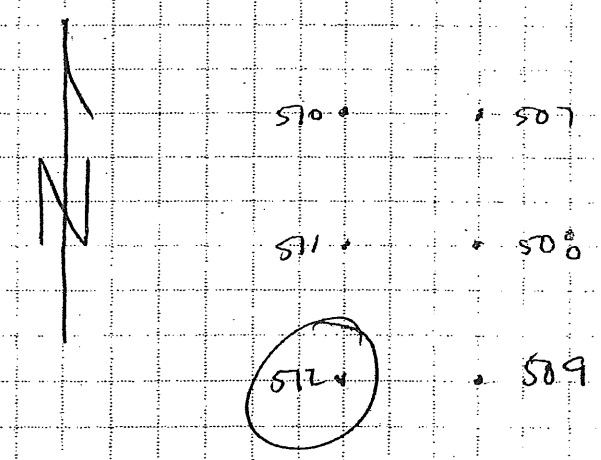
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	—	Nitro Aro. & 25	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
✓	✓	—	—	E. W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00512

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00512

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark Gray (10YR 3/1) SILT with fine grain SAND, moist, loose.	ML		1			
	1	~~Grading to dark brown (10YR 3/2) 0.9'~~			0-5'		2.5	
					M47		5.0	
								O_2 - 20.8%
	2	Dark gray (10YR 3/2) fine grain SAND, with silt, trace clay, moist, medium dense.	SP					H_2S - 0
								CO - 0
								LEL - 0
	3							VOC - 0
	4							
	5							
		Brown (10YR 5/3) SILT with fine sand and clay, moist, medium stiff.	ML		2			
	6	-wet at 6'.			5'-10'		5.0'	
		(intermittent sand lenses to 10').			M53		5.0'	
	7							
	8							
	9							
	10							

Project: PBOW Boring Complete

Hole Number: PR-00512

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HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PR-00511
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E&I
2. DRILL SUBCONTRACTOR	EnviroCore Limited
3. PROJECT	PBOW
4. LOCATION	PRRWP
5. NAME OF DRILLER	Jacob Gilliam
6. MANUFACTURER'S DESIGNATION OF DRILL	6620 DT Geoprobe
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	Geoprobe 6620DT Rig 2.25" X 5' Long MacroCore with Acetate liner
8. HOLE LOCATION	West side of PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	10-21-09
11. DATE COMPLETED	10-21-09
12. OVERBURDEN THICKNESS	—
15. DEPTH GROUNDWATER ENCOUNTERED	N 6'
13. DEPTH DRILLED INTO ROCK	—
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

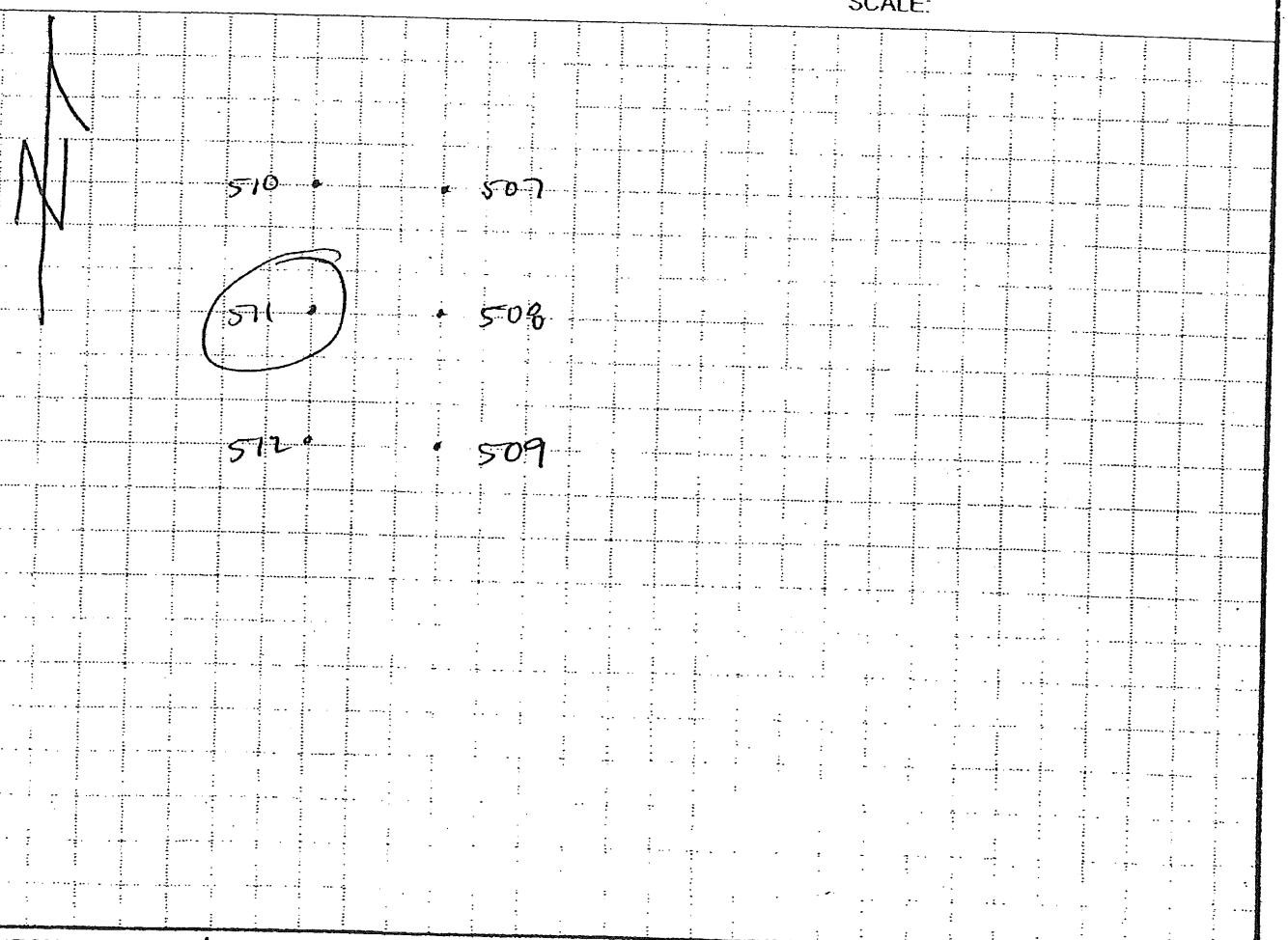
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	—	Nitroaromatics	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Backfilled	✓	—	—	E. W. Weaver

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT PBOW

HOLE NO. PR-00511

Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00571

Project: PBOW | Geologist: E. Weaver | Sheet 2 of Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Very dark gray (10YR 3/1) SILT with fine grain Sand, noted (roots + weeds) organics, moist, loose.	ML		1 0-5' 1350		2.7/5.0	O_2 - 20.8 H_2S - 0 CO - 13 LEL - 0 VOC - 4.6
	2	Dark yellowish brown (10YR 4/6) fine grain SAND with silt, moist, medium stiff.	SP					
	3							
	4							
	5				2 5'-10' 1350		5.0'/5.0'	
	6	Brown (10YR 4/3) SILT with fine grain Sand, trace Clay, wet, medium stiff. (Intermittent sand lenses to 10'.)	ML					
	7							
	8							
	9							
	0							

Project: PBOW | Hole Number: PR-00571

HTRW DRILLING LOG

1. COMPANY NAME	Shaw E&I
DISTRICT	Nashville
HOLE NUMBER	PR-00572
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / OF / SHEETS	1 of 2
3. PROJECT	PBOW
4. LOCATION	PRRWP
5. NAME OF DRILLER	Jacob Gilliam
6. MANUFACTURER'S DESIGNATION OF DRILL	6620 DT Geoprobe
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	Geoprobe 6620 DT Rig 2.25" x 5' Long Macrocore with Acetate Liner
8. HOLE LOCATION	Westside of PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	10-21-09
11. DATE COMPLETED	10-21-09
12. OVERBURDEN THICKNESS	—
15. DEPTH GROUNDWATER ENCOUNTERED	~6'
13. DEPTH DRILLED INTO ROCK	—
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

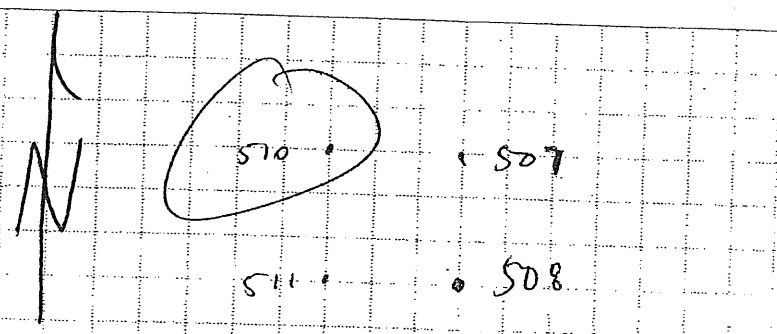
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
✓	✓	—	—	L. W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00572

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00572

Project: PBOW

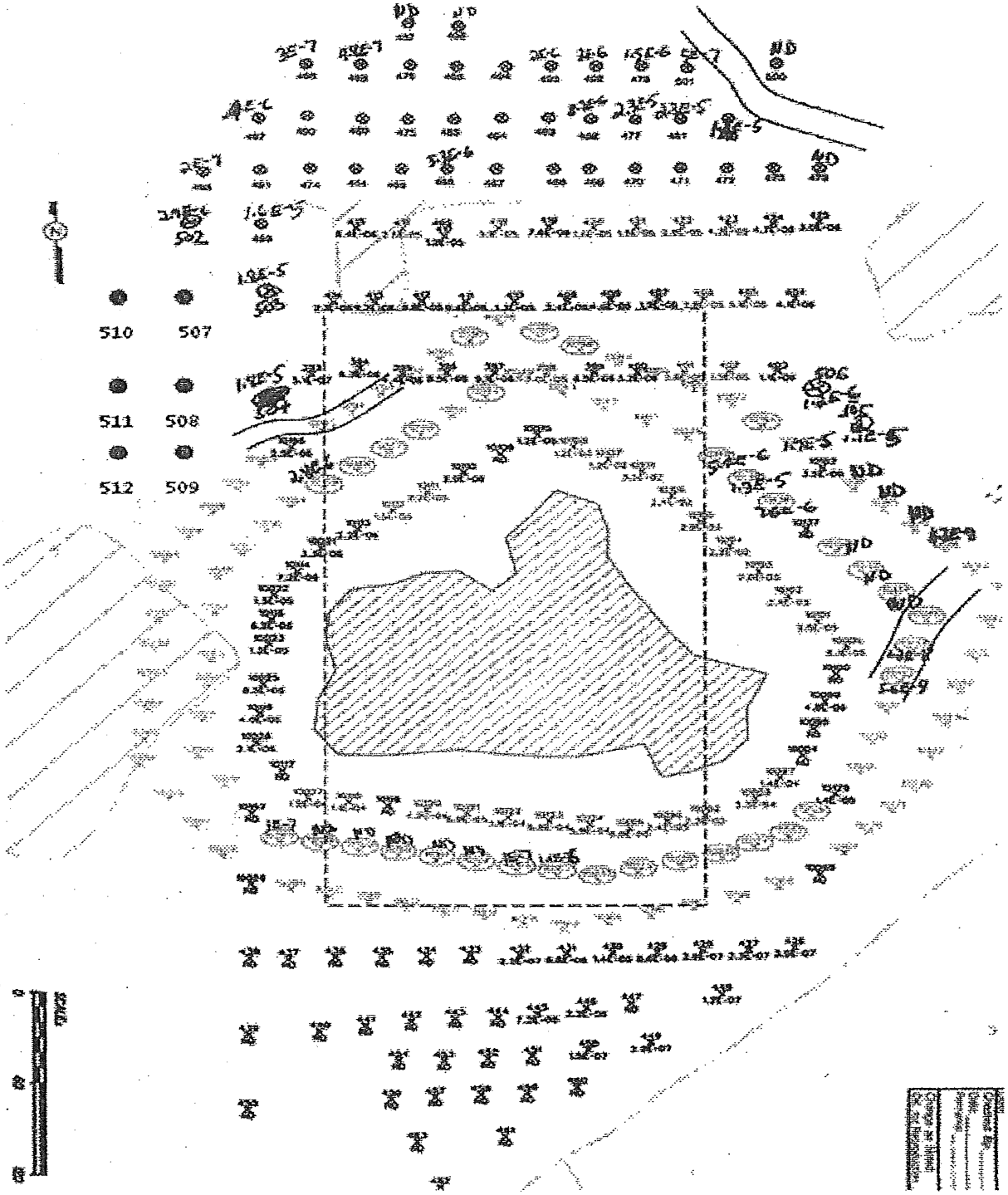
Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Very dark grayish brown (10YR 3/2) SILT with fine grain Sand, noted organics (weeds, roots) moist, loose.	ML		1 0-5' 1410		4.5'/5.0'	O_2 - 20.8 H_2S - 0 CO - 7 LEL - 0 VOC - 7.1
	2	Dark yellowish brown (10YR 3/4) fine grain SAND with Silt, moist, medium dense.	SP					
	3	Brown (10YR 5/3) SILT with fine grain Sand, trace Clay moist, medium stiff.	ML					
	4							
	5				2 5'-10' 1415		5.0'/5.0'	
	6	-wet						
	7							
	8	Dark gray (10YR 4/1) Clayey SILT, with fine grain Sand, wet, stiff. Intermittent sand lenses to 10'.	ML					
	9							
	10							

Project: PBOW Boring

Hole Number: PR-00572


510
507
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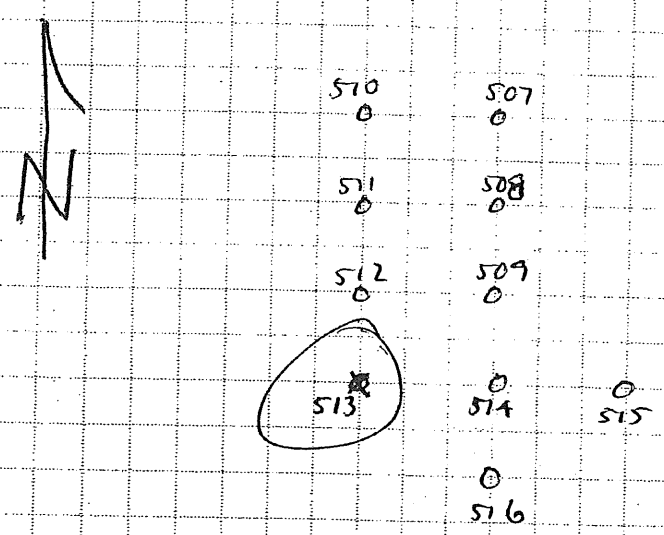
HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PR-00513
SHEET / SHEETS	1 of 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	—
3. PROJECT	Pentolite Road Redwater Pond
4. LOCATION	PBOW - Sandusky, Ohio
5. NAME OF DRILLER	Joe Baltz
6. MANUFACTURER'S DESIGNATION OF DRILL	Hand auger
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	3" bucket auger
8. HOLE LOCATION	PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	11-19-09
11. DATE COMPLETED	11-19-09
12. OVERBURDEN THICKNESS	—
13. DEPTH DRILLED INTO ROCK	—
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	~6.5'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—
18. GEOTECHNICAL SAMPLES	—
DISTURBED	—
UNDISTURBED	—
19. TOTAL NUMBER OF CORE BOXES	—
20. SAMPLES FOR CHEMICAL ANALYSIS	—
VOC	—
METALS	—
OTHER (SPECIFY)	—
OTHER (SPECIFY)	—
OTHER (SPECIFY)	—
21. TOTAL CORE RECOVERY	— %
22. DISPOSITION OF HOLE	backfilled
BACKFILLED	✓
MONITORING WELL	—
OTHER (SPECIFY)	—
23. SIGNATURE OF INSPECTOR	E. W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00513

Shaw
Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00573

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark gray (10YR 3/1), Silty CLAY trace sand, loose, moist.	CL		PR-00573	PR00573		
	1							
	2	2.0' Yellowish brown (10YR 5/4), Silty CLAY with sand, moist medium stiff.						
	3							
	4							
	5							
	6							
		wet						
	7							
	8							
	9	9.0' Yellowish brown (10YR 4/6) very fine grain SAND with silt, wet, medium dense.	SP					
	10	Bore hole complete						

Project: PBOW

Hole Number: PR-00573

HTRW DRILLING LOG

1. COMPANY NAME	Shaw E+I
DISTRICT	Nashville
2. DRILL SUBCONTRACTOR	—
HOLE NUMBER	PR-00514
SHEET / SHEETS	1 OF 2
3. PROJECT	Pentolite Road Red Water Pond
4. LOCATION	PBOW - Sandusky, Ohio
5. NAME OF DRILLER	Joe Baltz
6. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	3" bucket auger
8. HOLE LOCATION	PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	11-19-09
11. DATE COMPLETED	11-19-09
12. OVERBURDEN THICKNESS	—
13. DEPTH DRILLED INTO ROCK	—
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	~6.0'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

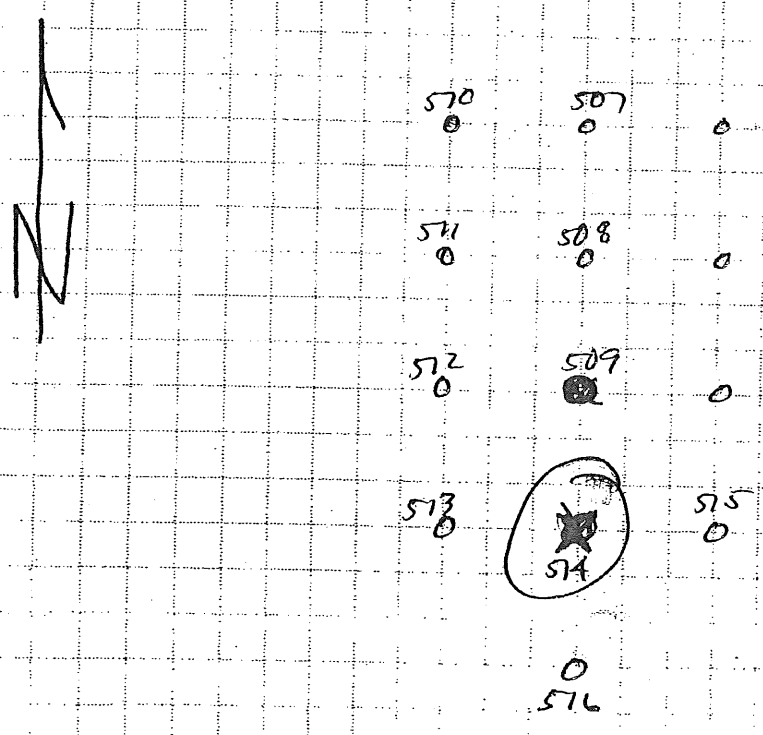
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	%

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
backfilled	✓	—	—	E. W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00514

Shaw
Shaw E&I Inc

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00514

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark gray (10YR 3/1) silty CLAY with sand, moist-medium stiff.	CL			PR-00514		
	1							
		1.5'						
		Yellowish brown (10YR 5/4) silty CLAY with sand, moist, medium stiff.						
	2							
	3							
	4							
	5							
	6	— wet						
	7							
	8							
	9							
	10	Boring Complete						

Project: PBOW

Hole Number: PR-00514

HTRW DRILLING LOG

1. COMPANY NAME	Shaw E&I
DISTRICT	Nashville
2. DRILL SUBCONTRACTOR	—
HOLE NUMBER	PR-00515
SHEET / SHEETS	1 OF 2
3. PROJECT	Pentolite Road Red Water Pond
4. LOCATION	PBOW - Sandusky, Ohio
5. NAME OF DRILLER	Joe Baltz
6. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	3" bucket auger
8. HOLE LOCATION	PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	11-19-09
11. DATE COMPLETED	11-19-09
12. OVERBURDEN THICKNESS	—
15. DEPTH GROUNDWATER ENCOUNTERED	~ 6.0'
13. DEPTH DRILLED INTO ROCK	—
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

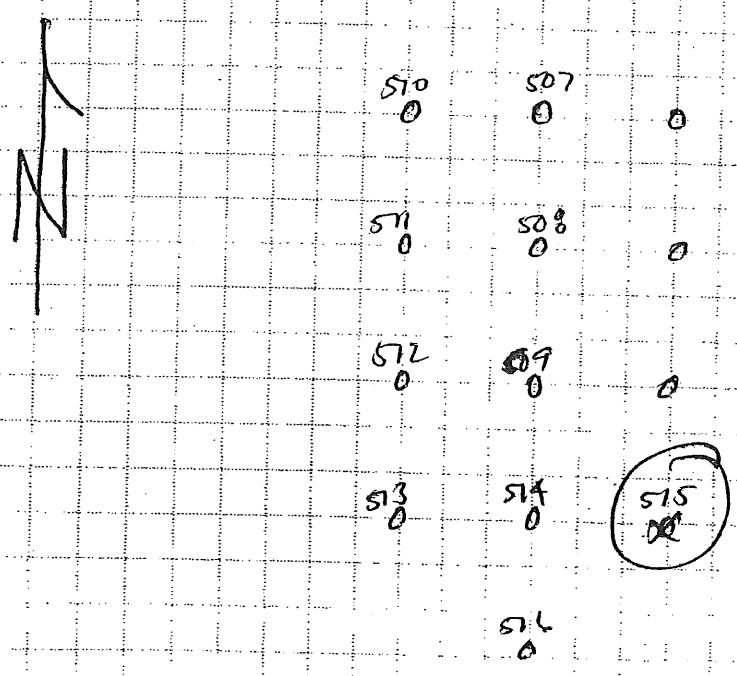
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
backfilled	✓	—	—	Eric W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00515

Shaw
Shaw E&I Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR00515

Project: PBOW

Geologist: E Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark yellowish brown (10YR 4/4) Silty Sandy CLAY, moist medium stiff.	CL			PR-00515		
	1							
		1.5						
		Yellowish brown (10YR 5/4) Silty CLAY with Sand, moist. medium stiff						
	2							
	3							
	4							
	5							
	6	wet						
	7							
	8							
	9							
		Yellowish brown (10YR 5/4) Silty clayey SAND, wet, medium dense	SP					
	10							

Project: PBOW

Hole Number: PR-00515

HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PR-00516
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	—
3. PROJECT	Pentolite Road Red Water Pond
4. LOCATION	PBOW - Sandusky, Ohio
5. NAME OF DRILLER	Joe Baltz
6. MANUFACTURER'S DESIGNATION OF DRILL	Hand Auger
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	3" bucket auger
8. HOLE LOCATION	PRRWP
9. SURFACE ELEVATION	
10. DATE STARTED	11-19-09
11. DATE COMPLETED	11-19-09
12. OVERBURDEN THICKNESS	—
13. DEPTH DRILLED INTO ROCK	—
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	~7.5'
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

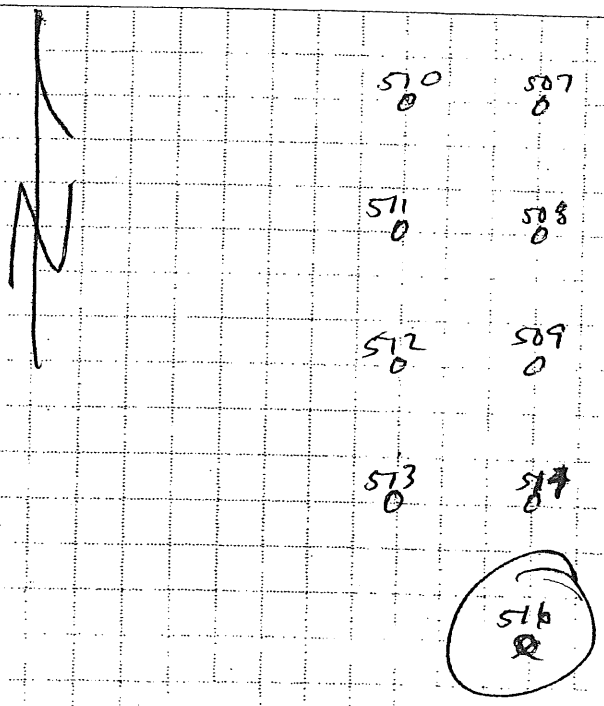
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
—	—	—	—	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
backfilled	✓	—	—	E.W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. PR-00516

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: PR-00516

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark gray (10YR 3/1) silty CLAY with sand, moist, medium stiff.	CL			PR-00516		
	1							
		1.5'						
		Yellowish brown (10YR 5/4) ~~very fine grained SAND~~ silty CLAY with sand moist, medium stiff.	CL					
	2							
	3							
	4							
	5							
	6							
	7							
		wet						
	8							
		9.0'						
	9	Yellowish brown (10YR 4/6) very fine grain SAND, wet, medium dense	SP					
	10							

Project: PBOW

Hole Number: PR-00516

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HTRW DRILLING LOG

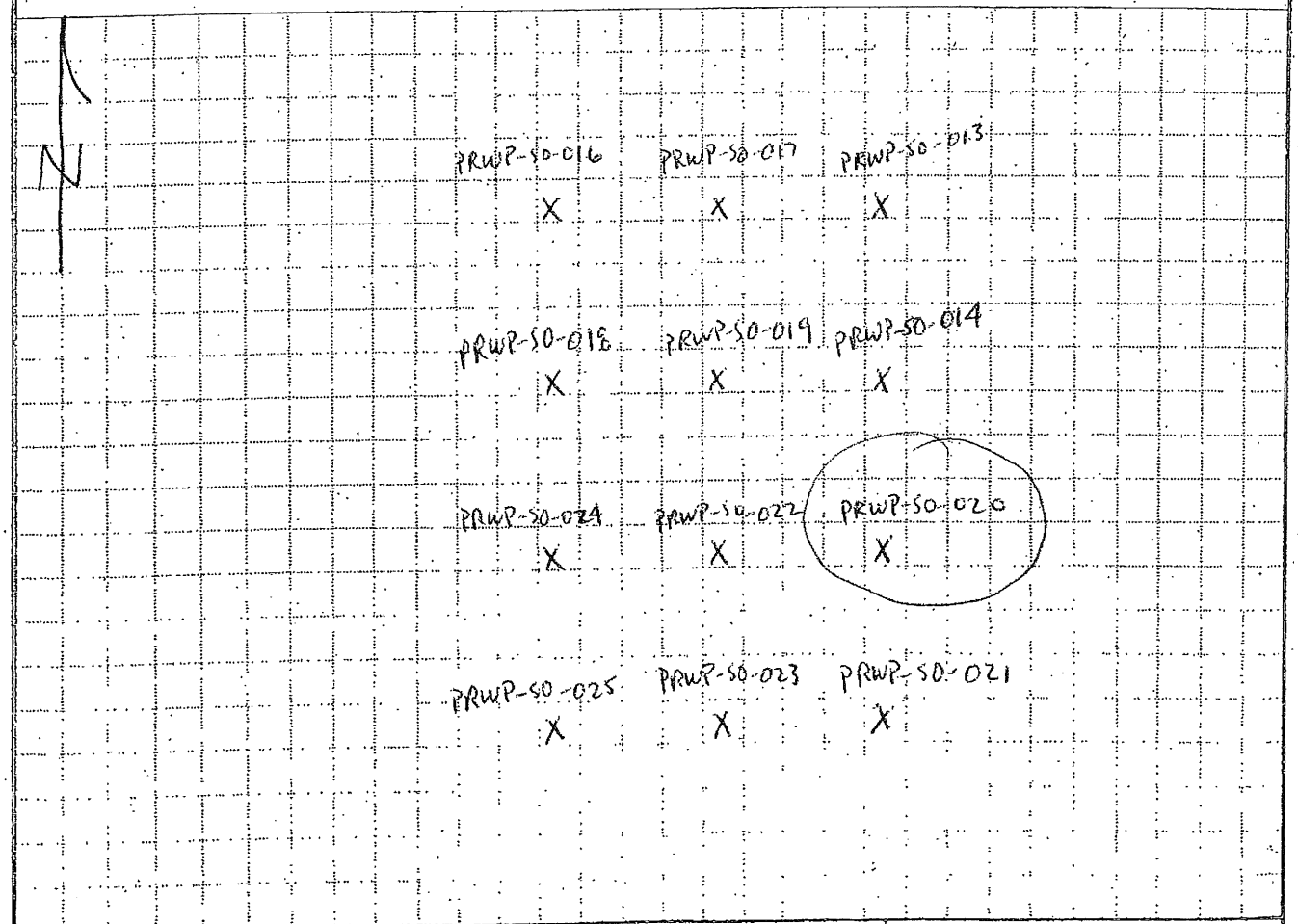
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-020	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-8-10	11. DATE COMPLETED: 11-8-10
12. OVERBURDEN THICKNESS: >10'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-020

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-020.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10YR 4/3) fine grain. sand with silt, trace organics, moist, loose	SM					
	1	1.3'				PRWP-SO-020 (1'-10')		
		Black (10YR 2/1) silt with sand, trace clay, moist, medium stiff.	ML				4.5'/5.0'	
	2							
	3	3.2'						
		Dark yellowish brown (10YR 3/4) clay with silt, trace sand, moist, medium stiff.	CL					
	4							
	5							
		— wet at 5.5'						
	6						5.0'/5.0'	
	7							
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-020

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HTRW DRILLING LOG

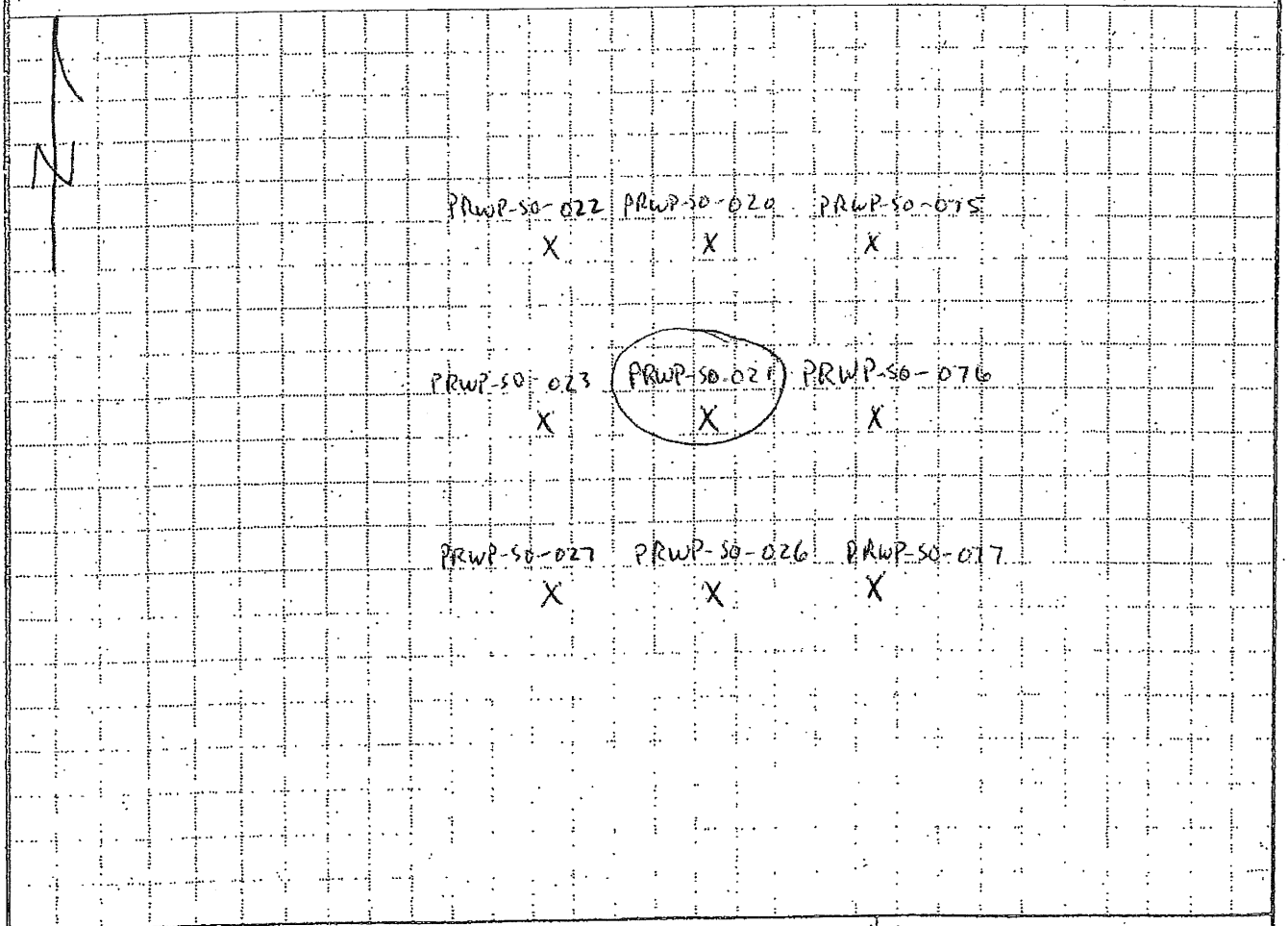
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-021
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-8-10	11. DATE COMPLETED: 11-8-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-021

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-021

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10yR 2/2) Sand with silt, trace organics, moist loose, 0.5'	SM					
	1	Black (10yR 2/1) silt with sand, trace clay, moist, medium stiff.	ML			PRWP-SO-021 (1'-10')		
	2	2.0' Dark yellowish brown (10yR 3/4) Sand with silt, trace clay, moist, medium stiff.	SM				4.5'/5.0'	
	3							
	4							
	5	— wet at 5.5'						
	6							
	7						5.0'/5.0'	
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-021

HTRW DRILLING LOG

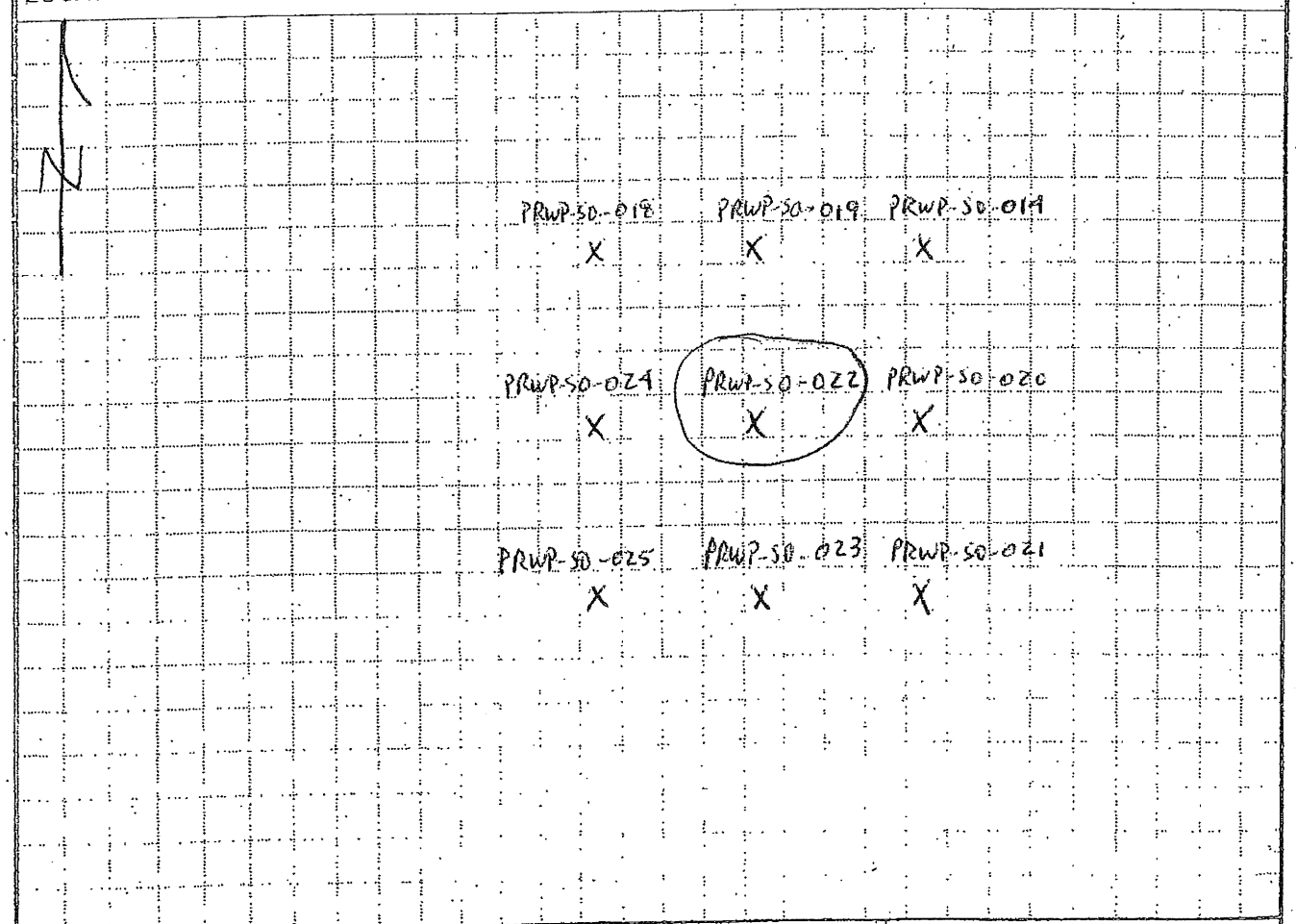
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-022
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-8-10	11. DATE COMPLETED: 11-8-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-022

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-022.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Very dark brown (10yR2/2) Silt with sand, trace organics, moist, soft. 2.0'	ML			PRWP-SO-022 (1'-10')		
	2	Dark yellowish brown (10yR4/6) sand with silt, trace clay, moist, soft. 3.0'	SM				4.5'/5.0'	
	3	Dark yellowish brown (10yR4/6) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5	- wet at 5.5'						
	6							
	7						5.0'/5.0	
	8							
	9	9.0' Very dark grayish brown (10yR3/2) Clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-022

HTRW DRILLING LOG

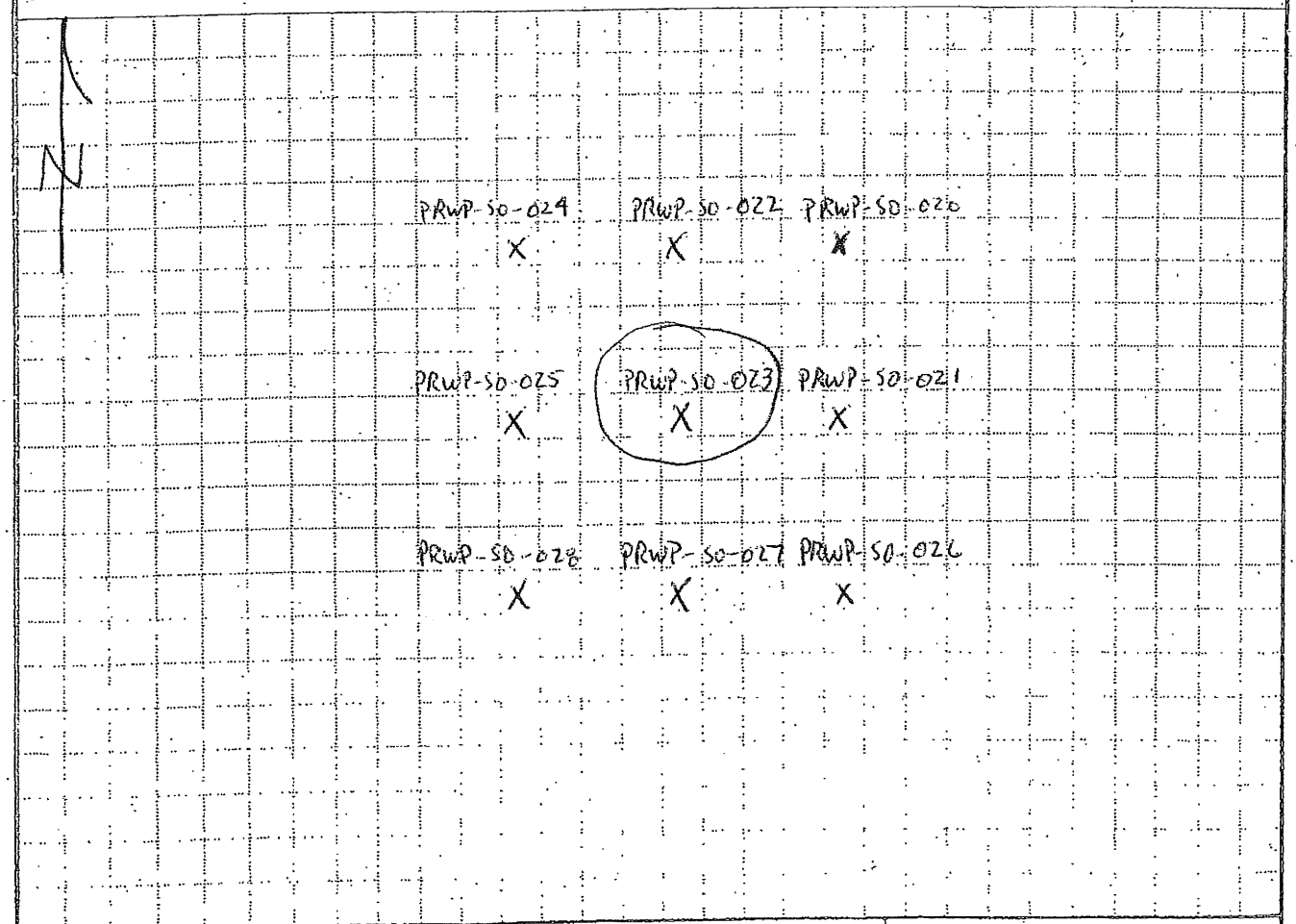
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-023
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-8-10
11. DATE COMPLETED	11-8-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-023

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-023.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) fine grain sand with silt, trace organics, moist, loose.	SM					
	1	1.3'				PRWP-SO-023 (1'-10')		
		Very dark brown (10YR 2/2) Silt with sand, clay, moist, medium stiff.	ML					
	2	2.4'					4.5'/5.0'	
		Dark yellowish brown (10YR 4/6) Silt with clay, sand, moist, medium stiff.						
	3							
	4							
	5							
		- wet at 5.5'						
	6						5.0'/5.0'	
	7							
	8							
	9	9.0'						
		Very dark grayish brown (10YR 3/2) clay with silt, moist, medium stiff.	CL					
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-023

HTRW DRILLING LOG

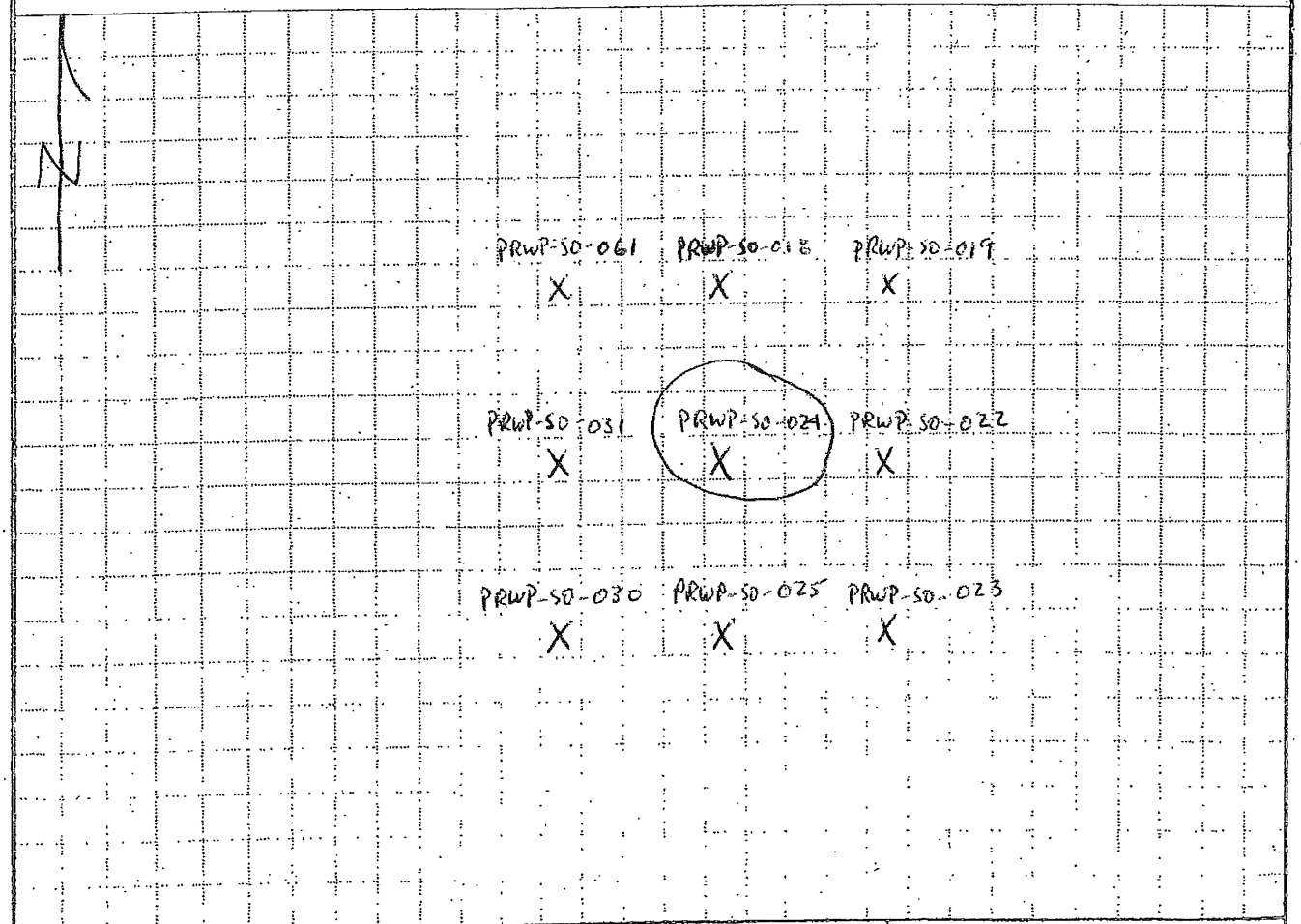
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-024
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-8-10	11. DATE COMPLETED: 11-8-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-024

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-024

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Very dark brown (10YR 2/2) Silt with fine grain sand, trace organics, moist, soft. 1.3'	ML					
						PRWP-SO-024 (1'-10')		
	2	Dark yellowish brown (10YR 4/6) fine grain sand with silt, moist, loose. 2.5'	SM				4.5/5.0	
	3	Brown (10YR 4/3) Silt with clay, fine grain sand, moist, medium stiff.	ML					
	4							
	5							
		- wet at 5.5'						
	6							
	7						5.0/5.0	
	8							
	9	Very dark grayish brown (10YR 3/2) Clay with silt, fine grain sand, moist, medium stiff.	CL					
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-024

HTRW DRILLING LOG

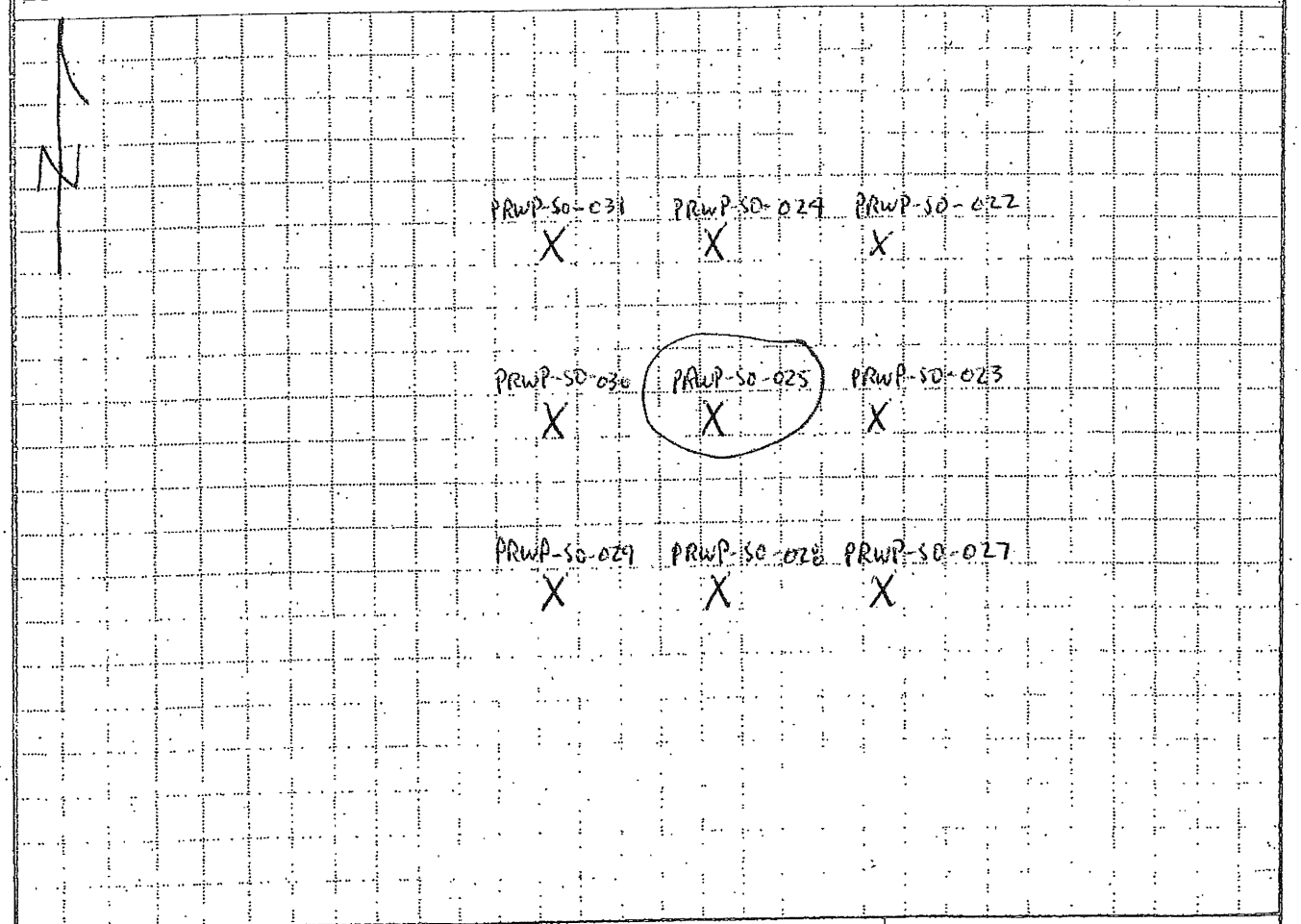
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-025	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-8-10	11. DATE COMPLETED: 11-8-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO: PRWP-SO-025

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-025

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Black (10YR2/1) Silt with sand, trace clay, moist, soft. 1.0'	ML					
	1	Dark yellowish brown (10YR4/6) fine grain Sand with silt, moist, loose. 2.8'	SM			PRWP-SO-025 (1'-10')	4.5'/5.0'	
	2							
	3	Dark yellowish brown (10YR4/6) clay with silt, trace sand, moist, medium stiff. 4.0'	CL					
	4	Brown (10YR4/3) Silt with clay, trace fine grain sand, moist, medium stiff.	ML					
	5	—wet at 5.5'						
	6						5.0'/5.0'	
	7							
	8							
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-025

HTRW DRILLING LOG

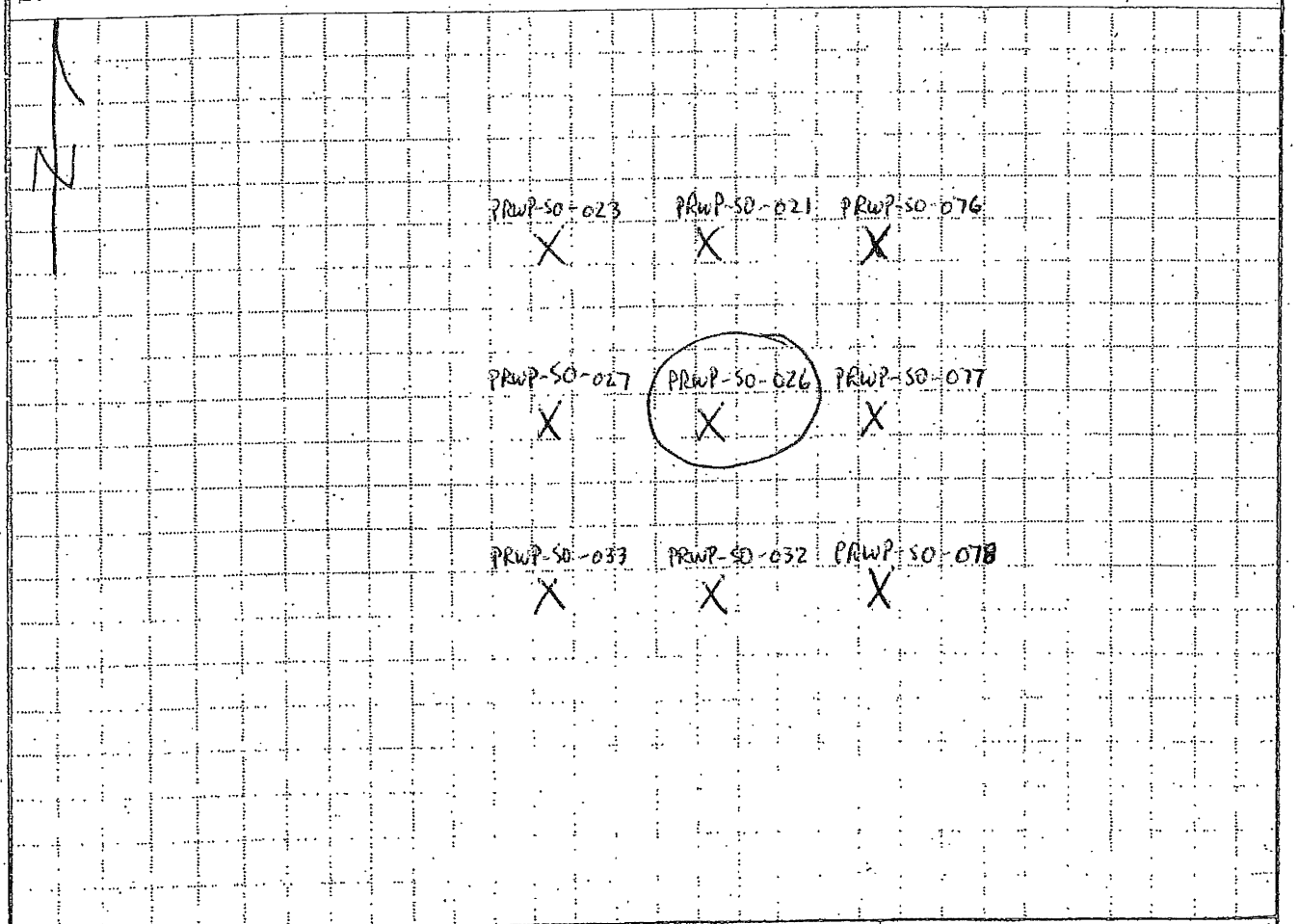
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-026
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-9-10
11. DATE COMPLETED	11-9-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-026

Figure 4-2
Drilling Log

Shaw Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-026

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) fine grain sand with silt, organics, moist, loose 0.9'	SM					
	1	Very dark brown (10yR 2/2) silt with fine grain sand, moist, medium stiff 2.1'	ML			PRWP-SO-026 (1'-10')	4.5'/5.0'	
	2	Very dark brown (10yR 2/2) clay with silt, sand, very moist, soft. 2.9'	CL					
	3	Brown (10yR 4/3) clay with silt, sand, wet, soft.						
	4							
	5							
	6						5.0'/5.0'	
	7							
	8							
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-026

HTRW DRILLING LOG

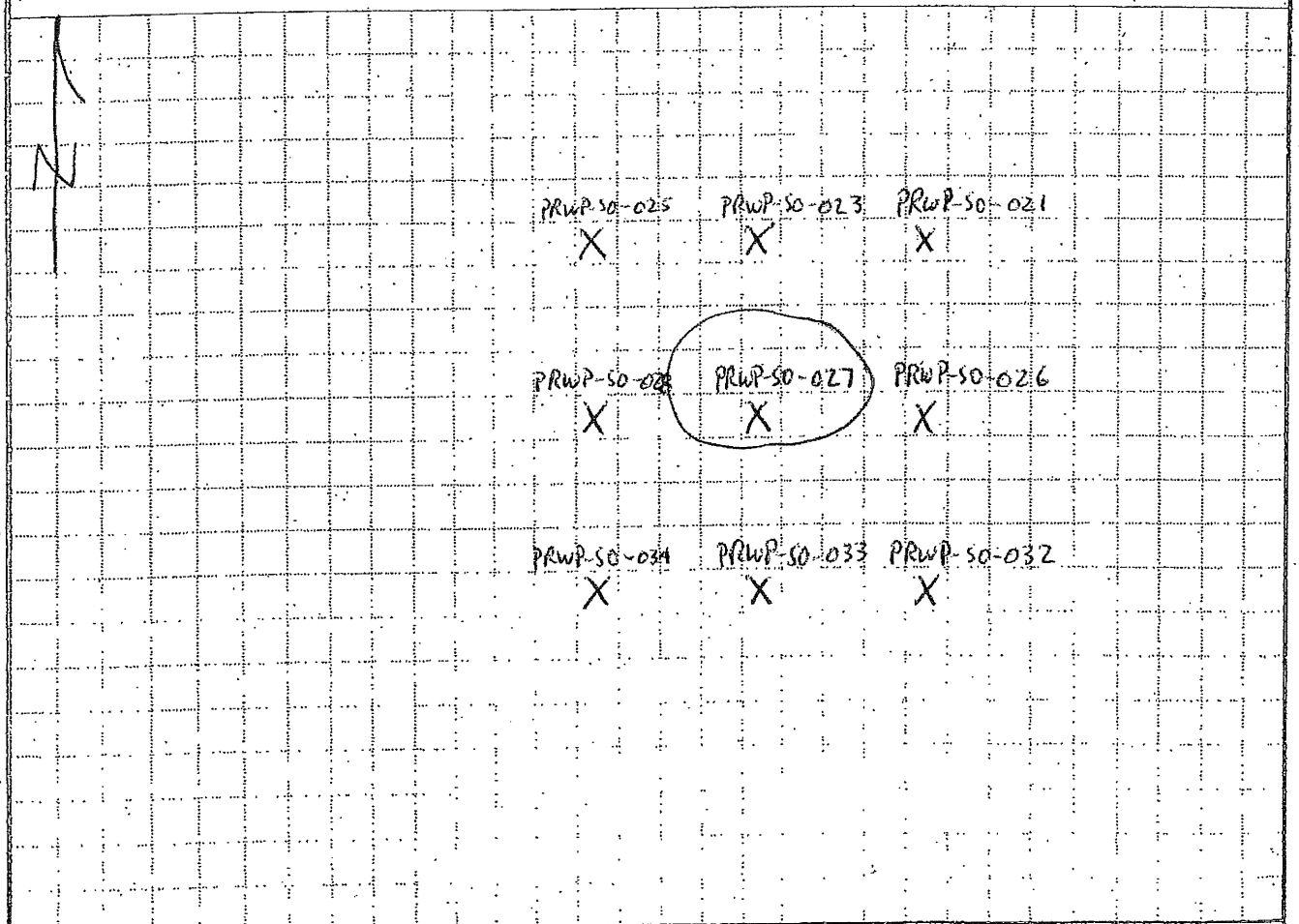
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-027	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-9-10	11. DATE COMPLETED: 11-9-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT PBOW-PRRWP — HOLE NO. PRWP-SO-027

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-027

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) fine grain sand with silt, organics, moist, loose. 1.1'	SM					
	1	Very dark brown (10YR 2/2) silt with fine grain sand, moist, medium stiff. 2.1'	ML			PRWP-SO-027 (1'-10')		
	2	Dark yellowish brown (10YR 4/6) clay with silt, sand, wet, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
	9	9.0' Dark grayish brown (10YR 4/2) silt with clay, sand, wet, medium stiff.	ML					
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-027

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HTRW DRILLING LOG

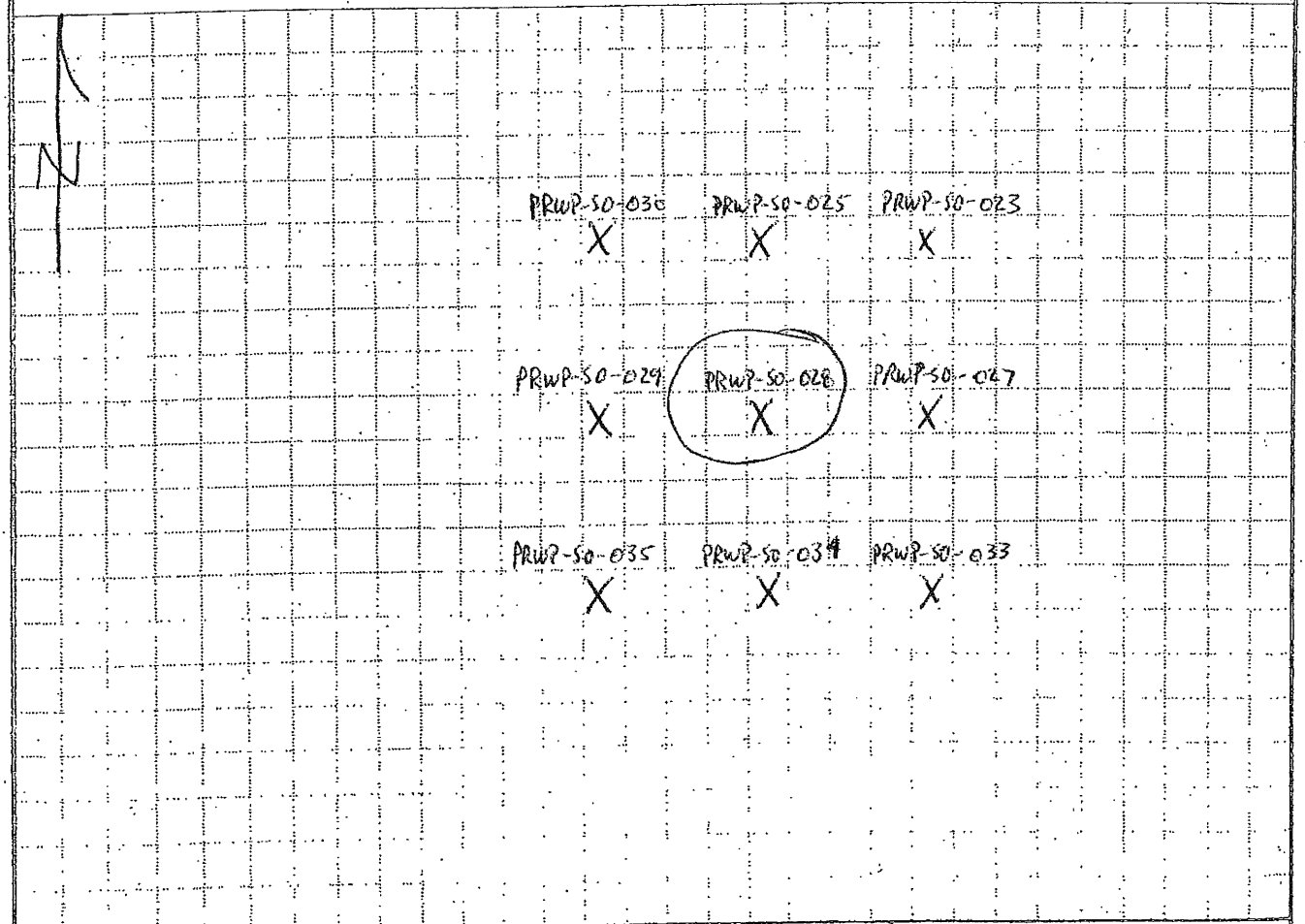
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-028
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-9-10
11. DATE COMPLETED	11-9-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-028

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-028

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) fine grain sand with silt, organics, moist, loose. 0.5'	SM					
	1	Very dark brown (10yR 2/2) silt with fine grain sand, trace clay, moist, medium stiff. 1.2'	ML					
	2	Dark yellowish brown (10yR 4/6) fine grain sand with silt, clay, moist, medium dense. 2.6'	SM			PRWP-SO-028 (1'-10')	4.5'/5.0'	
	3	Dark yellowish brown (10yR 3/6) silt with clay, sand, moist, medium stiff. 6.5'	ML					
	7	Dark grayish brown (10yR 4/2) silt with clay, sand, moist, medium stiff.					5.0'/5.0	
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-028

HTRW DRILLING LOG

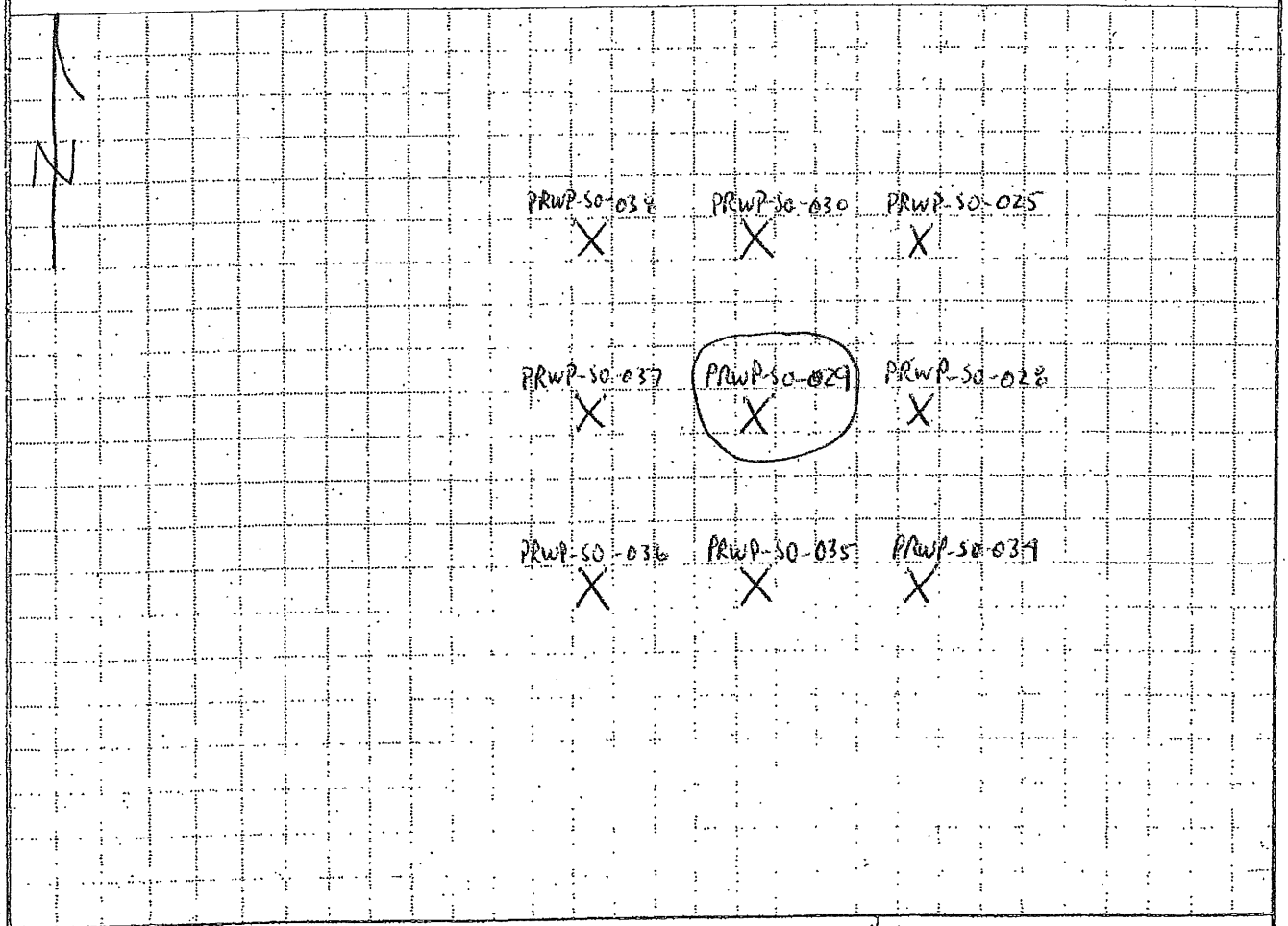
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-029	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-9-10	11. DATE COMPLETED: 11-9-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-029

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-029

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10YR 2/2) Sand with silt, organics, moist, loose. 0.6'	SM					
	1	Brown (10YR 4/3) Sand with silt, moist, loose. 1.8'				PRWP-SO-029 (1'-10')		
	2	Dark yellowish brown (10YR 4/6) Sand with silt, clay, moist, medium dense. 2.9'					4.5'/5.0'	
	3	Brown (10YR 4/3) Silt with clay, sand, moist, medium stiff.	ML					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-029

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HTRW DRILLING LOG

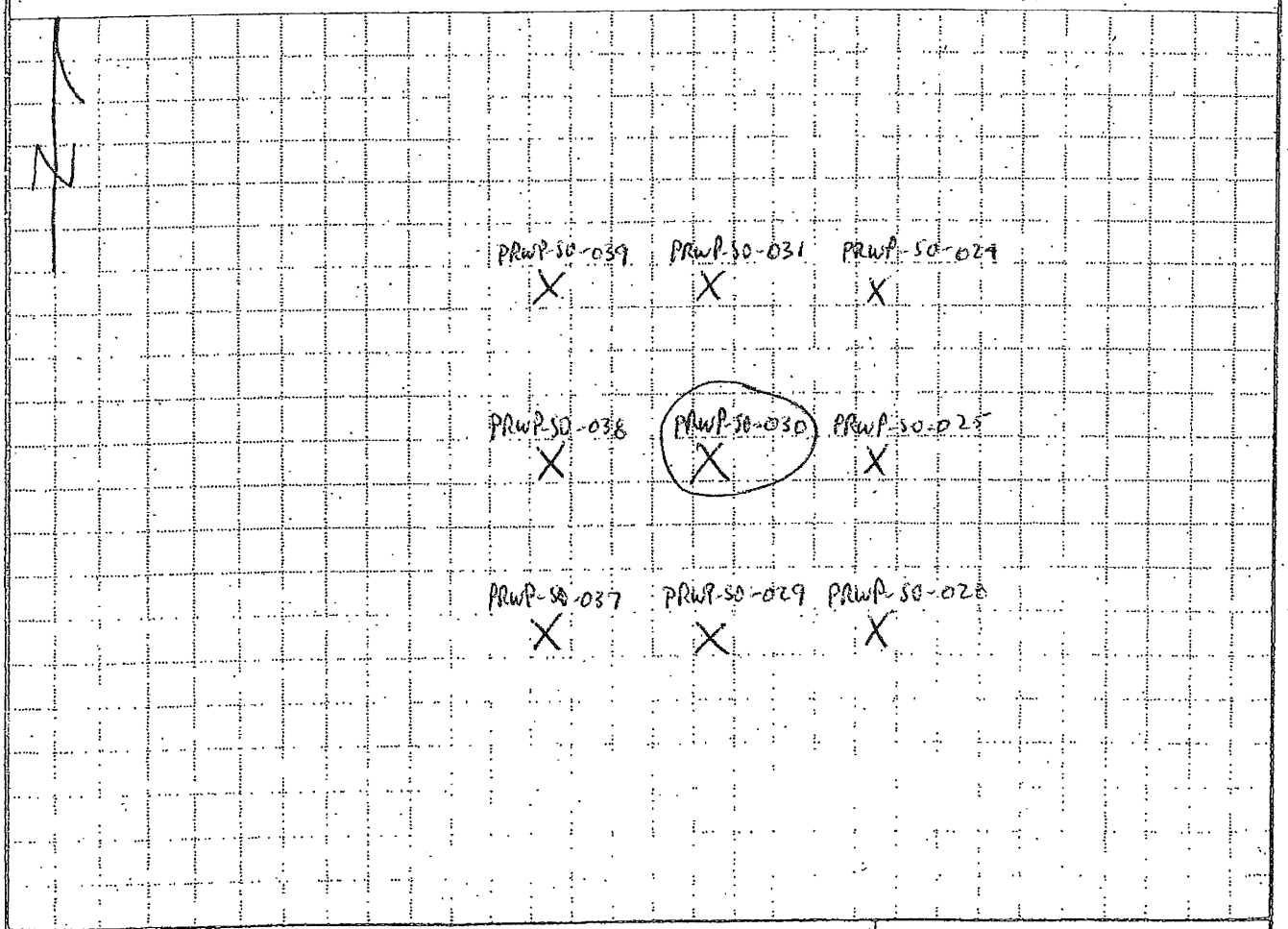
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-030
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-9-10	11. DATE COMPLETED: 11-9-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-030

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-030.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10yR 2/2) Silt with sand, organics, moist, loose. 0.4'	ML					
	1	Brown (10yR 4/3) Sand with silt, moist, loose, 2.0'	SM			PRWP-SO-030 (1'-10')		
	2	Dark yellowish brown (10yR 4/6) sand with silt, moist, loose. 2.7'					4.5'/5.0'	
	3	Brown (10yR 4/3) Silt with clay, sand, moist, medium stiff. 8.5'	ML					
	4							
	5							
	6						5.0'/5.0'	
	7							
	8							
	9	Dark grayish brown (10yR 4/2) clay with silt, moist, medium stiff.	CL					
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-030

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HTRW DRILLING LOG

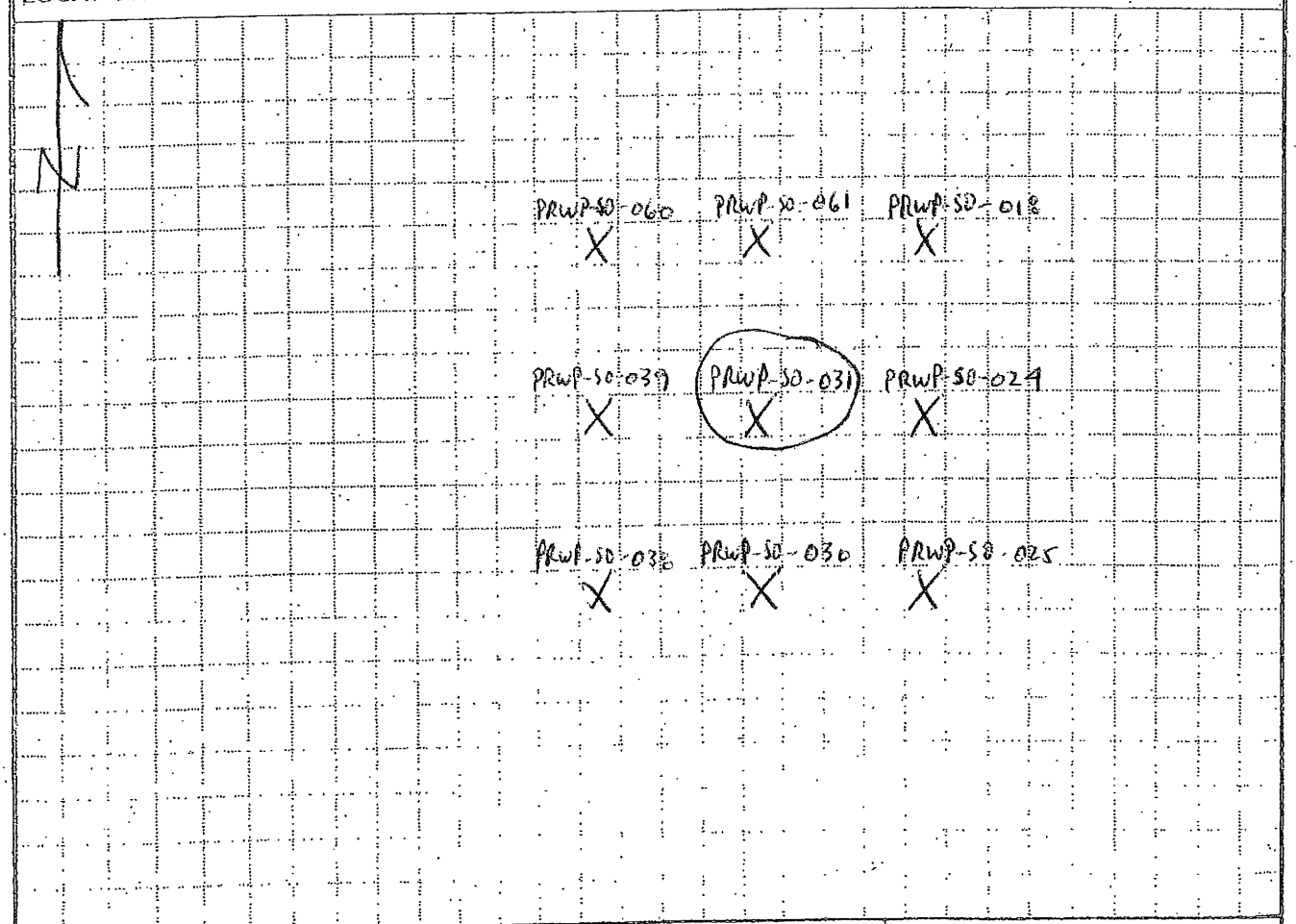
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-031
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-9-10
11. DATE COMPLETED	11-9-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-031

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-031.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10yR 2/2) Silt with sand, organics, moist, loose. 0.5'	ML					
	1	Brown (10yR 4/3) Sand with silt, moist, loose. 1.5'	SM			PRWP-SO-031 (1-10')		
	2	Dark yellowish brown (10yR 4/6) Sand with silt, moist, medium dense. 2.7'					4.5'/5.0'	
	3	Brown (10yR 4/3) Silt with clay, sand, moist, medium stiff.	ML					
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	8.3'						
	9	Dark grayish brown (10yR 4/2) Clay with silt, moist, medium stiff.	CL					
	10	Boring Complete						

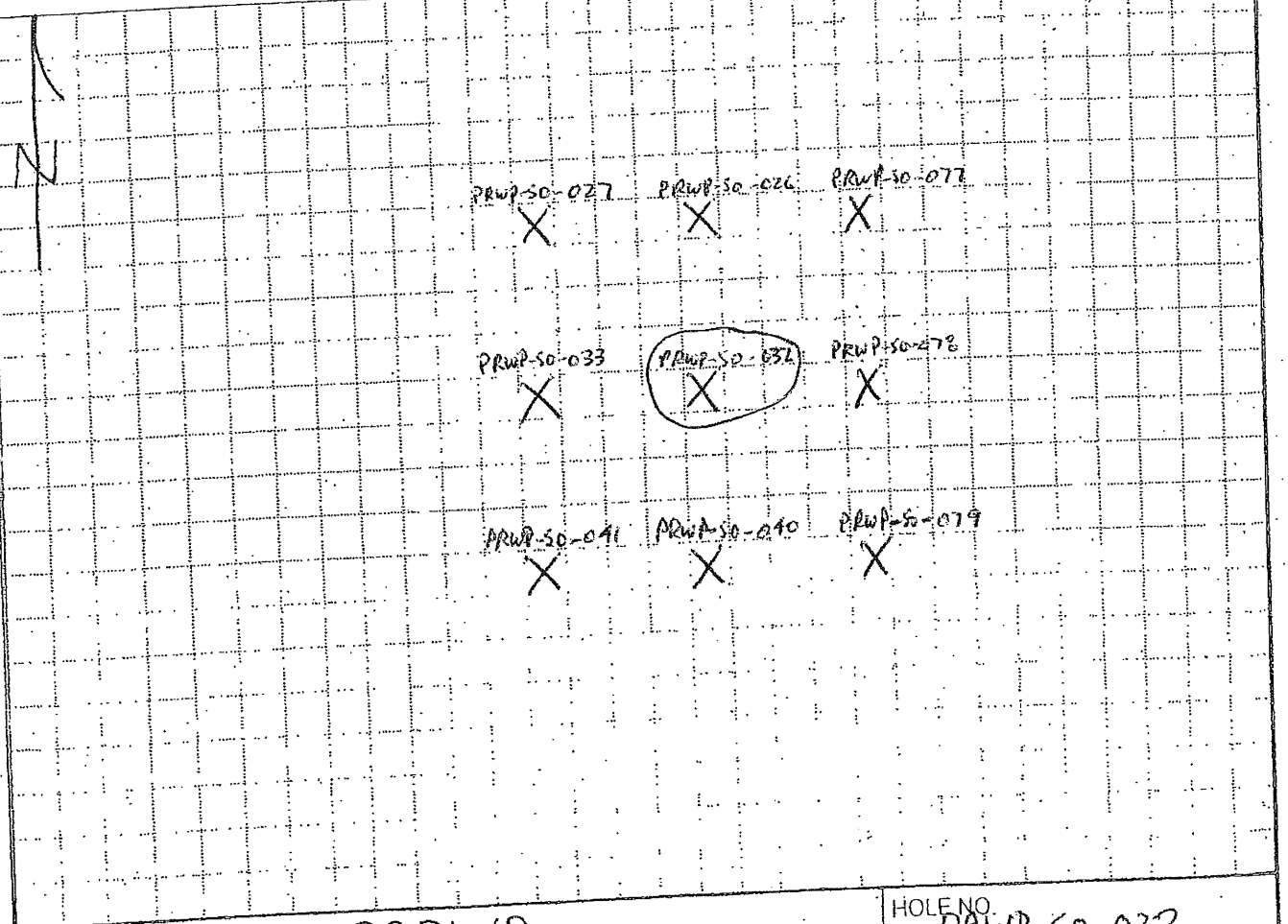
Project: PBOW-PRRWP

Hole Number: PRWP-SO-031

HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-032
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-10-10
11. DATE COMPLETED	11-10-10
12. OVERBURDEN THICKNESS	>10.0'
13. DEPTH DRILLED INTO ROCK	0
14. TOTAL DEPTH OF HOLE	10.0
15. DEPTH GROUNDWATER ENCOUNTERED	—
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—
18. GEOTECHNICAL SAMPLES	DISTURBED: — UNDISTURBED: —
19. TOTAL NUMBER OF CORE BOXES	—
20. SAMPLES FOR CHEMICAL ANALYSIS	Yes
VOC	—
METALS	—
OTHER (SPECIFY)	Nitroaromatics
OTHER (SPECIFY)	—
OTHER (SPECIFY)	—
21. TOTAL CORE RECOVERY	— %
22. DISPOSITION OF HOLE	—
BACKFILLED	✓
MONITORING WELL	—
OTHER (SPECIFY)	—
23. SIGNATURE OF INSPECTOR	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT PBOW-PRRWP — HOLE NO. PRWP-SO-032

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-032

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10YR4/3) silt with sand, trace clay, moist, medium stiff.	ML					
	1					PRWP-SO-032		
		1.7						
		Brown (10YR4/3) clay with silt, sand, moist, medium stiff.	CL					
	2						4.5'/5.0'	
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
		8.6						
		Dark gray (10YR4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-032

HTRW DRILLING LOG

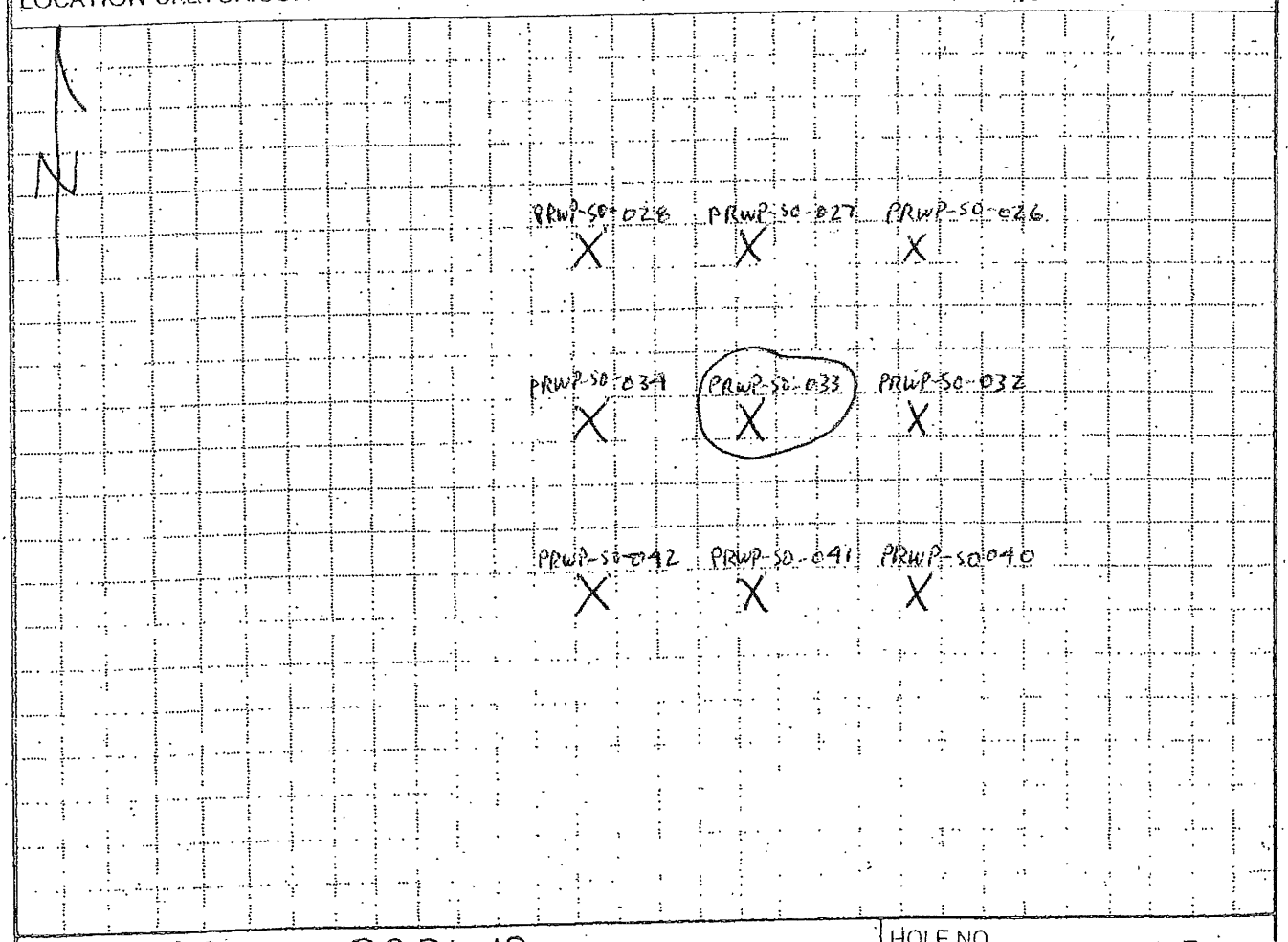
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-033
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-033

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SD-033

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) fine grain sand with silt, organics, moist, loose. 1.0'	SM					
	1	Very dark brown (10YR 2/2) silt with sand, trace clay, moist, medium stiff. 2.0'	ML			PRWP-SD-033 (1'-10')		
	2	Dark yellowish brown (10YR 4/6) sand with silt, trace clay, moist, medium dense. 3.0'	SM				4.5'/5.0'	
	3	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
	9	9.5'						
	10	Dark gray (10YR 4/1) clay with silt, moist, medium stiff. Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SD-033

HTRW DRILLING LOG

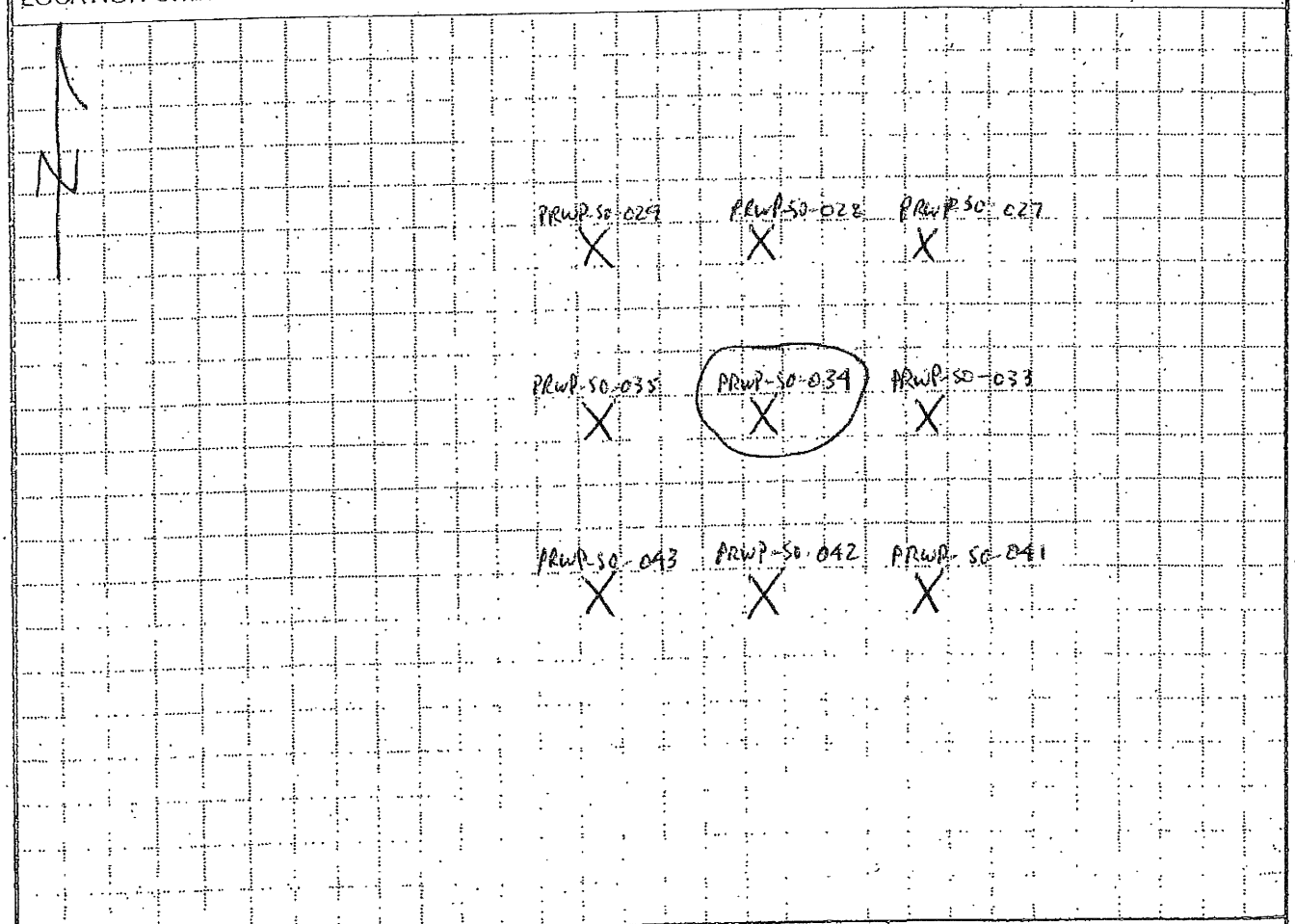
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-034	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-034

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SD-034.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10YR 2/2) Sand with silt, organics, moist, loose. 0.9'	SM					
	1	Dark yellowish brown (10YR 3/6) fine grain sand with silt, moist, loose. 2.6'				PRWP-SD-034 (1'-10')	4.5/5.0	
	2							
	3	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff. 9.4'	CL					
	4							
	5							
	6							
	7						5.0/5.0	
	8							
	9							
	10	Dark gray (10YR 4/1) clay with silt, moist, medium stiff. Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SD-034

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HTRW DRILLING LOG

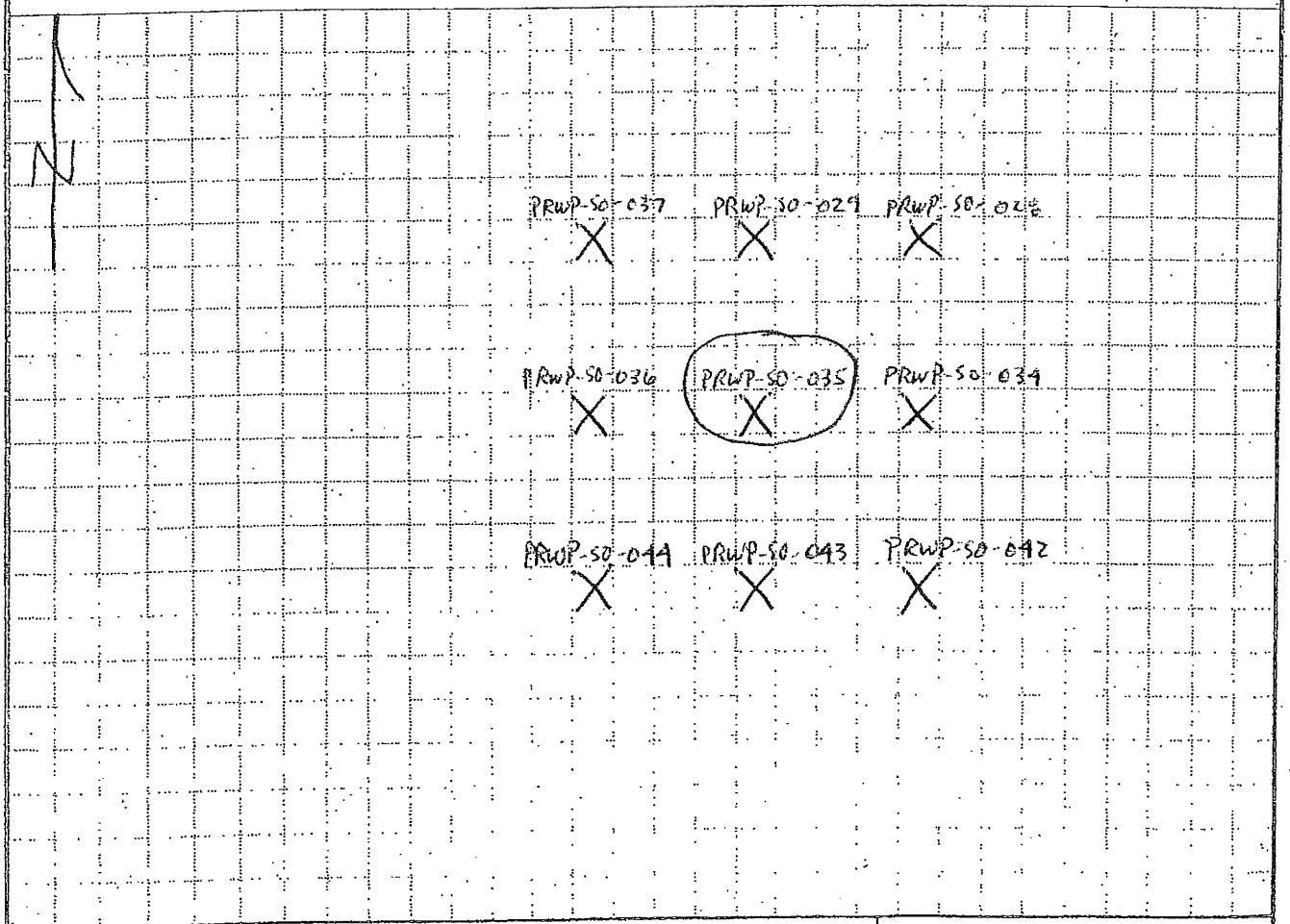
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-035
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-035

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-035.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10YR 2/2) Silt with sand, organics, moist, soft.	ML					
	1	1.4'				PRWP-SO-035 (1'-10')		
		Dark yellowish brown (10YR 3/6) Sand with silt, moist, loose	SM				4.5'/5.0'	
	2	2.9'						
	3	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
	9	9.0' Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-035

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HTRW DRILLING LOG

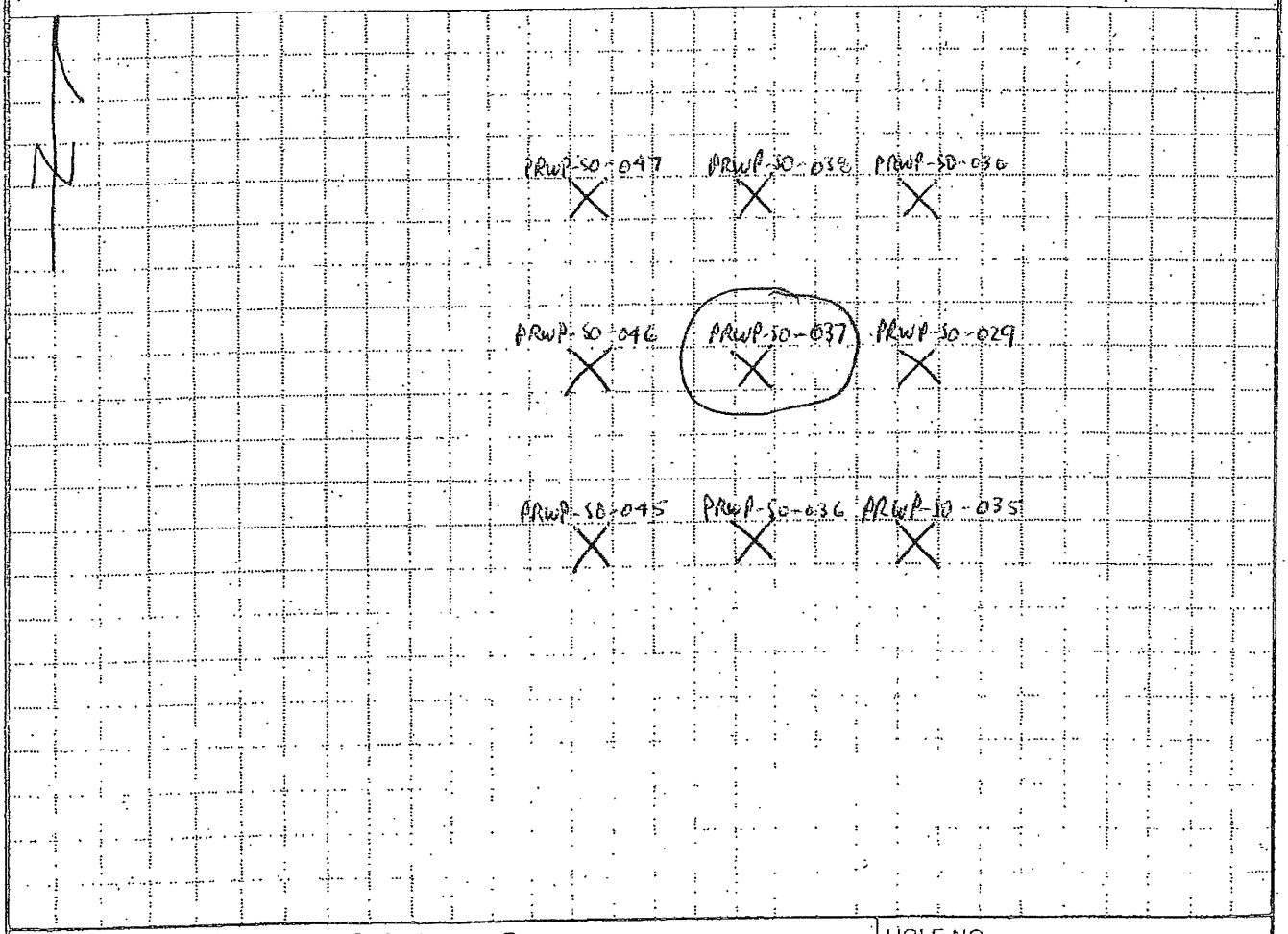
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-037
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP		4. LOCATION: Sandusky, Ohio
5. NAME OF DRILLER: John Grogan		6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.		8. HOLE LOCATION
		9. SURFACE ELEVATION
		10. DATE STARTED: 11-10-10 / 11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'		15. DEPTH GROUNDWATER ENCOUNTERED: —
13. DEPTH DRILLED INTO ROCK: 0		16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —
14. TOTAL DEPTH OF HOLE: 10.0'		17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO. PRWP-SO-037

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-037

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR3/3) silt with sand, organics, moist, loose.	ML					
	1					PRWP-SO-037 (1'-10')		
	2	2.1'					4.5/5.0	
		Brown (10yR4/3) clay with silt, trace sand, moist medium stiff.	CL					
	3							
	4							
	5							
	6	6.7'						
	7	Dark gray (10yR4/1) clay with silt, moist, medium stiff.					5.0/5.0	
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-037

HTRW DRILLING LOG

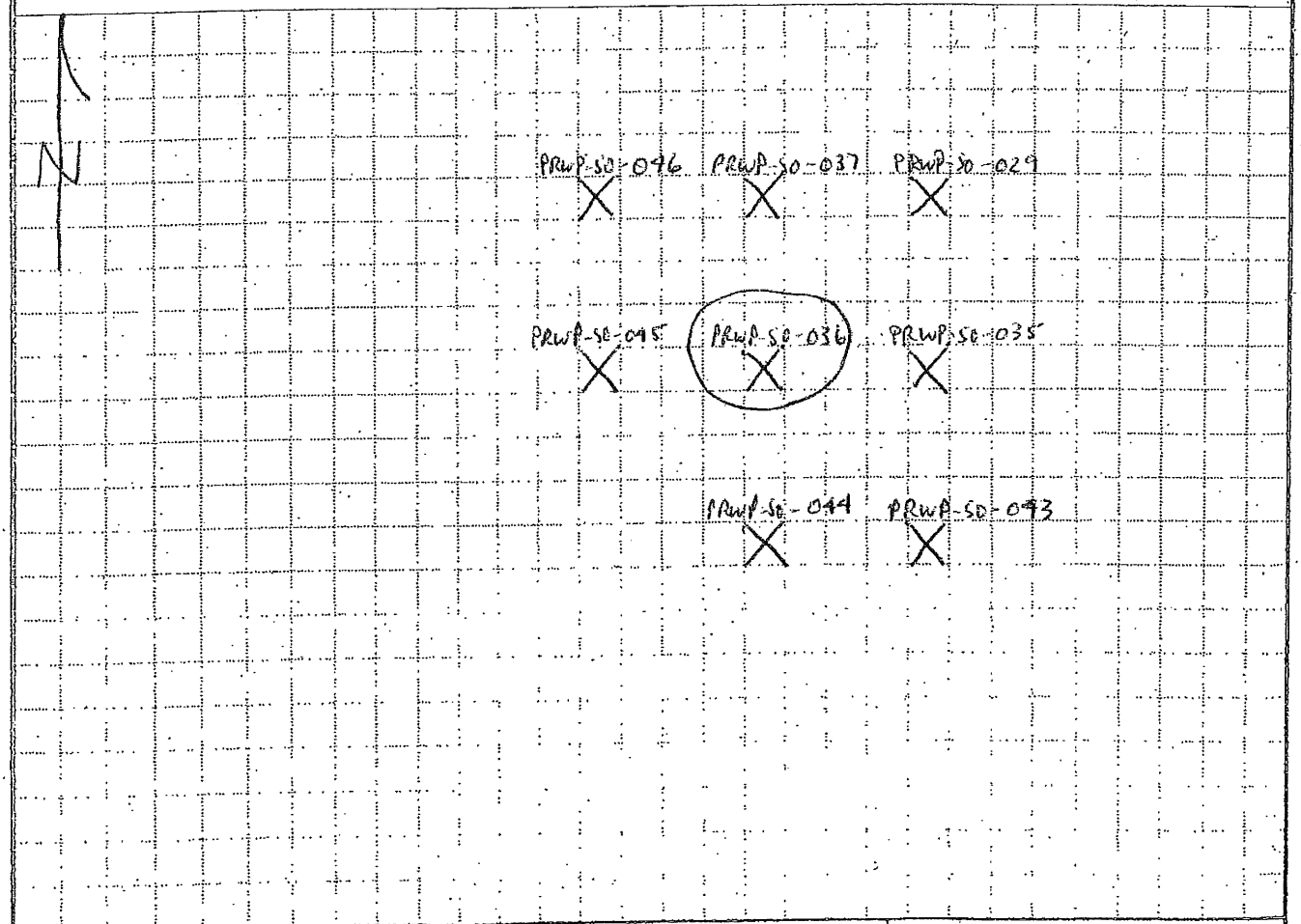
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-036
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO: PRWP-SO-036

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-036

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10YR 4/3) Sand with silt, moist, loose.	SM					
	1	1.5'				PRWP-SO-036 (1'-10')		
		Dark yellowish brown (10YR 4/6) sand with silt, moist, medium dense.						
	2	2.7'					4.5'/5.0'	
		Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	3							
	4							
	5							
	6						5.0'/5.0	
	7							
	8	8.4'						
		Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-036

HTRW DRILLING LOG

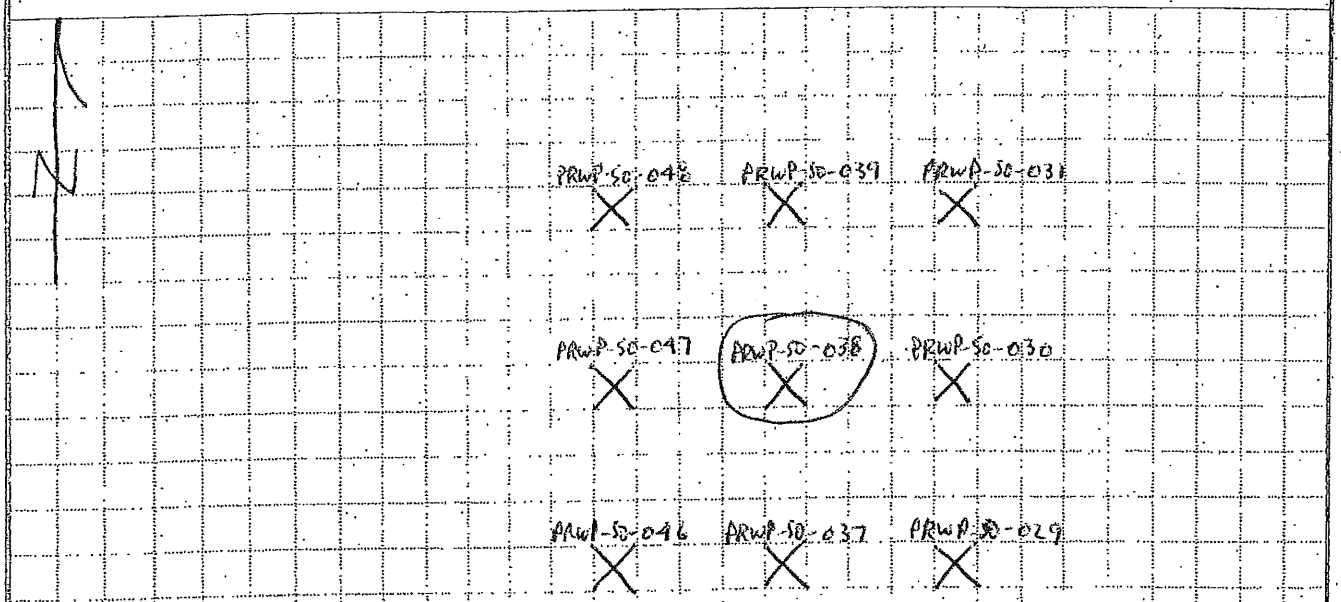
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-038	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-038

Figure 4-2
Drilling Log

Shaw Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-038.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) Sand with silt, moist, loose. 0.4'	SM					
	1	Dark yellowish brown (10YR 4/6) sand with silt, moist, loose.				PRWP-SO-038 (1'-10')		
	2	2.4'					4.5'/5.0'	
	3	Dark yellowish brown (10YR 4/6) silt with clay, sand, moist, medium stiff. 3.4'	ML					
	4	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	5							
	6							
	7						5.0'/5.0'	
	8	8.8'						
	9	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-038

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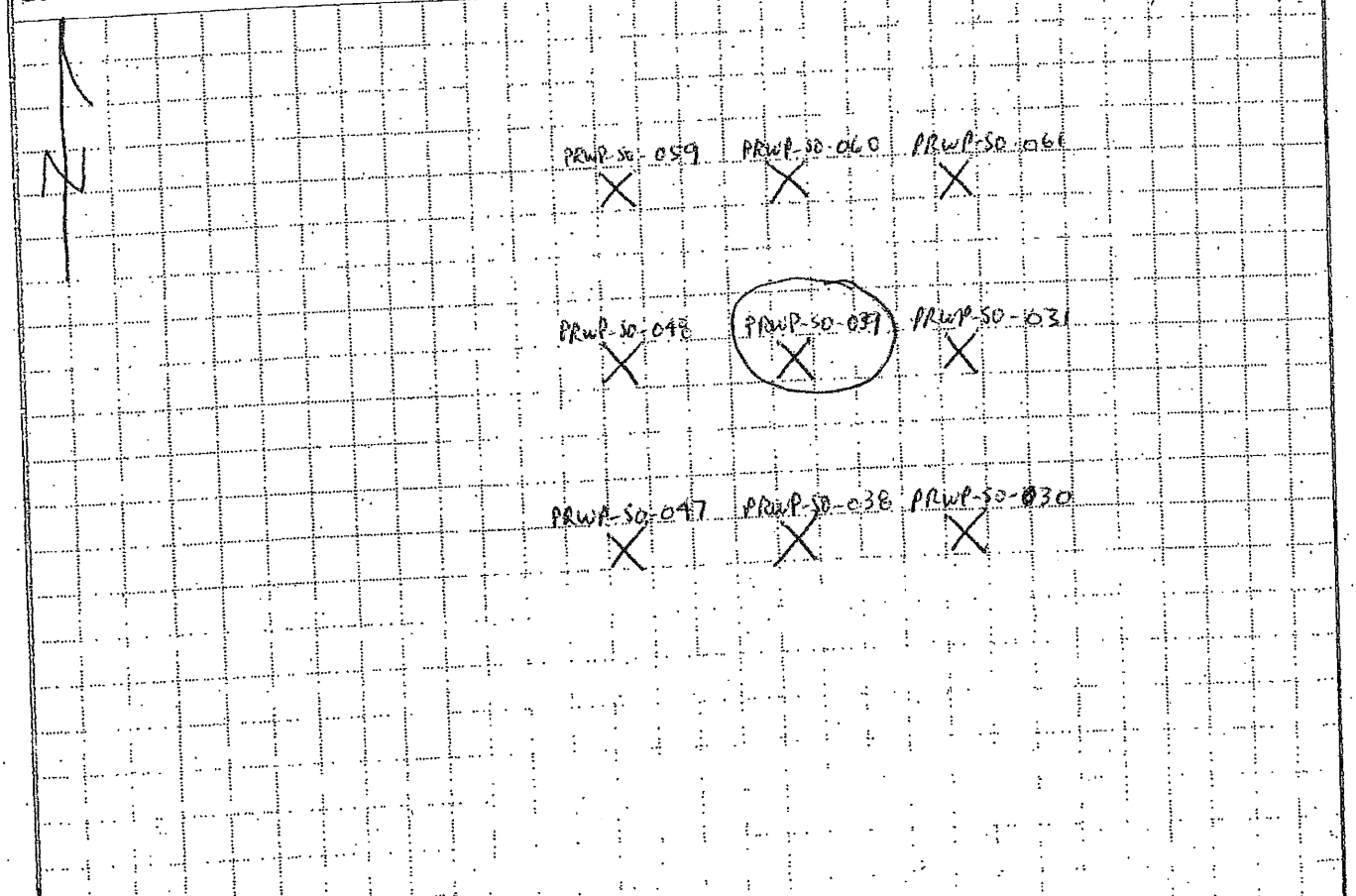
HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-039
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-10-10
11. DATE COMPLETED	11-10-10
12. OVERBURDEN THICKNESS	>10.0
13. DEPTH DRILLED INTO ROCK	0
14. TOTAL DEPTH OF HOLE	10.0
15. DEPTH GROUNDWATER ENCOUNTERED	—
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—
18. GEOTECHNICAL SAMPLES	—
DISTURBED	—
UNDISTURBED	—
19. TOTAL NUMBER OF CORE BOXES	—
20. SAMPLES FOR CHEMICAL ANALYSIS	Yes
VOC	—
METALS	—
OTHER (SPECIFY)	Nitroaromatics
OTHER (SPECIFY)	—
OTHER (SPECIFY)	—
21. TOTAL CORE RECOVERY	— %
22. DISPOSITION OF HOLE	—
BACKFILLED	✓
MONITORING WELL	—
OTHER (SPECIFY)	—
23. SIGNATURE OF INSPECTOR	Erick J. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW-PRRWP

HOLE NO. PRWP-SO-039

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-039.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) Sand with silt, organics, moist, loose. 1.0'	SM					
	1	Yellowish brown (10yR 5/6) fine grain sand with silt, moist, loose. 2.5'				PRWP-SO-039 (1'-10')	4.5'/5.0'	
	2							
	3	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff. 7.8'	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-039

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HTRW DRILLING LOG

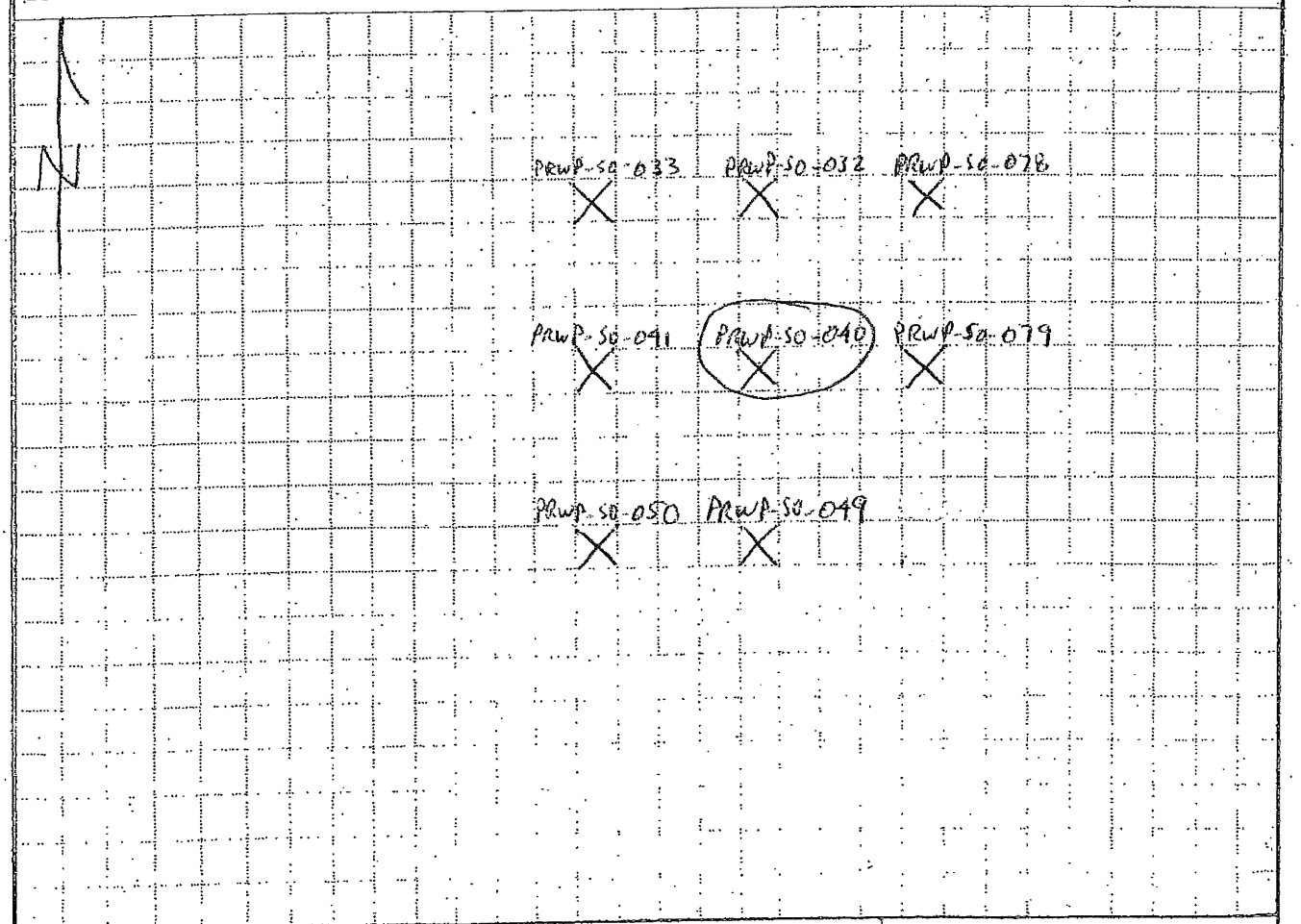
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-040
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-040

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-040

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft. 0.9'	ML					
	1	Dark yellowish brown (10yR 3/6) sand with silt, moist, medium dense. 1.7'	SM			PRWP-SO-040 (1'-10')		
	2	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6						5.0'/5.0'	
	7	7.6'						
	8	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-040

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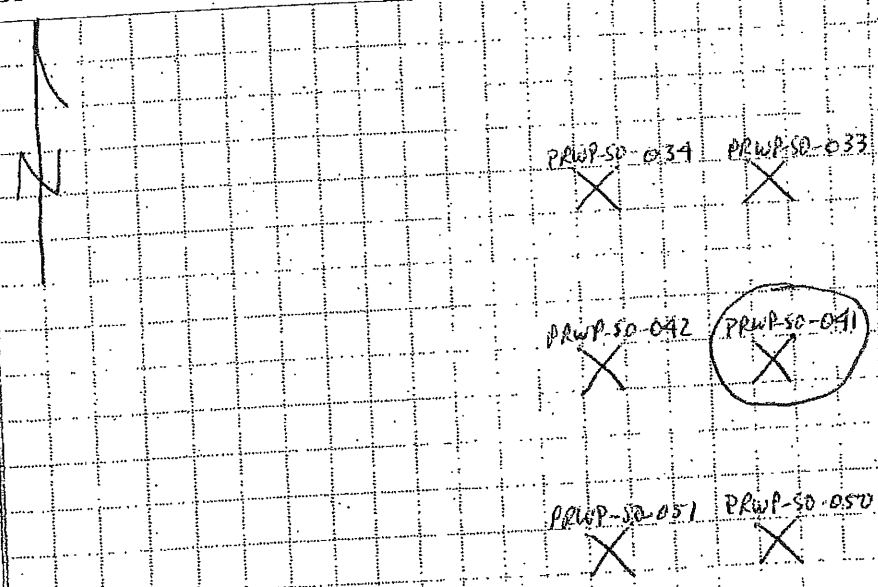
HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-041
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-10-10
11. DATE COMPLETED	11-10-10
12. OVERBURDEN THICKNESS	>10.0'
13. DEPTH DRILLED INTO ROCK	0
14. TOTAL DEPTH OF HOLE	10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—
18. GEOTECHNICAL SAMPLES	—
DISTURBED	—
UNDISTURBED	—
19. TOTAL NUMBER OF CORE BOXES	—
20. SAMPLES FOR CHEMICAL ANALYSIS	Yes
VOC	—
METALS	—
OTHER (SPECIFY)	Nitroaromatics
OTHER (SPECIFY)	—
OTHER (SPECIFY)	—
21. TOTAL CORE RECOVERY	— %
22. DISPOSITION OF HOLE	—
BACKFILLED	✓
MONITORING WELL	—
OTHER (SPECIFY)	—
23. SIGNATURE OF INSPECTOR	Erick J. Weaver

SCALE: None

LOCATION SKETCH/COMMENTS



PROJECT PBOW-PRRWP

HOLE NO. PRWP-SO-041

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-041

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) Sand with silt, moist, loose.	SM					
	1	1.2'						
		Dark yellowish brown (10yR 3/6) sand with silt, moist, medium dense.				PRWP-SO-041 (1'-10')		
	2	2.1'						
		Brown (10yR 4/3) clay with silt, sand, moist, medium stiff	CL				4.5'/5.0'	
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	8.2'						
		Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-041

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HTRW DRILLING LOG

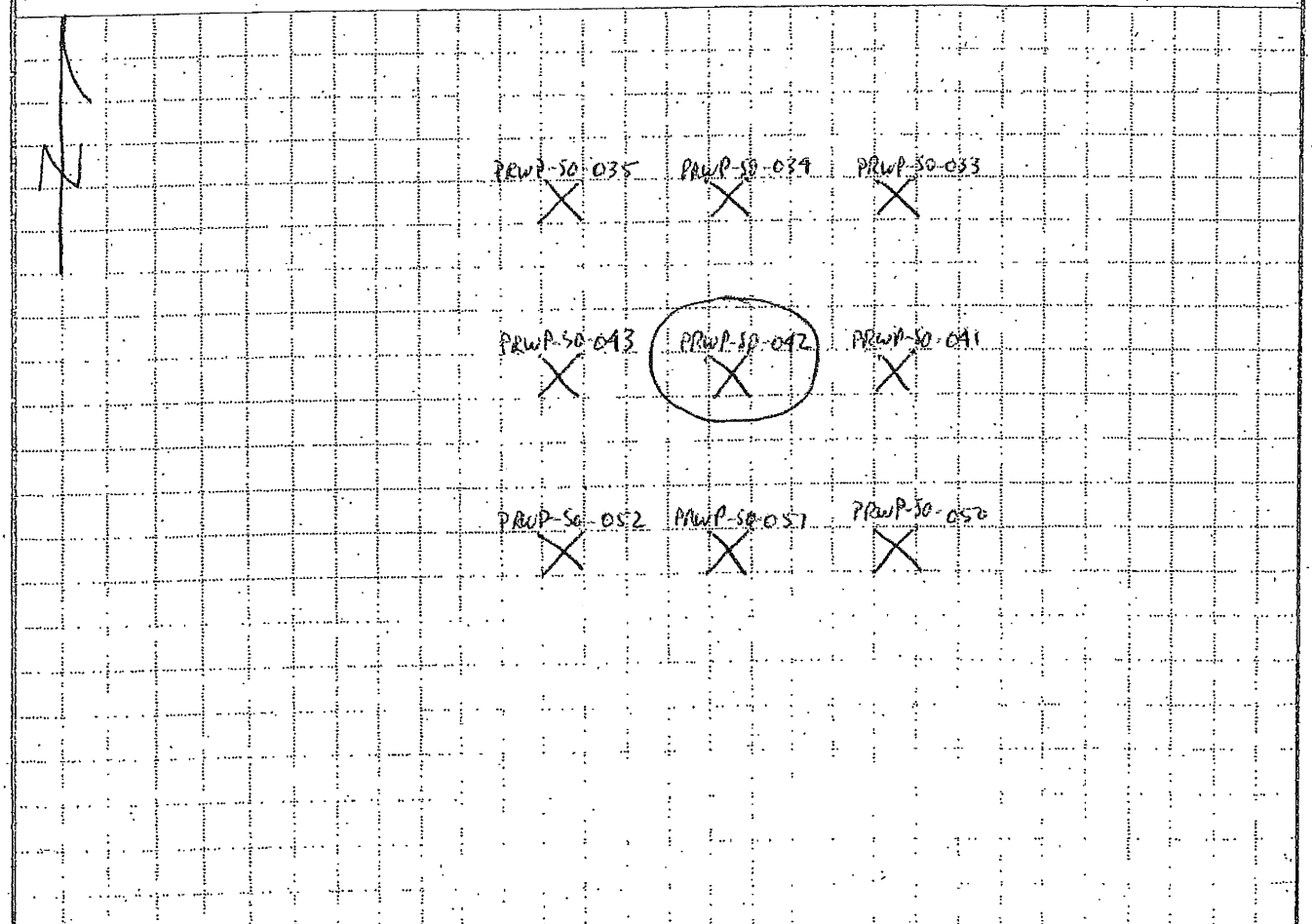
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-042
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT PBOW-PRRWP — HOLE NO. PRWP-SO-042

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-042

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, loose. 1.0'	ML					
	1	Dark yellowish brown (10yR 4/6) sand with silt, moist, medium dense. 2.7'	SM			PRWP-SO-042	4.5'/5.0'	
	2							
	3	Brown (10yR 4/3) clay with silt, sand, moist, medium dense. 9.0'	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
	9	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-042

HTRW DRILLING LOG

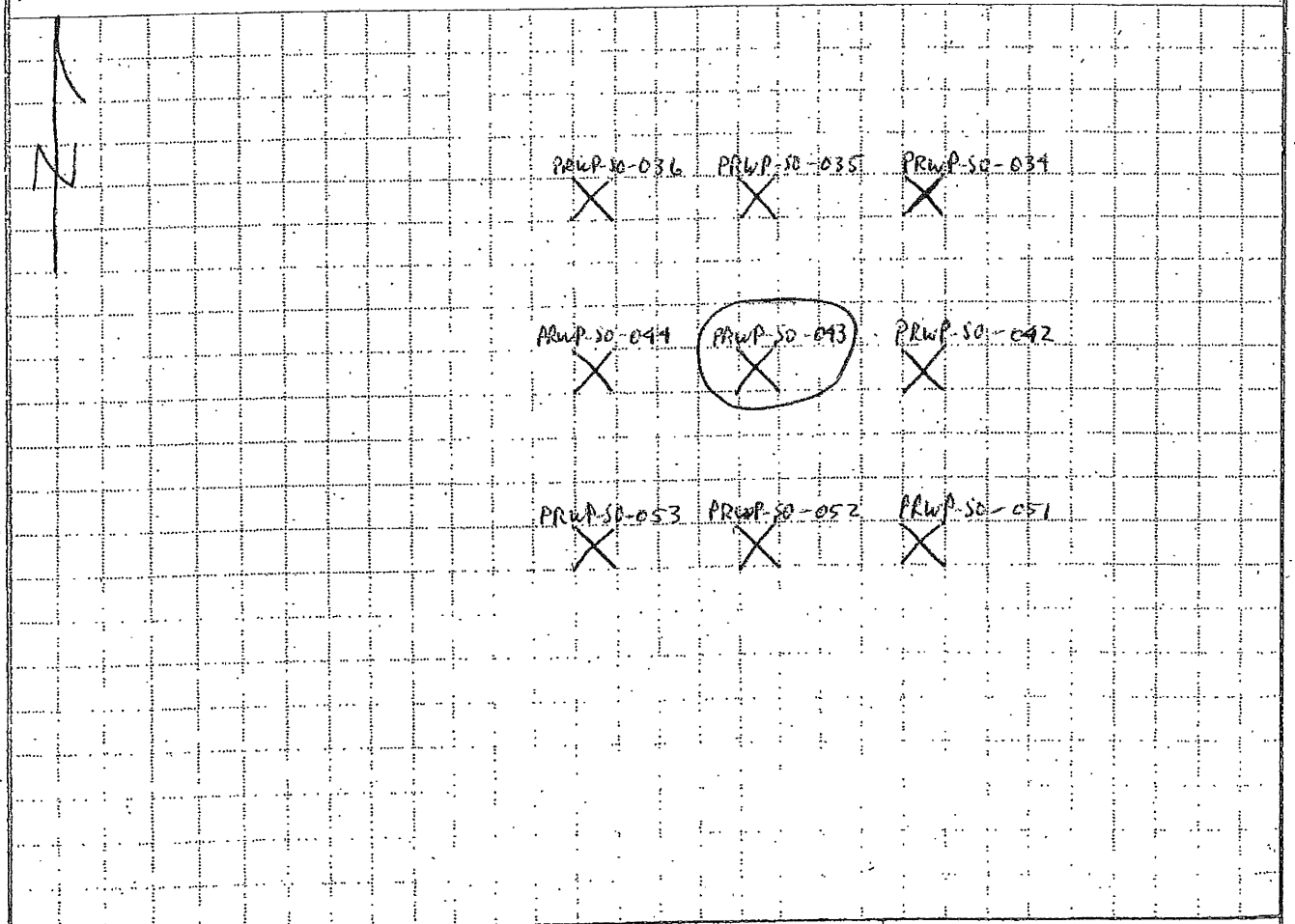
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-043
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-043

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-043

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR3/3) Sand with silt, organics, moist, loose.	SM					
	1					PRWP-SO-043 (1'-10')		
		2.0'					4.5'/5.0'	
	2	Brown (10yR4/3) clay with silt, moist, medium stiff.	CL					
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
	8							
		9.0'						
	9	Dark gray (10yR4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-043

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HTRW DRILLING LOG

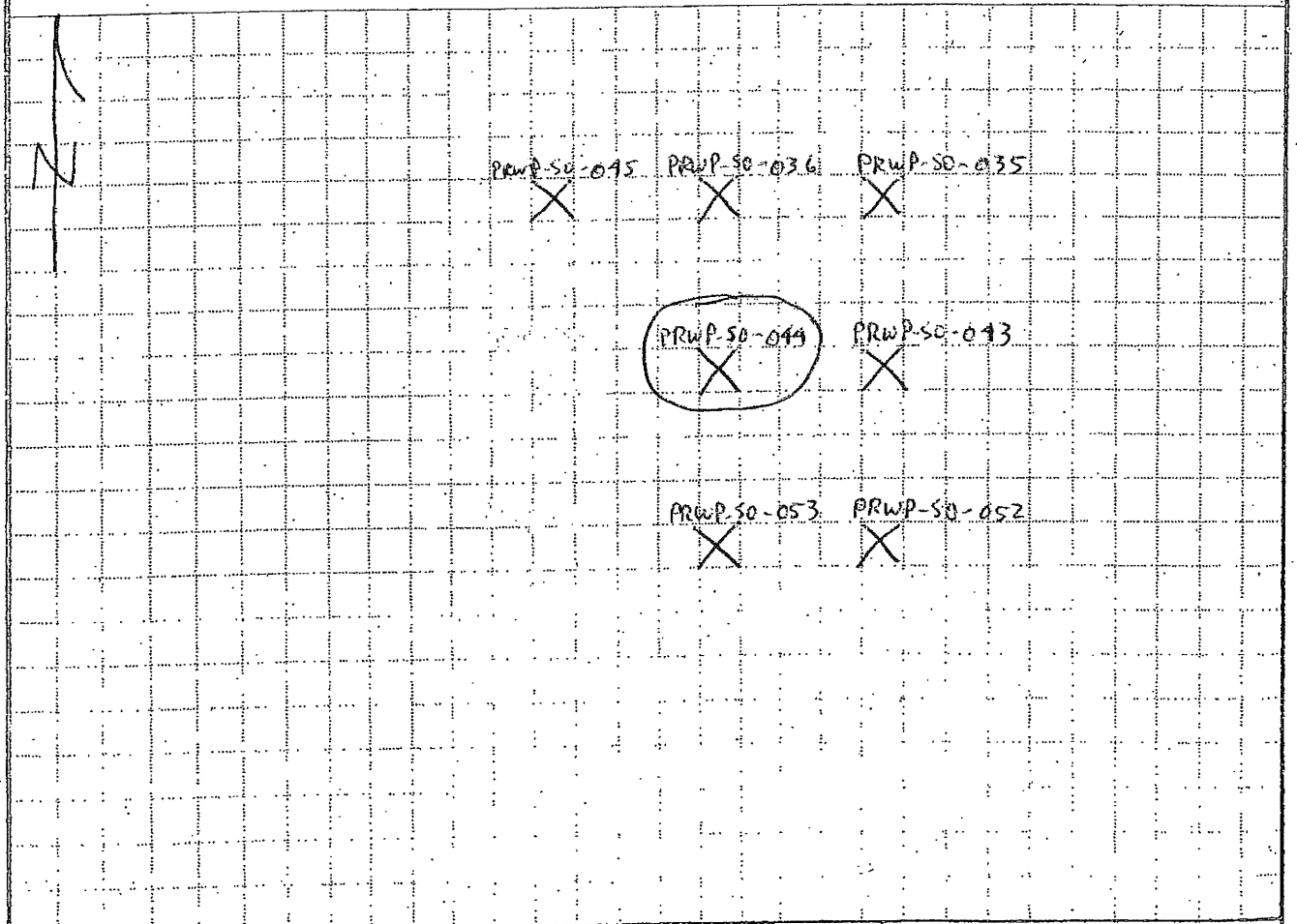
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-044
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO: PRWP-SO-044

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-044

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) silt with sand, organics, moist, soft. 0.7	ML					
	1	Dark yellowish brown (10YR 4/6) sand with silt, moist, loose. 3.2'	SM			PRWP-SO-044 (1'-10')	4.5'/5.0'	
	2							
	3							
		Brown (10YR 4/3) clay with silt, sand, moist, medium stiff. 7.8'	CL					
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-044

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HTRW DRILLING LOG

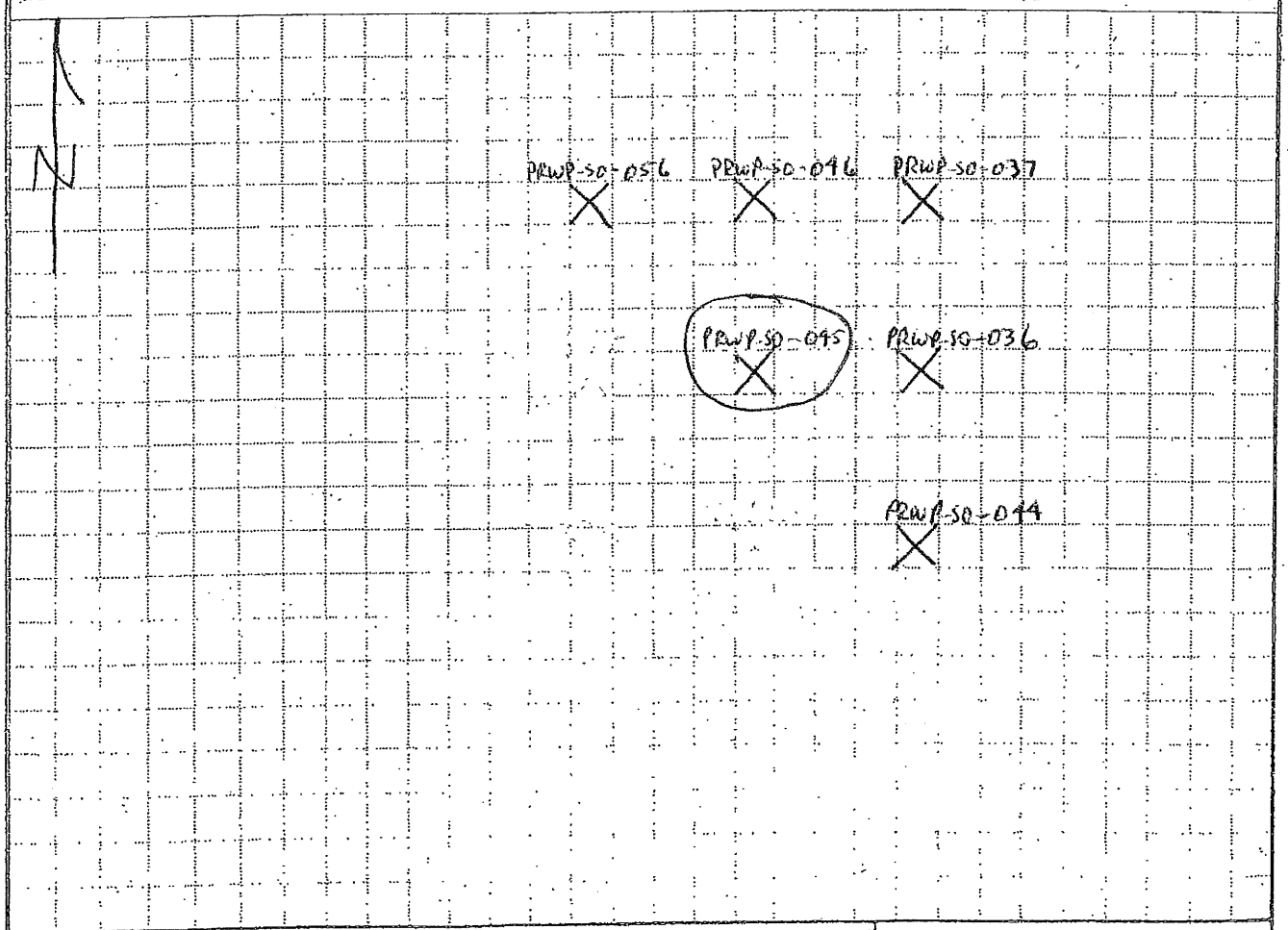
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-045	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION:	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-045

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-045

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, loose. 0.3'	ML					
		Yellowish brown (10yR 5/6) silt with sand, moist, loose.						
	1					PRWP-SO-045 (1'-10')		
	2						4.5'/5.0'	
	3	3.2'						
		Brown (10yR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	8.7'						
		Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-045

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HTRW DRILLING LOG

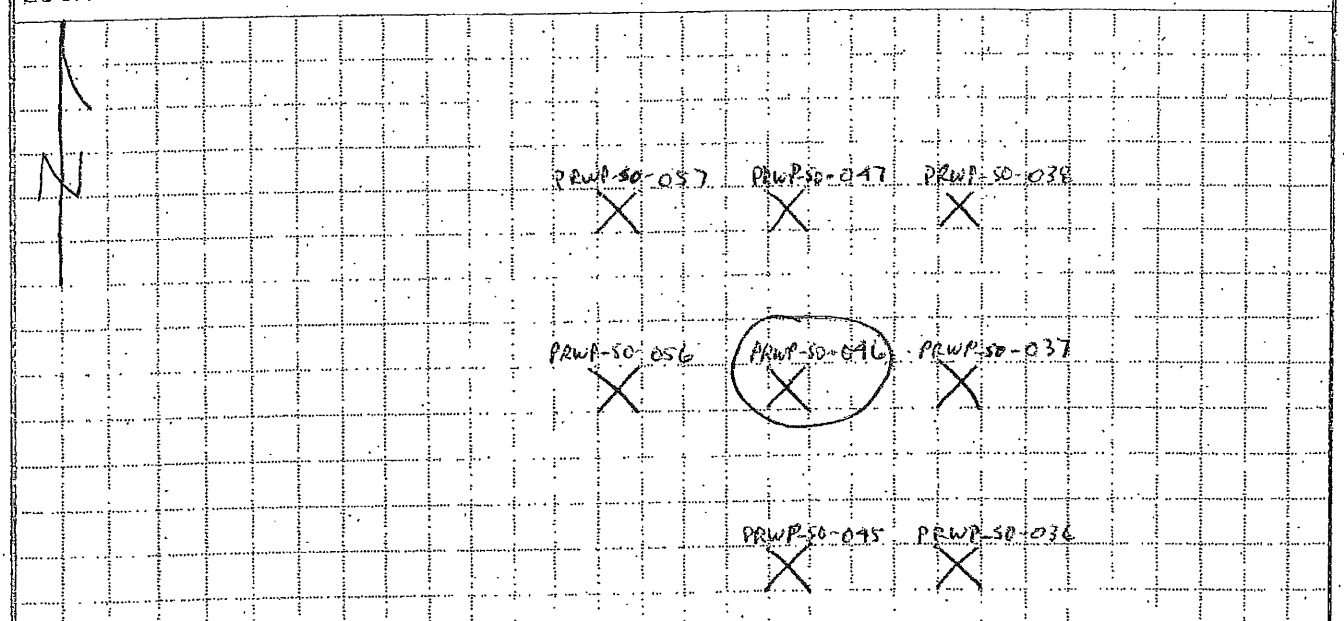
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-046	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-046

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG (continuation sheet)

Hole Number: PRWP-SO-046

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithm	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown (10yR 5/6) silt with sand, organics, moist, loose.	ML					
	1					PRWP-SO-046		
	2							
		2.4'					4.5'/5.0'	
		Brown (10yR 4/3) clay with silt, moist, medium stiff.	CL					
	3							
	4							
	5							
	6							
							5.0'/5.0'	
	7							
	8							
		8.6'						
		Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-046

HTRW DRILLING LOG

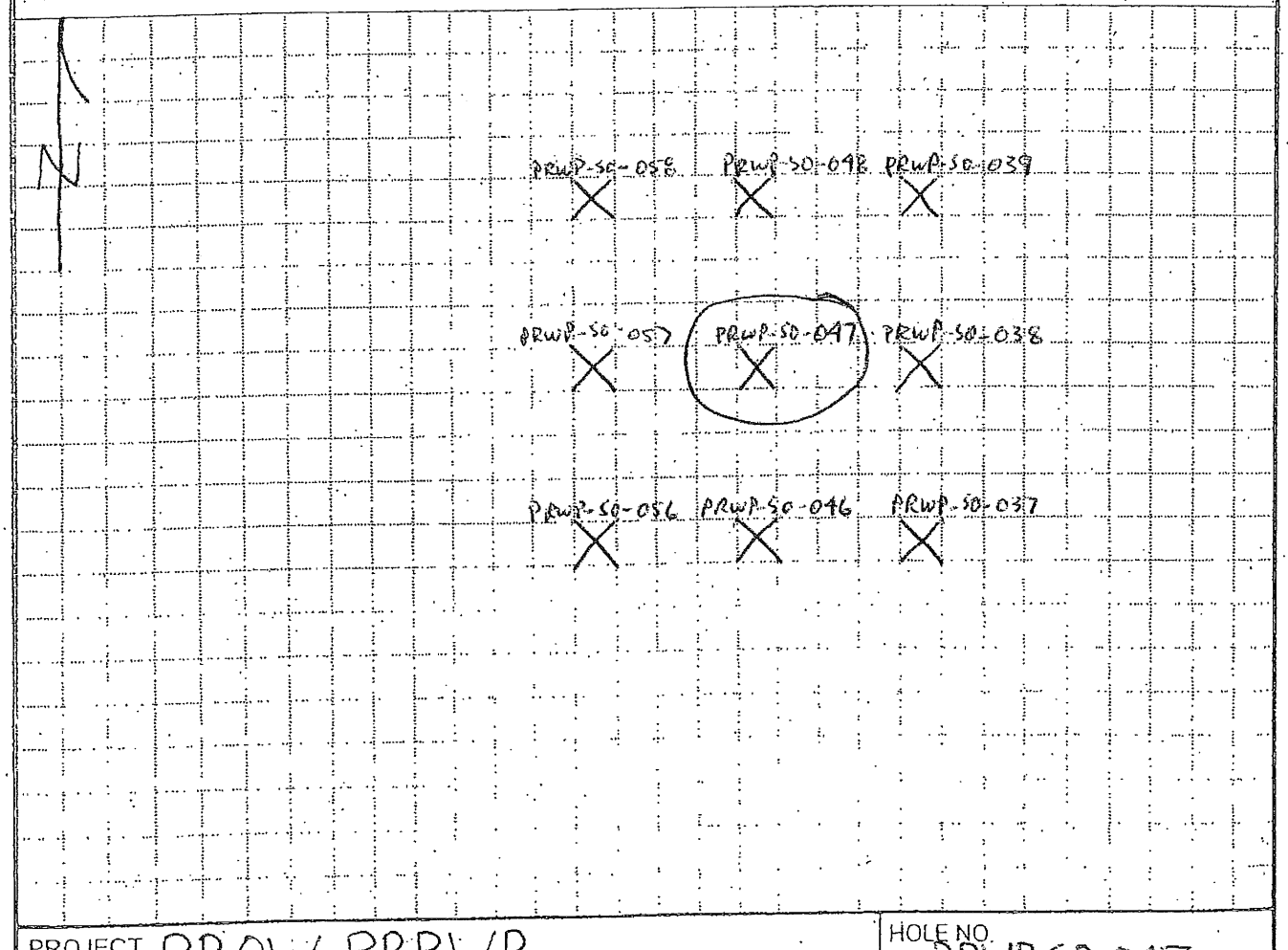
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-047	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-047

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG (continuation sheet)

Hole Number: PRWP-SO-047.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithol	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown (10yR 5/6) sand with silt, organics, moist, loose -	SM					
	1					PRWP-SO-047 (1'-10')		
		2.0'						
	2	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
		7.7'						
	8	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-047

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HTRW DRILLING LOG

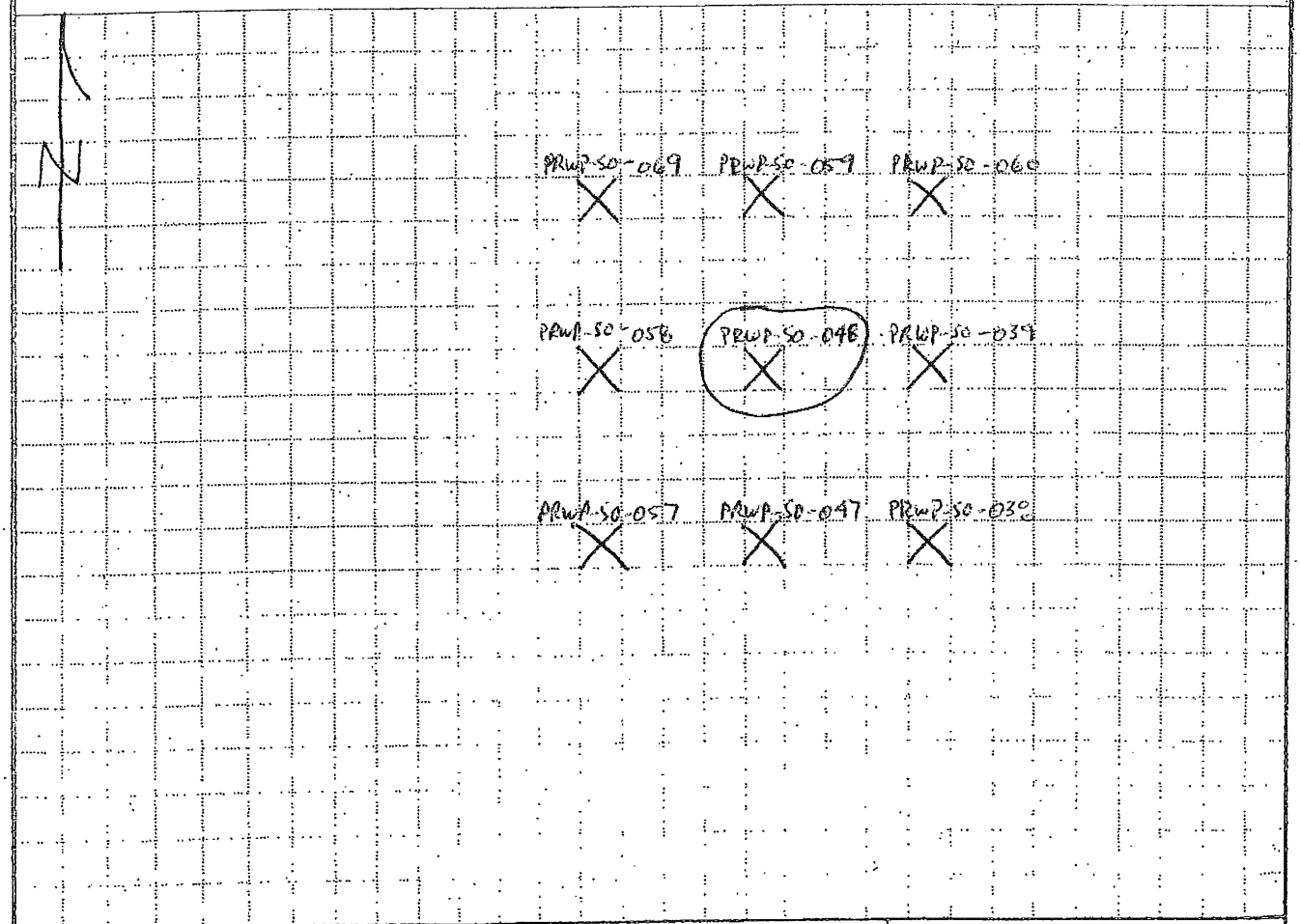
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-048
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-10-10
11. DATE COMPLETED	11-10-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-048

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-048.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Yellowish brown (10YR 5/6) Sand with silt, organics, moist, loose.	SM					
	1							
						PRWP-SO-048 (1'-10')		
	2						4.5'/5.0'	
	3	3.4'						
		Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
	7	7.7'					5.0'/5.0'	
		Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-048

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HTRW DRILLING LOG

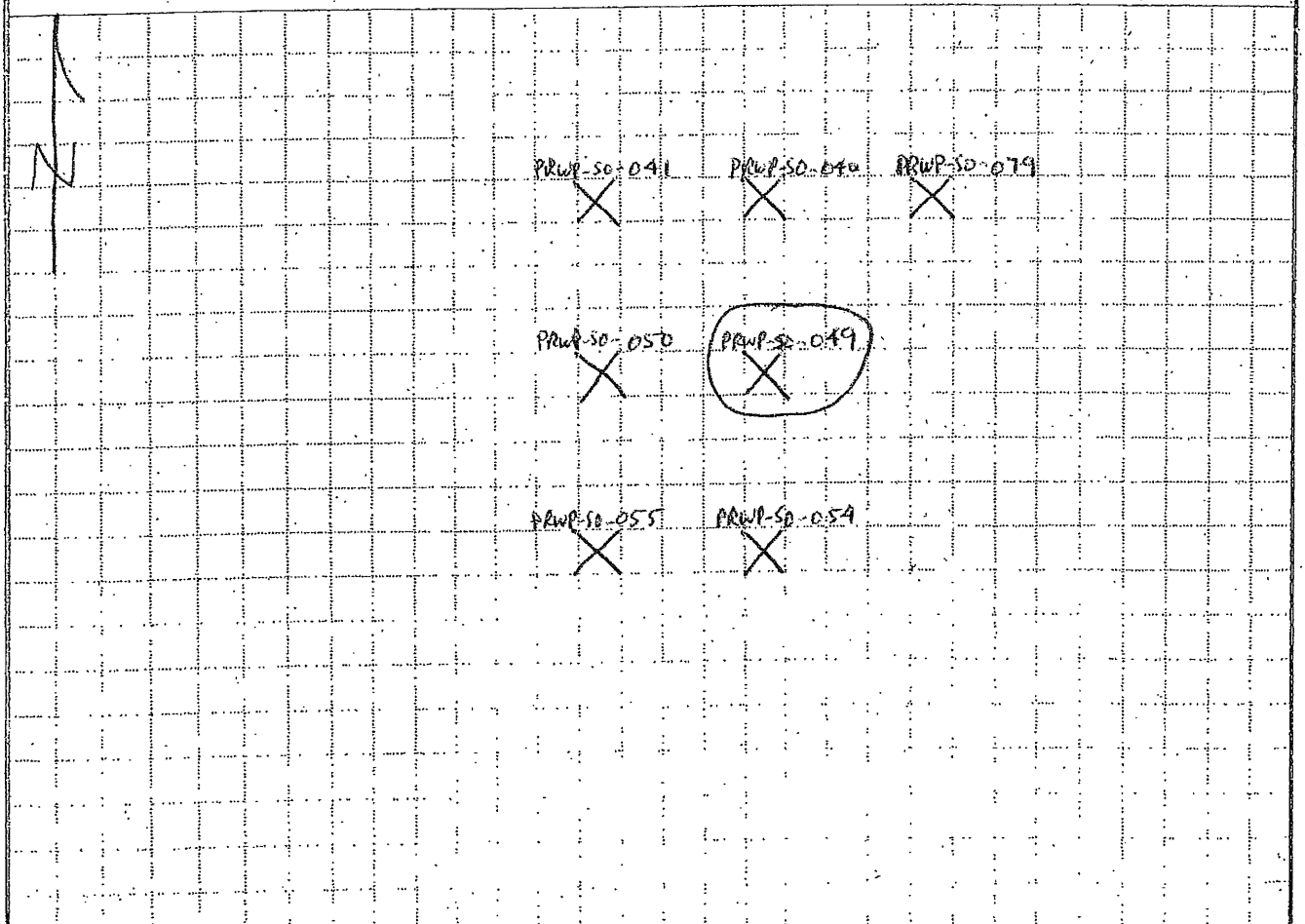
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-049	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-10-10	11. DATE COMPLETED: 11-10-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO: PRWP-SO-049

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-049.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) Sand with silt, organics, moist, loose. 0.9'	SM					
	1	Yellowish brown (10yR 5/6) Sand with silt, moist, loose. 1.9'				PRWP-SO-049 (1'-10')	4.5'/5.0'	
	2	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff. 7.0'	CL					
	3							
	4							
	5							
	6						5.0'/5.0'	
	7	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	8							
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-049

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HTRW DRILLING LOG

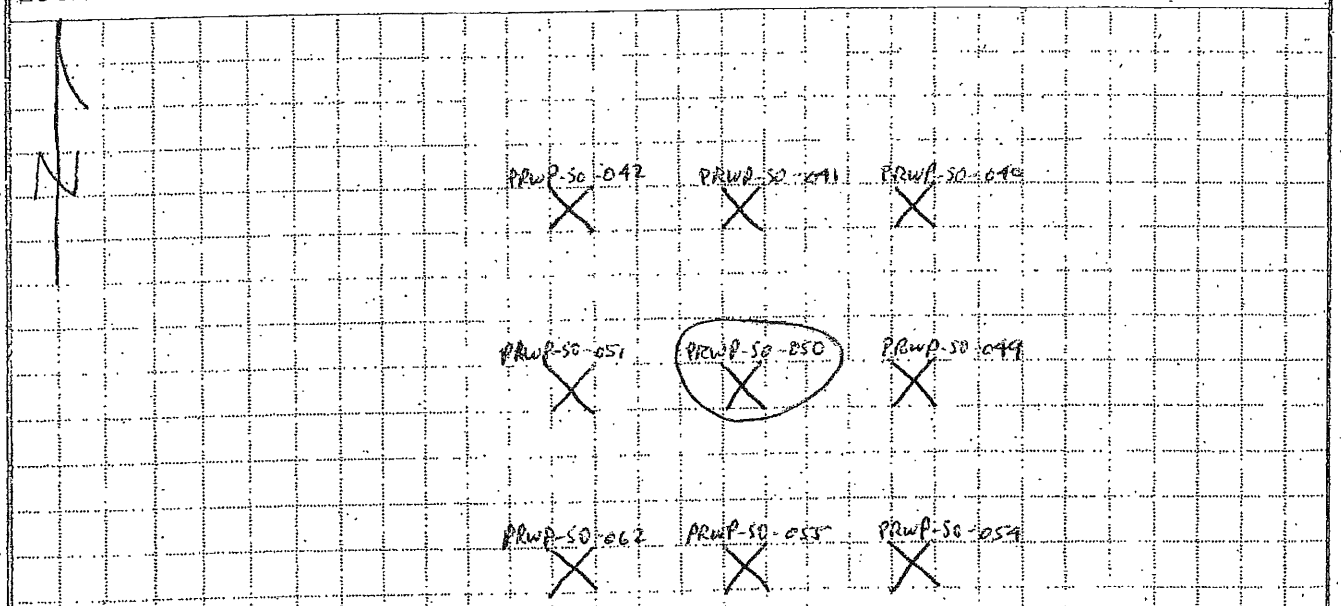
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-050
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-10-10
11. DATE COMPLETED	11-10-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-050

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-50-050.

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Dark brown (10yR 3/3) Silt with sand, organics, moist, soft. 1.3'	ML					
						PRWP-50-050 (1'-10')	4.5'/5.0'	
	2	Yellowish brown (10yR 5/6) Sand with silt, moist, loose. 3.2'	SM					
	3	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff. 7.9'	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-50-050

HTRW DRILLING LOG

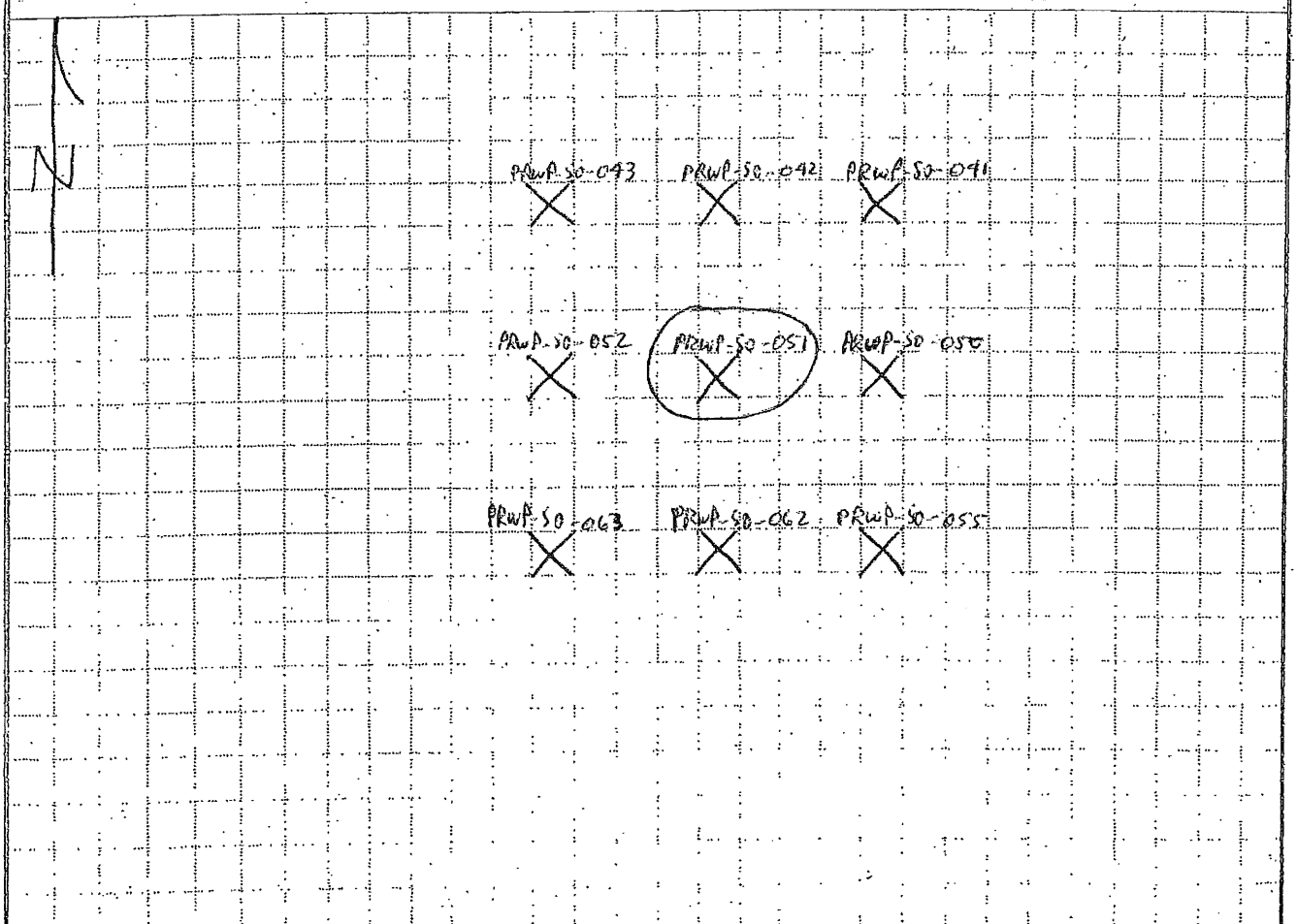
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-051
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-051

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-051

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) Silt with Sand, organics, moist, medium stiff. 0.5'	ML					
	1	Dark yellowish brown (10YR 4/6) Silt with sand, clay, moist, medium stiff.				PRWP-SO-051 (1'-10')		
	2	2.3'					4.5'/5.0'	
		Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	8.8'						
	9	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-051

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HTRW DRILLING LOG

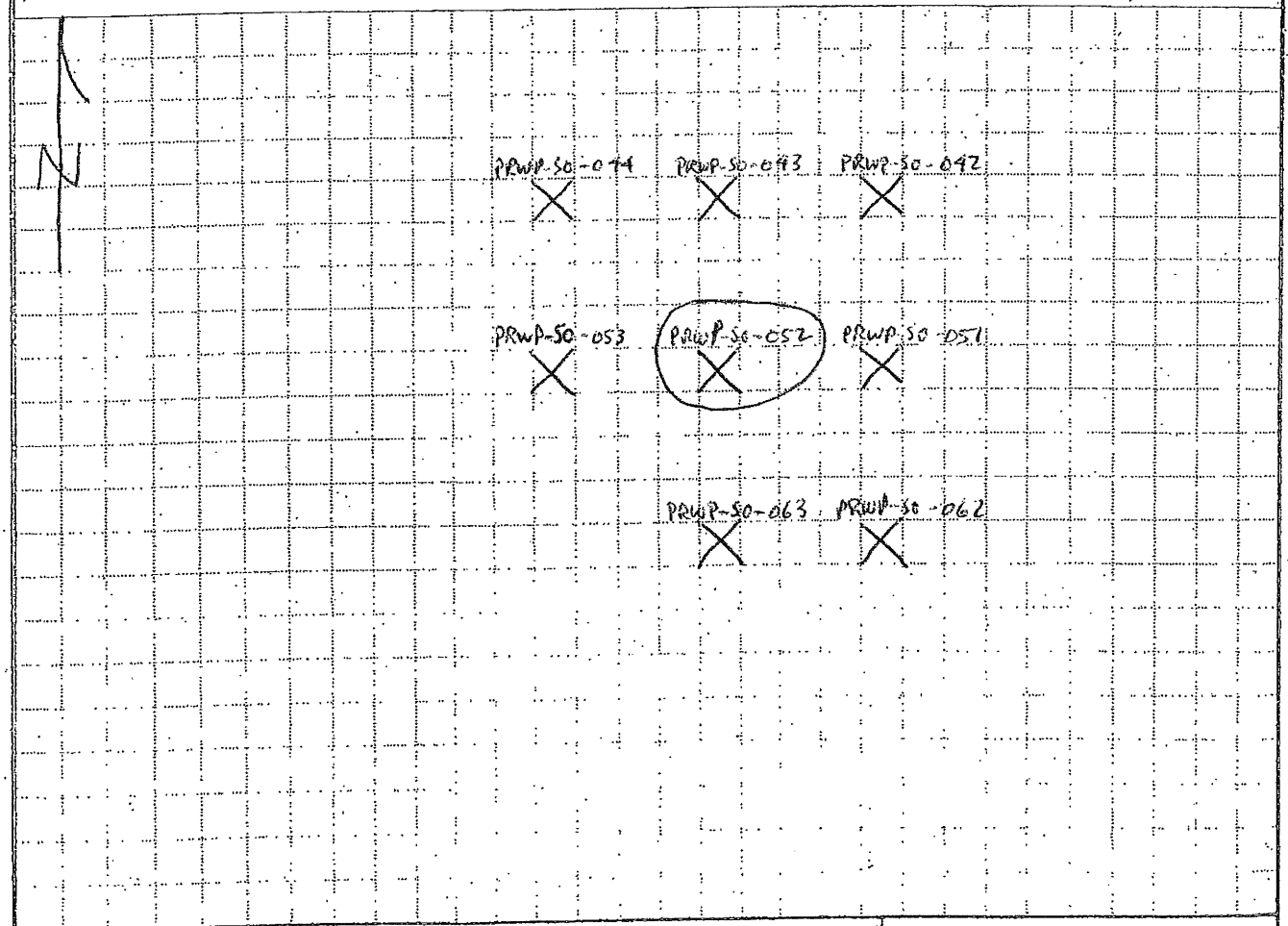
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-052	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >100'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-052

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-50-052.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10yR 4/3) Sand with silt, organics, moist, loose.	SM					
	1					PRWP-50-052 (1'-10')		
		1.8'						
	2	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
	8							
		8.6'						
	9	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-50-052

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HTRW DRILLING LOG

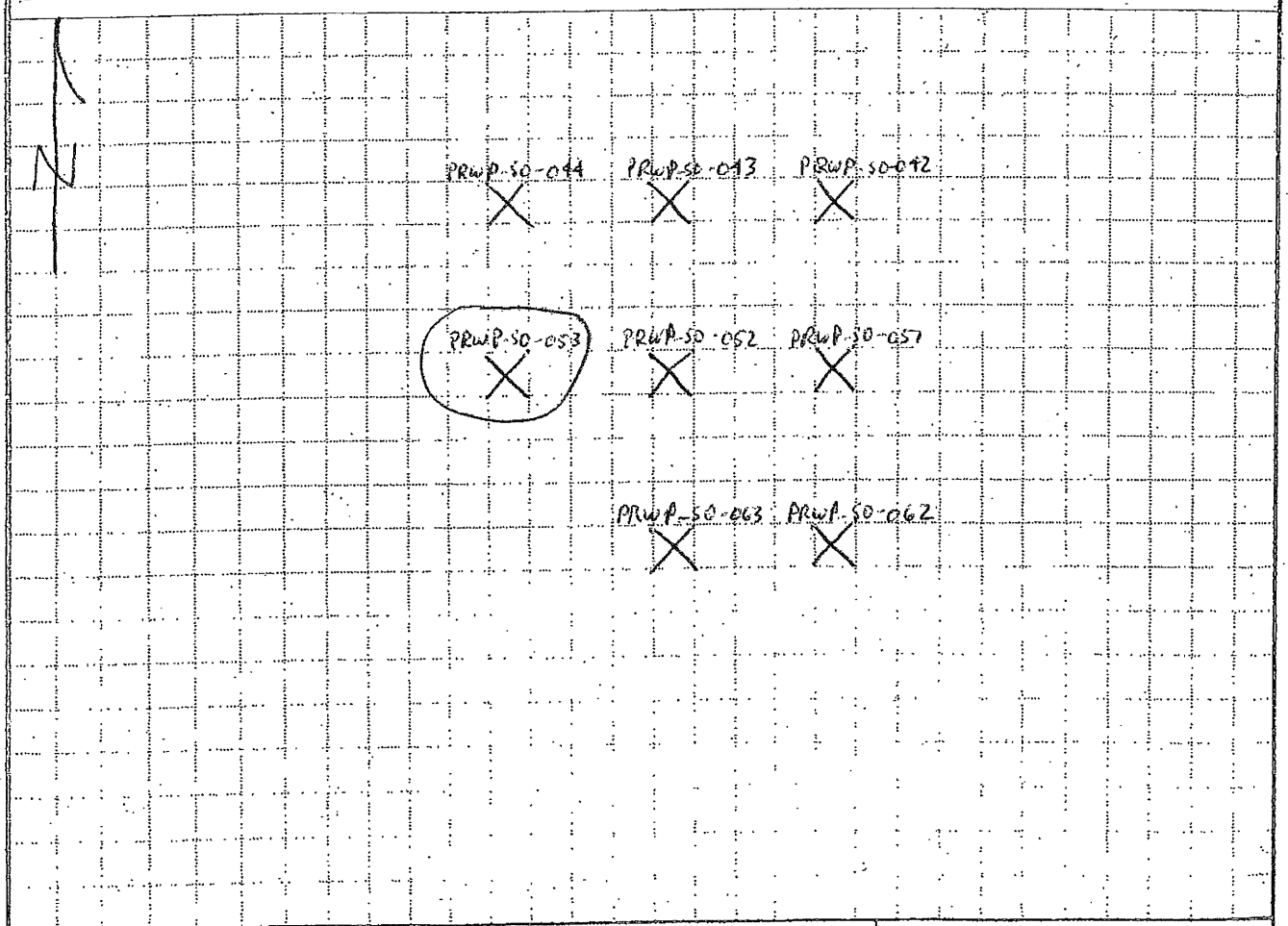
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-053
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-053

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-053.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft. 0.6'	ML					
	1	Yellowish brown (10yR 5/6) sand with silt, moist, medium dense.	SM			PRWP-SO-053 (1'-10')	4.5' / 5.0'	
	2	2.8'						
	3	Brown (10yR 4/3) clay with silt, moist, medium stiff.	CL					
	4							
	5							
	6						5.0' / 5.0'	
	7							
	8	8.0' Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-053

HTRW DRILLING LOG

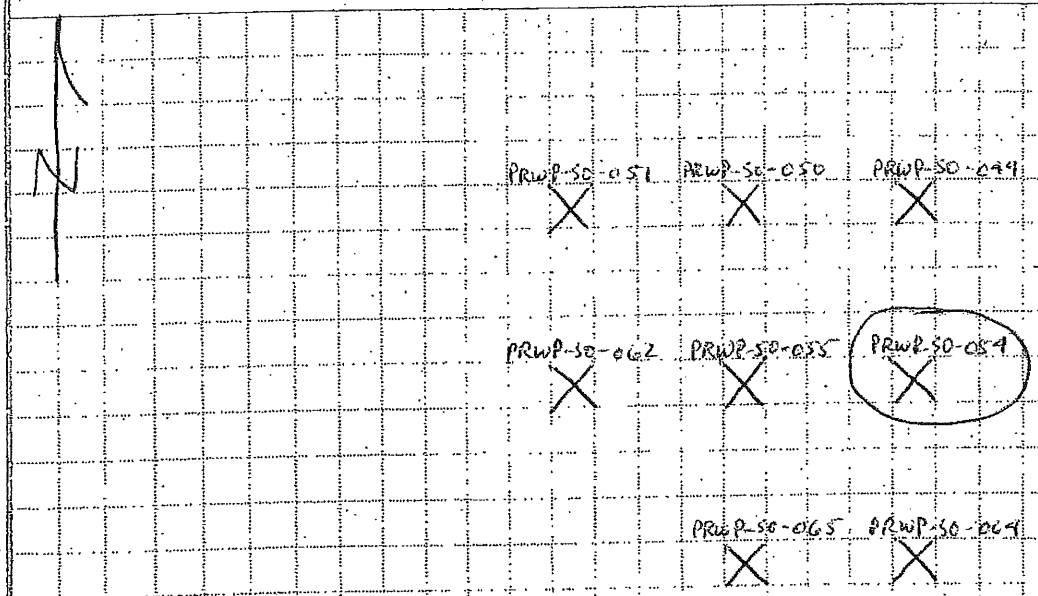
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-054	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Eric W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-054

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-054

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR3/3) silt with sand, organics, moist, soft. 1.0'	ML					
	1	Yellowish brown (10YR5/6) sand with silt, moist, loose. 1.7'	SM			PRWP-SO-054 (1'-10')		
	2	Brown (10YR4/3) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	8.9'						
	9	Dark gray (10YR4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-054

HTRW DRILLING LOG

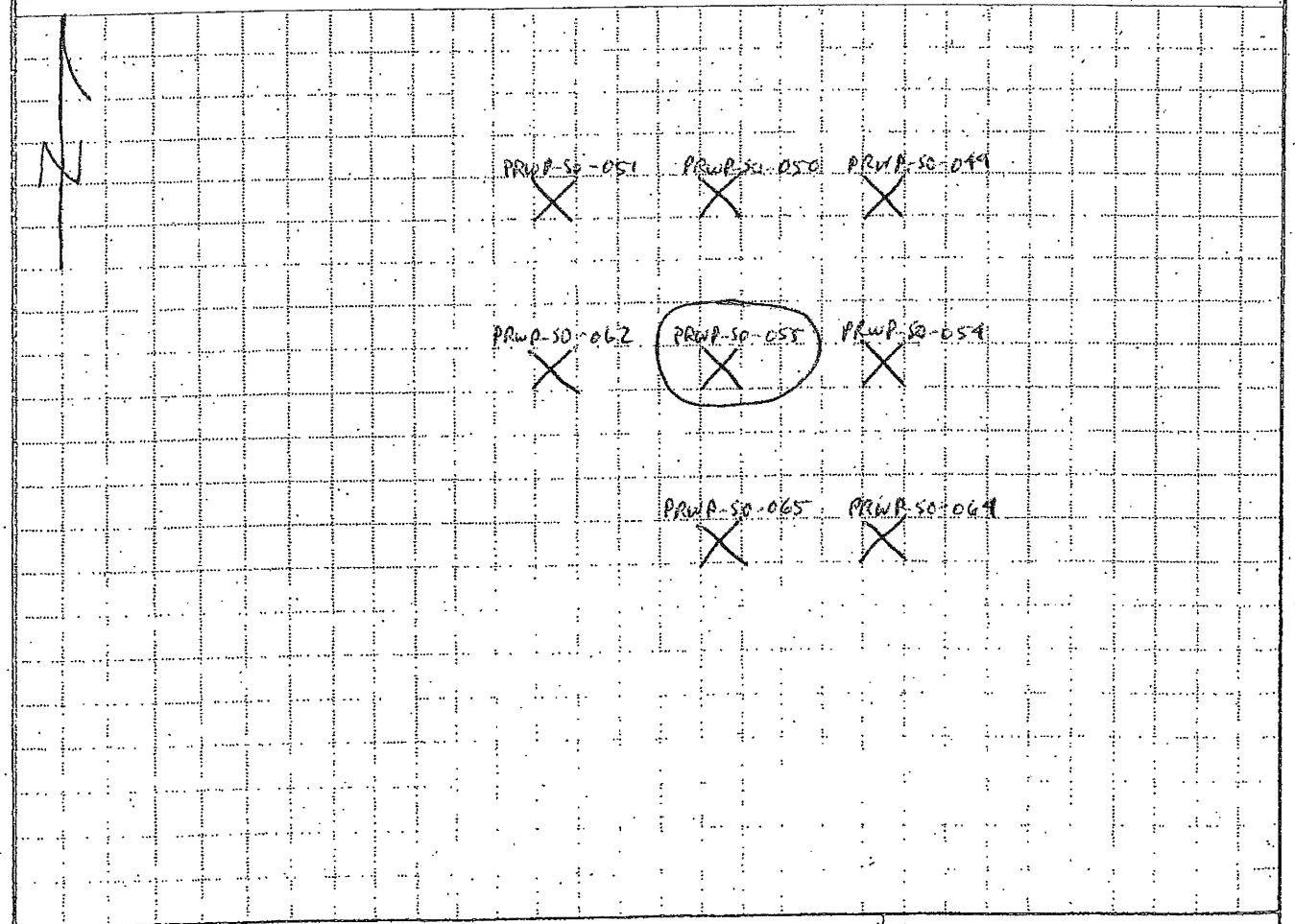
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-055
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-055

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-055.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10YR 4/3) Silt with sand, organics, moist, loose. 1.0'	ML					
	1	Yellowish brown (10YR 5/6) Sand with silt, trace clay, moist, medium dense. 2.0'	SM			PRWP-SO-055 (1'-10')	4.5'/5.0'	
	2	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	8.0'						
	9	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-055

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HTRW DRILLING LOG

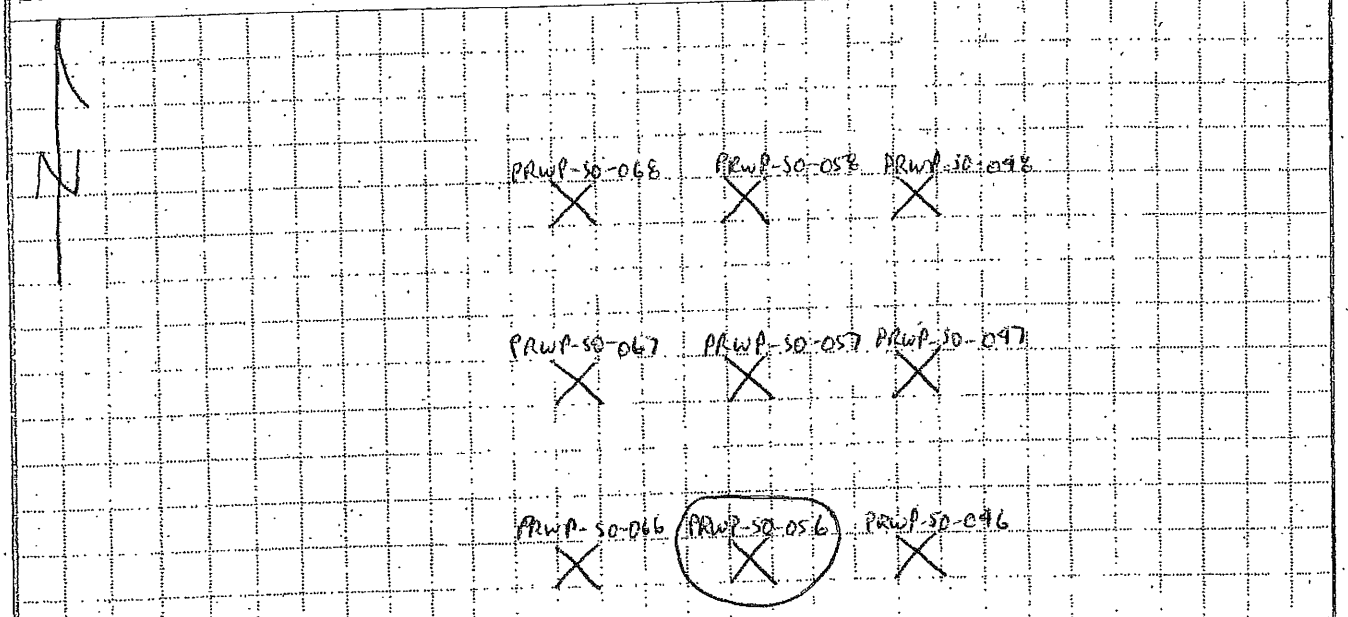
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-056
SHEET / SHEETS	1 OF 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-11-10
11. DATE COMPLETED	11-11-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-056

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-056.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR3/3) silt with sand organics, moist, soft. 0.1'	ML					
		Yellowish brown (10YR5/6) sand with silt, moist, loose.	SM					
	1							
						PRWP-SO-056 (1'-10')		
	2						4.3'/5.0'	
	3							
	4							
	5							
	6							
							5.0'/5.0'	
	7							
	8	8.0' Dark gray (10YR4/1) clay with silt, moist, medium stiff.	CL					
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-056

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HTRW DRILLING LOG

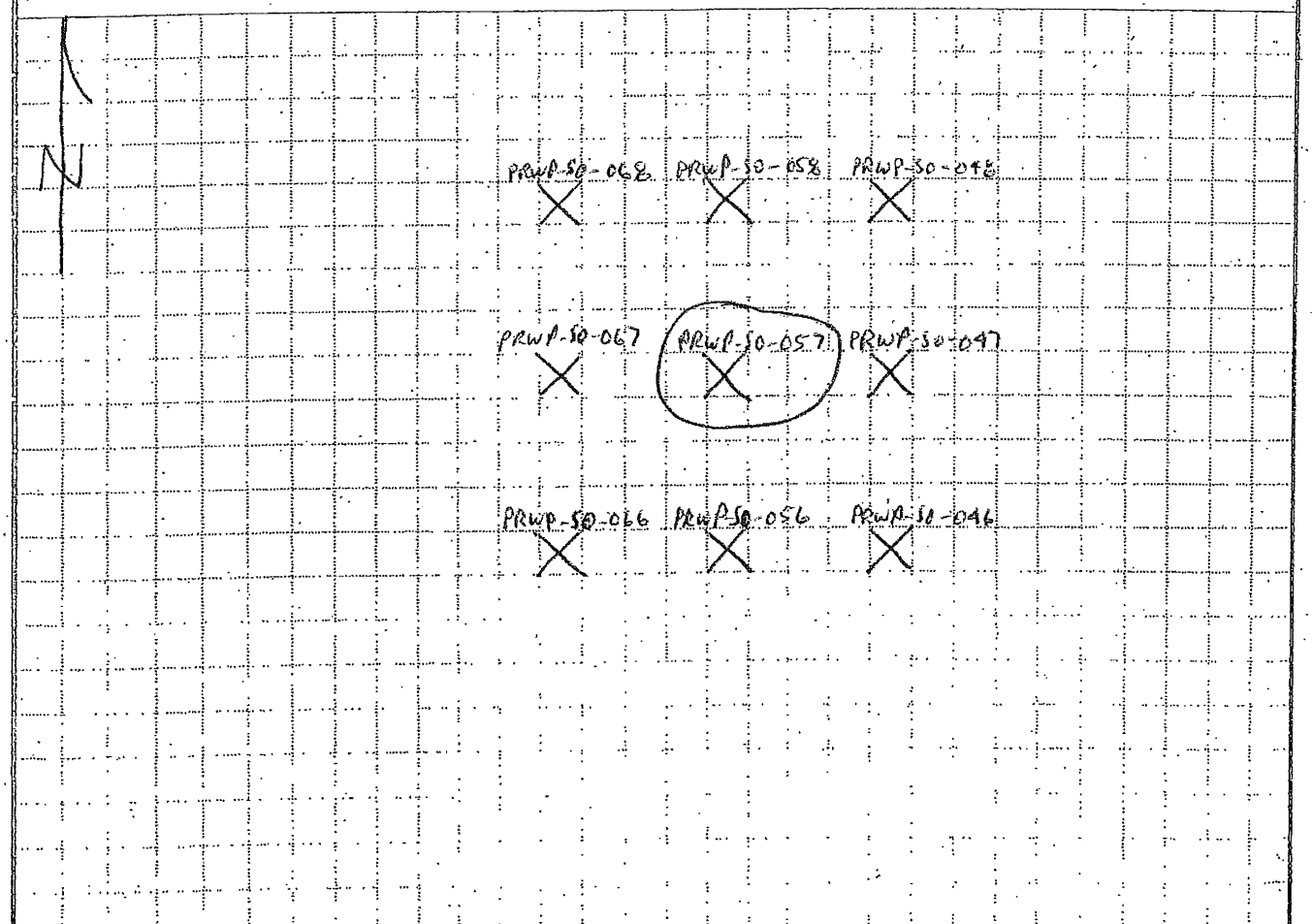
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-057	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO. PRWP-SO-057

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-057

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft 0.1'	ML					
		Dark yellowish brown (10yR 4/6) sand with silt, moist, loose	SM					
	1					PRWP-SO-057 (1'-10')		
	2						4.5'/5.0'	
	3	3.2'						
		Brown (10yR 4/3) clay with sand, silt, moist, medium stiff.	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	8.6'						
		Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-057

HTRW DRILLING LOG

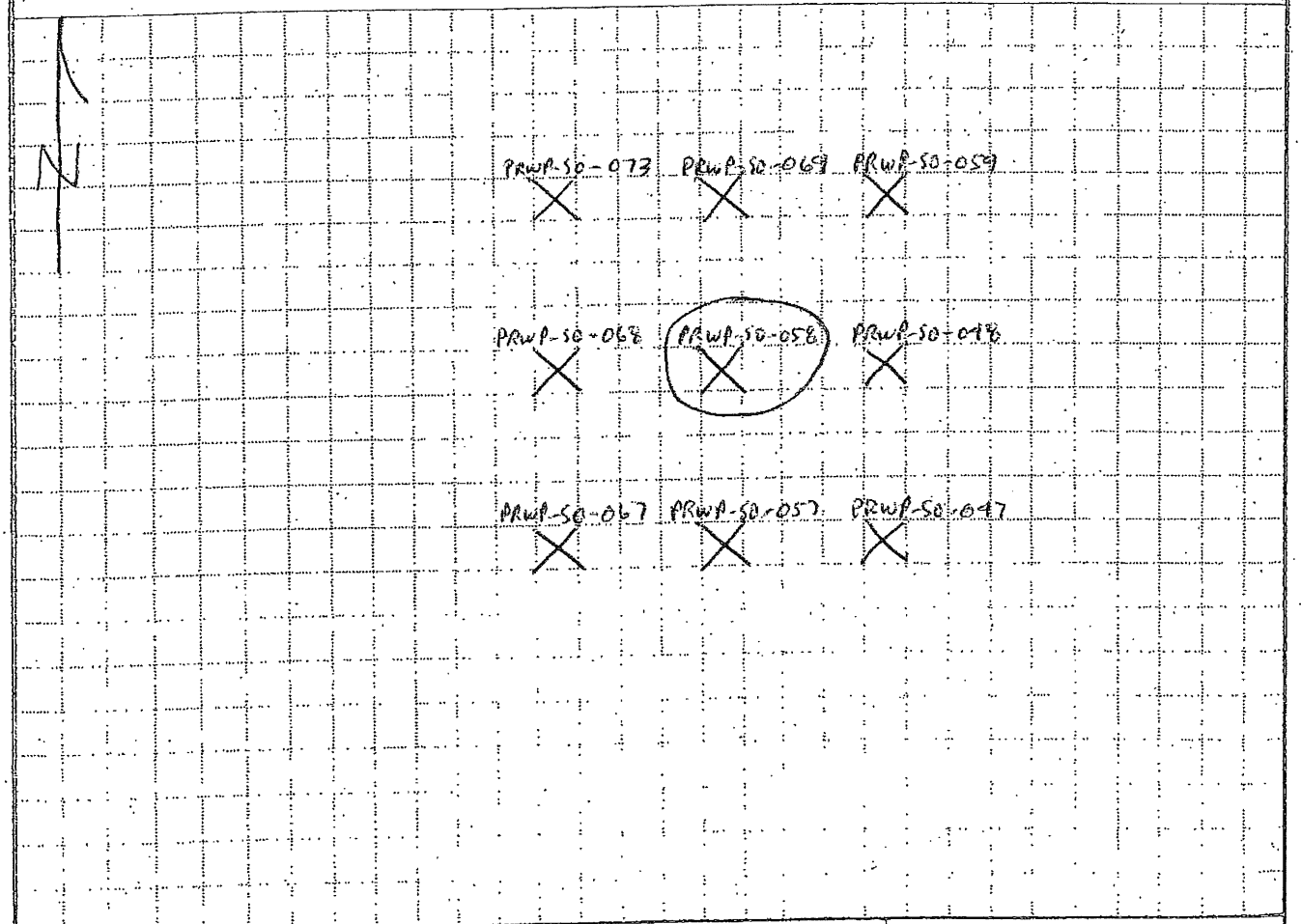
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-058
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-11-10
11. DATE COMPLETED	11-11-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-058

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG (continuation sheet)

Hole Number: PRWP-SO-058.

Project: PBOW-PRRWP | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft. 0.6'	ML					
	1	Dark yellowish brown (10yR 4/6) sand with silt, moist, loose. 3.4'	SM			PRWP-SO-058 (1'-10')	4.5'/5.0'	
	2							
	3							
	4	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff. 7.5'	CL					
	5							
	6							
	7	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.					5.0'/5.0	
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP | Hole Number: PRWP-SO-058

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HTRW DRILLING LOG

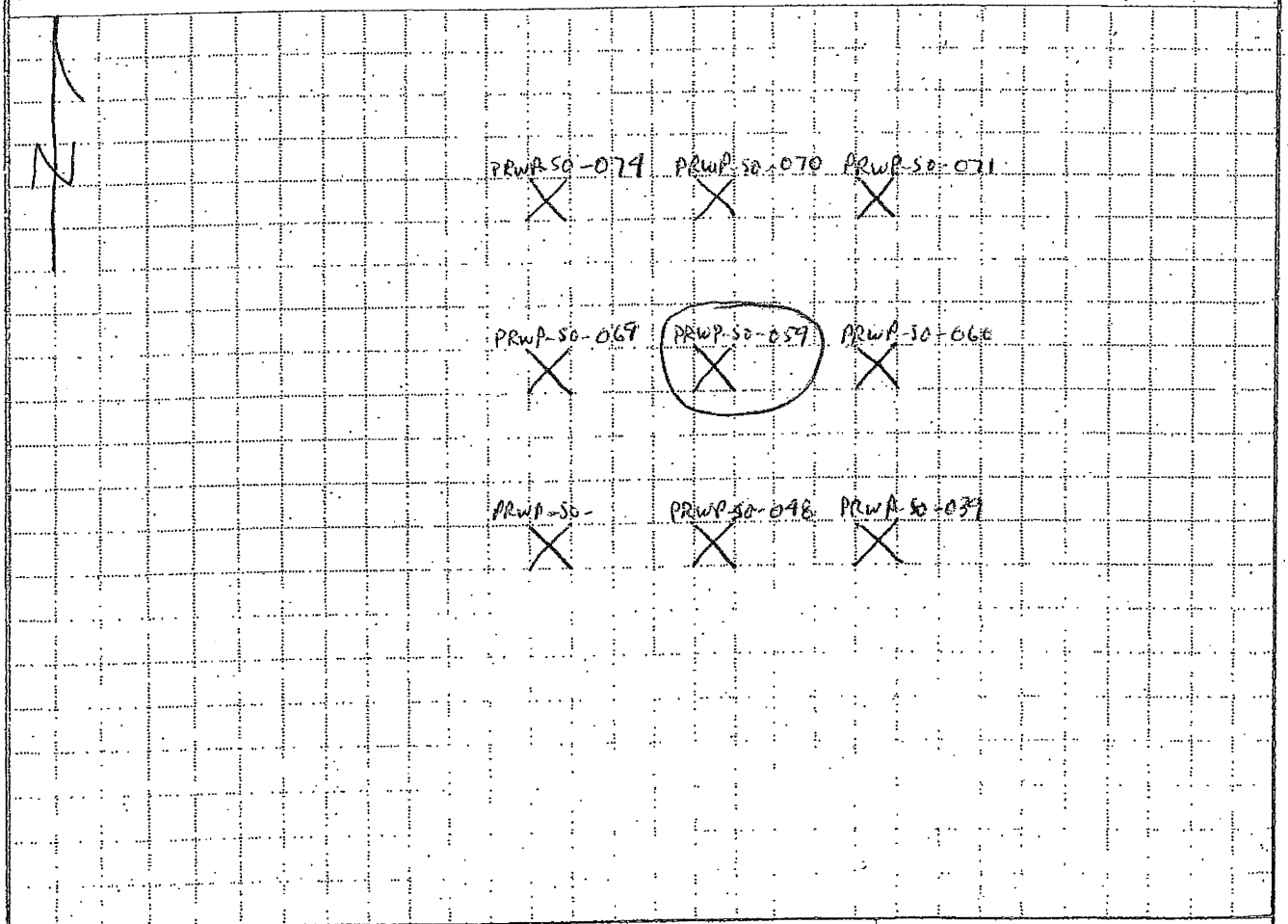
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-059
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF SHEETS 2
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBUROEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-059

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-059

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR3/3) silt with sand, organics, moist, soft. 0.1'	ML					
		Yellowish brown (10YR5/6) Sand with silt, moist, loose.	SM					
	1							
						PRWP-SO-059 (1'-10')		
	2						4.5'/5.0'	
		2.9'						
	3	Brown (10YR4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	8.0'						
		Dark gray (10YR4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-059

HTRW DRILLING LOG

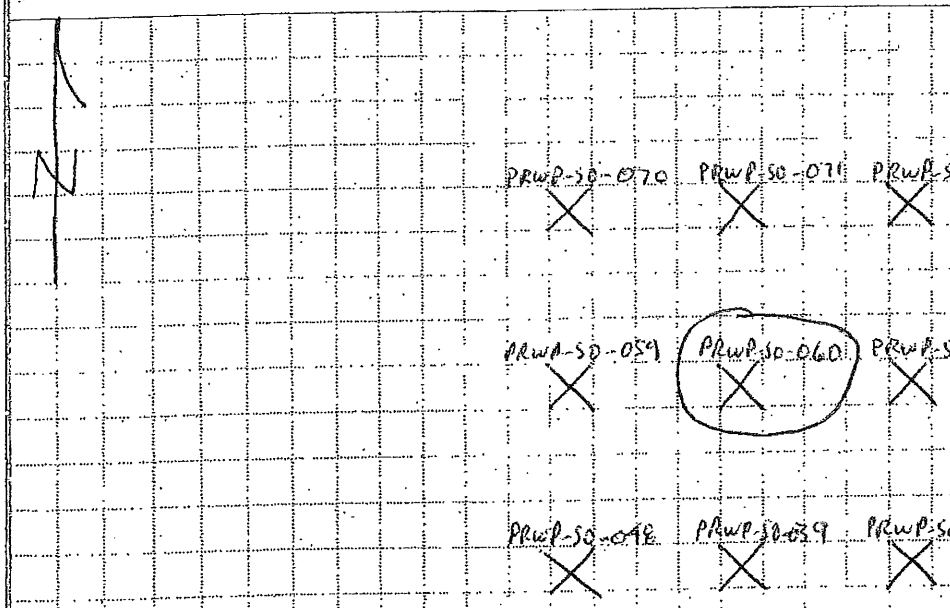
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-060	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO. PRWP-SO-060

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-060

Project: PBOW - PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) silt with sand, organics, moist, soft.	ML					
	1					PRWP-SO-060 (1'-10')		
		1.8'						
	2	Yellowish brown (10YR 5/6) sand with silt, moist, loose.	SM				4.5'/5.0'	
		3.0'						
	3	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
		7.9'						
	8	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-060

HTRW DRILLING LOG

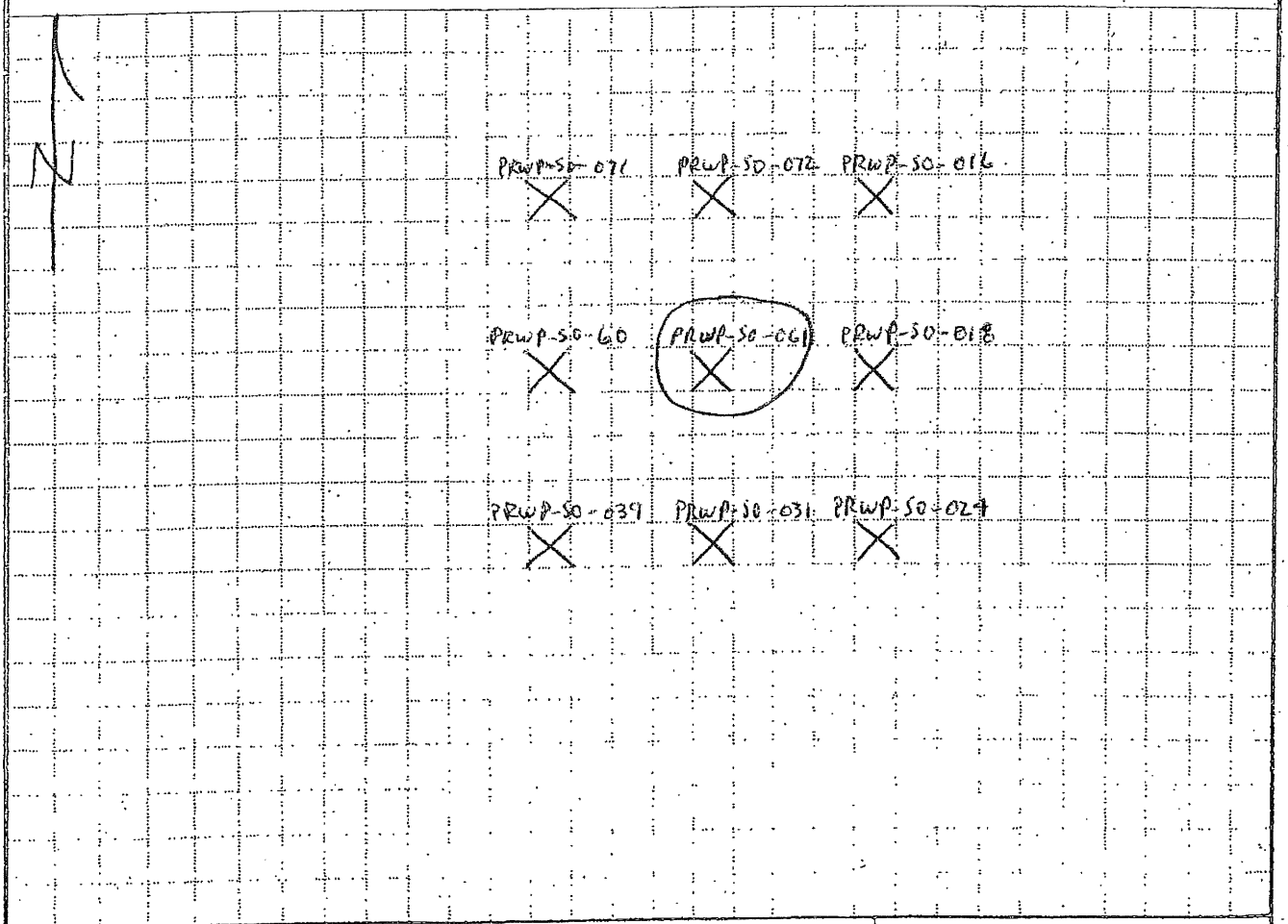
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-061
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO. PRWP-SO-061

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-061.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft 0.7'	ML					
	1	Dark yellowish brown (10yR 4/6) sand with silt, moist, loose. 2.8'	SM			PRWP-SO-061	4.5'/5.0'	
	2							
	3	Brown (10yR 4/3) clay with silt, moist, medium stiff.						
	4							
	5							
	6							
	7	7.9'					5.0'/5.0'	
	8	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-061

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HTRW DRILLING LOG

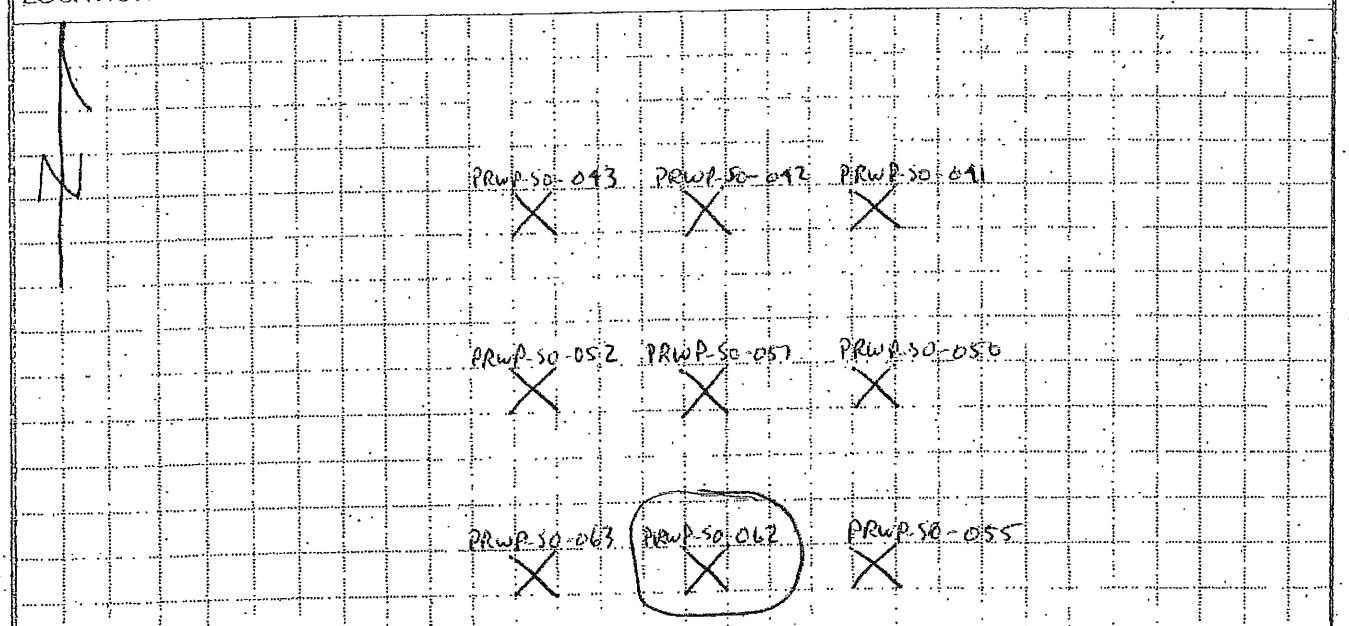
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-062	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO. PRWP-SO-062

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-062

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10yR4/3) Sand with silt, organics, moist, loose.	SM					
	1							
						PRWP-SO-062 (1'-10')		
	2	2.3'					4.5'/5.0'	
		Brown (10yR4/3) clay with silt, sand, moist, medium stiff.	CL					
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	8.2'						
		Dark gray (10yR4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-062

HTRW DRILLING LOG

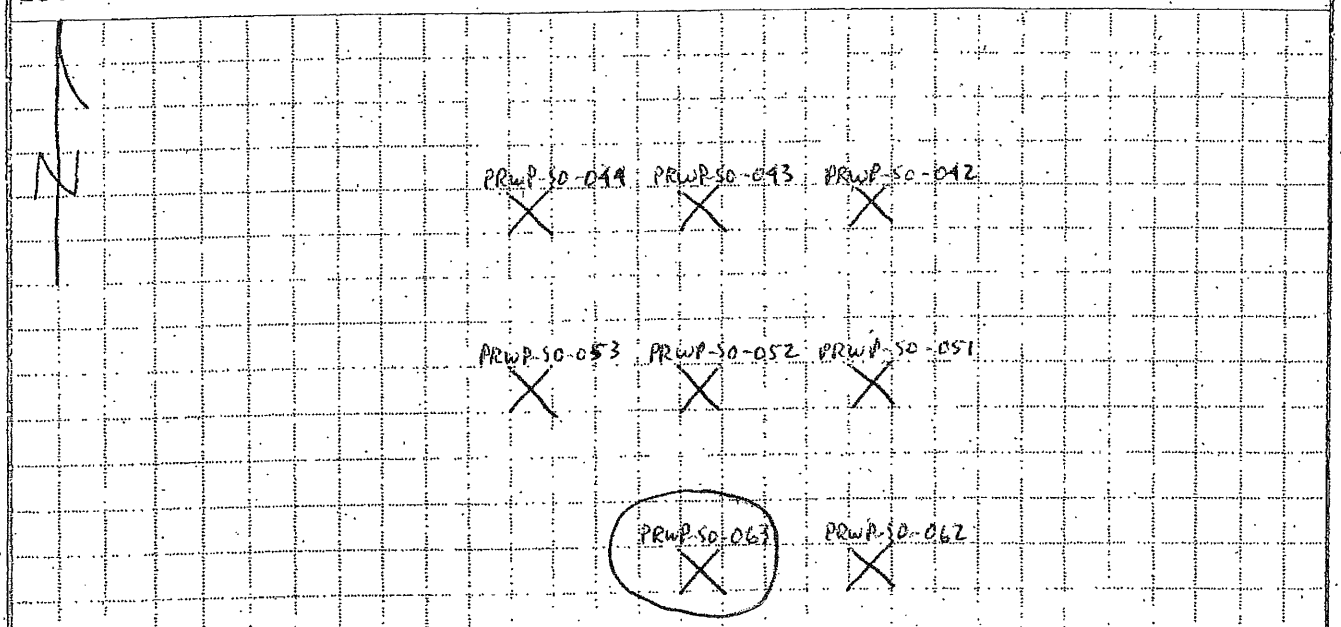
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-063	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-063

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-063

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn.	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft. 1.0'	ML					
	1	Dark yellowish brown (10yR 4/6) sand with silt, moist, loose. 2.7'	SM			PRWP-SO-063 (1'-10')	4.5'/5.0'	
	2							
	3	Brown (10yR 4/3) clay with silt, sand, moist, medium stiff. 7.8'	CL					
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-063

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HTRW DRILLING LOG

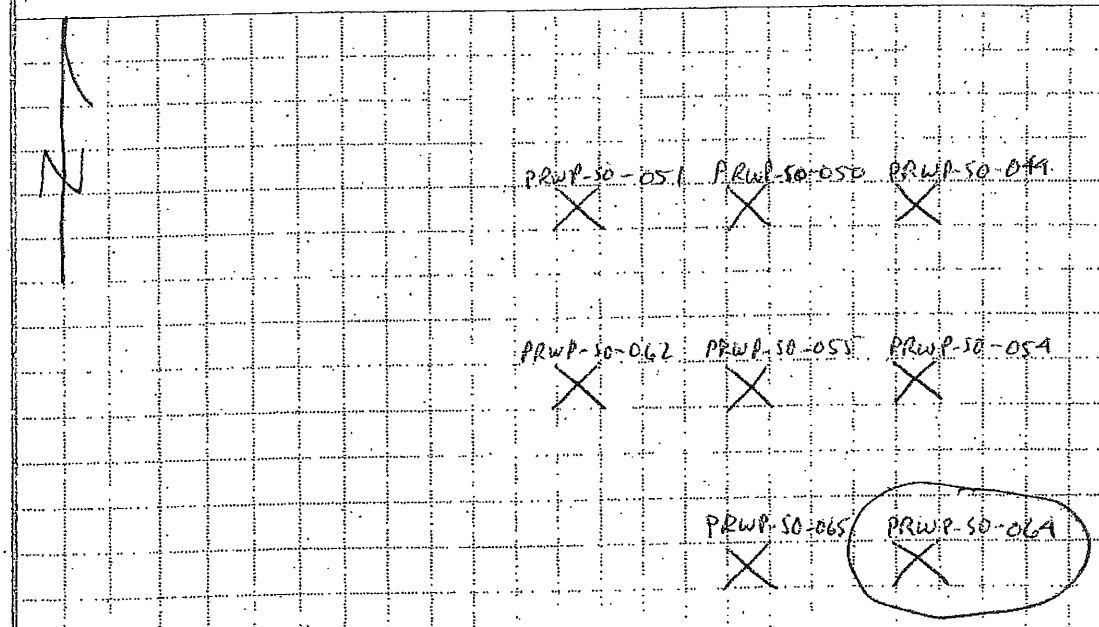
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	DISTRICT: Nashville
		HOLE NUMBER: PRWP-SO-064
		SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-064

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-064.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) Sand with silt, organics, moist, soft. 0.9'	SM					
	1	Dark yellowish brown (10YR 4/6) sand with silt, moist, medium dense. 2.1'				PRWP-SO-064 (1'-10")		
	2	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6							
	7	7.9'					5.0'/5.0'	
	8	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-064

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HTRW DRILLING LOG

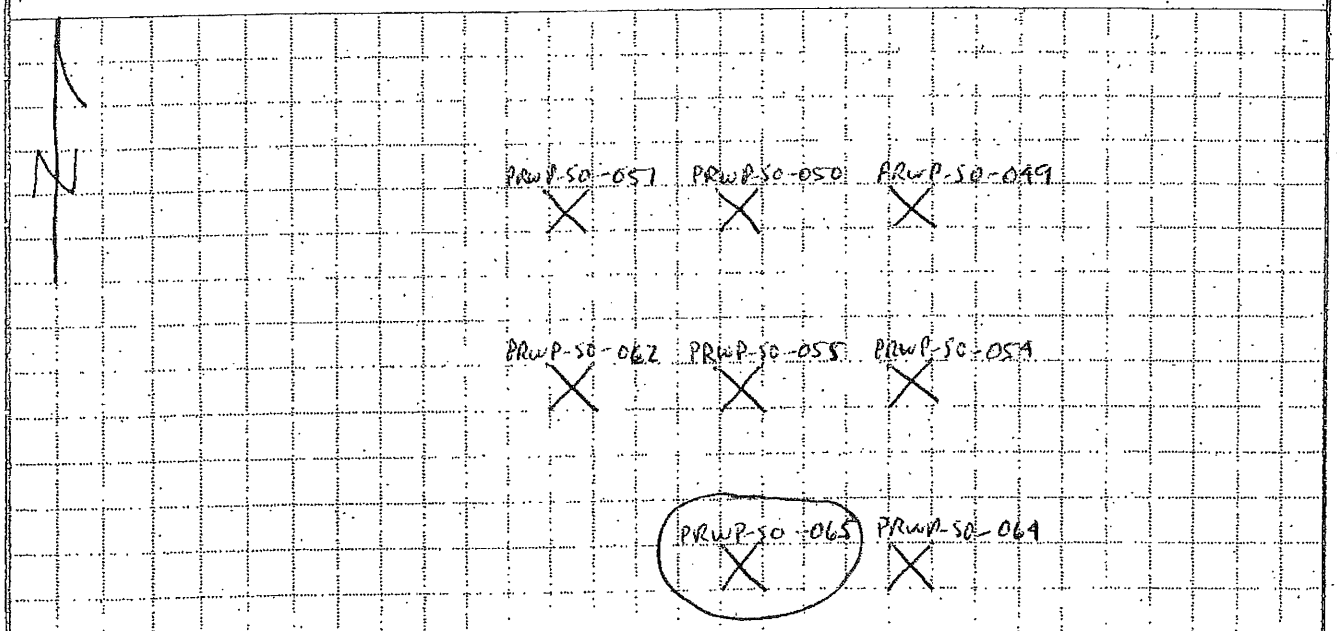
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-065
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-11-10
11. DATE COMPLETED	11-11-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-065

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG (continuation sheet)

Hole Number: PRWP-SO-065

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) silt with clay, organics, moist, soft. 1.0	ML					
	1	Dark yellowish brown (10YR 4/6) Sand with silt, trace clay, moist, medium dense. 2.0'	SM			PRWP-SO-065 (1'-10')	4.5' / 5.0'	
	2	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff	CL					
	3							
	4							
	5							
	6						5.0' / 5.0'	
	7							
	8							
	9	9.0' Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-065

HTRW DRILLING LOG

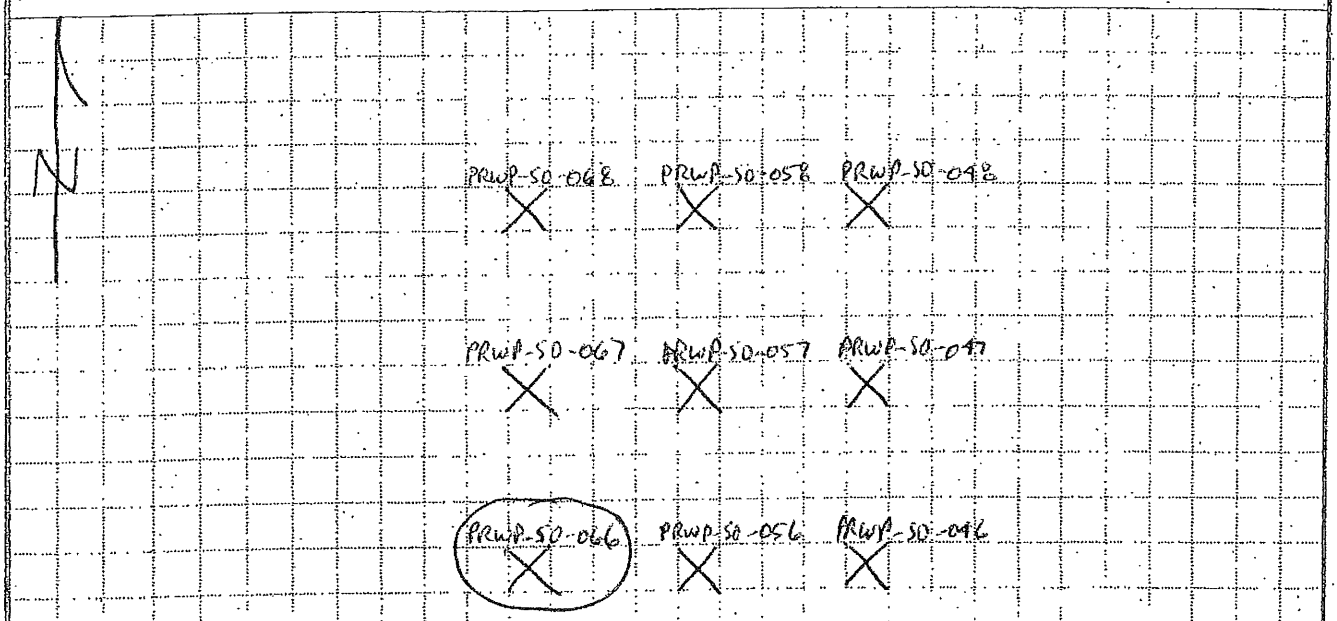
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-066
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Eric W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-066

Figure 4-2
Drilling Log

Shaw Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-066

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) sand with silt, organics, moist, loose. 0.3'	SM					
		Dark yellowish brown (10YR 4/6) sand with silt, moist, loose.						
	1							
						PRWP-SO-066 (1'-10')		
	2						4.5'/5.0'	
		2.9'						
	3	Brown (10YR 4/3) clay with silt, moist, medium stiff.	CL					
	4							
	5							
	6							
							5.0'/5.0'	
	7							
		7.9'						
	8	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-066

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HTRW DRILLING LOG

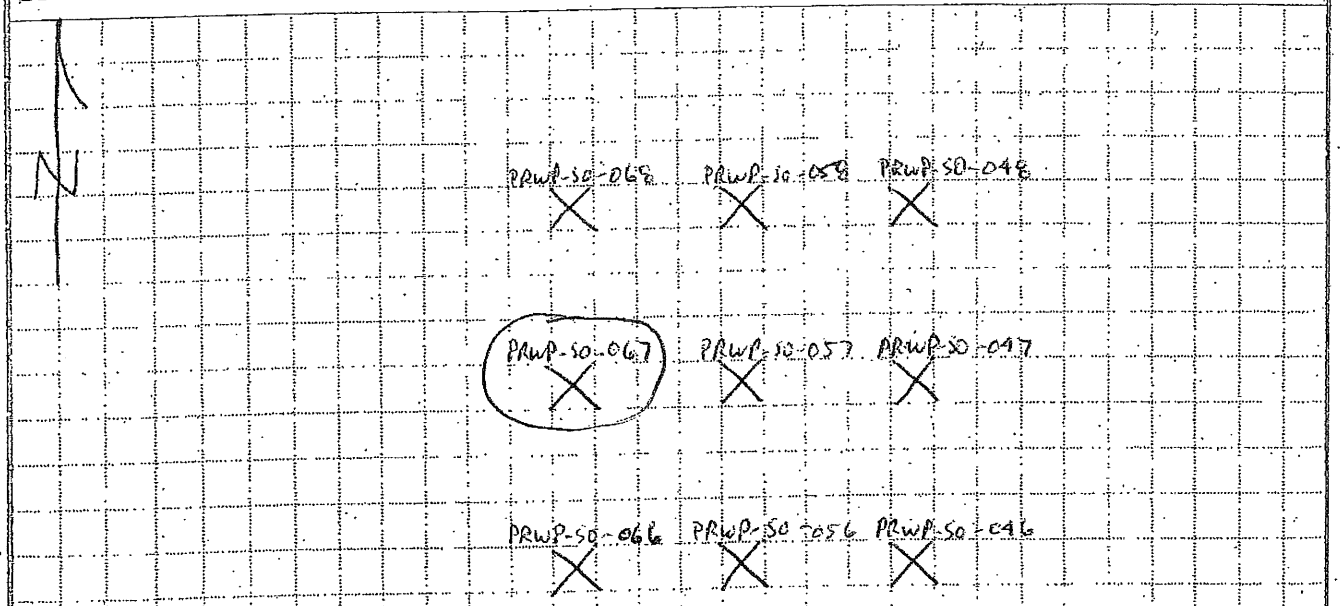
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-067	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-11-10	11. DATE COMPLETED: 11-11-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-067

Figure 4-2
Drilling Log

Shaw Shaw Environmental, Inc.

DRILLING LOG (continuation sheet)

Hole Number: PRWP-SD-067.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) Silt with Sand, organics, moist, soft. 1.0'	ML					
	1	Yellowish brown (10YR 5/6) Sand with silt, moist, loose. 3.2'	SM			PRWP-SD-067 (1'-10')	4.5'/5.0'	
	2							
	3	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff. 6.4'	CL					
	4							
	5							
	6							
	7						5.0'/5.0'	
	8	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SD-067

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HTRW DRILLING LOG

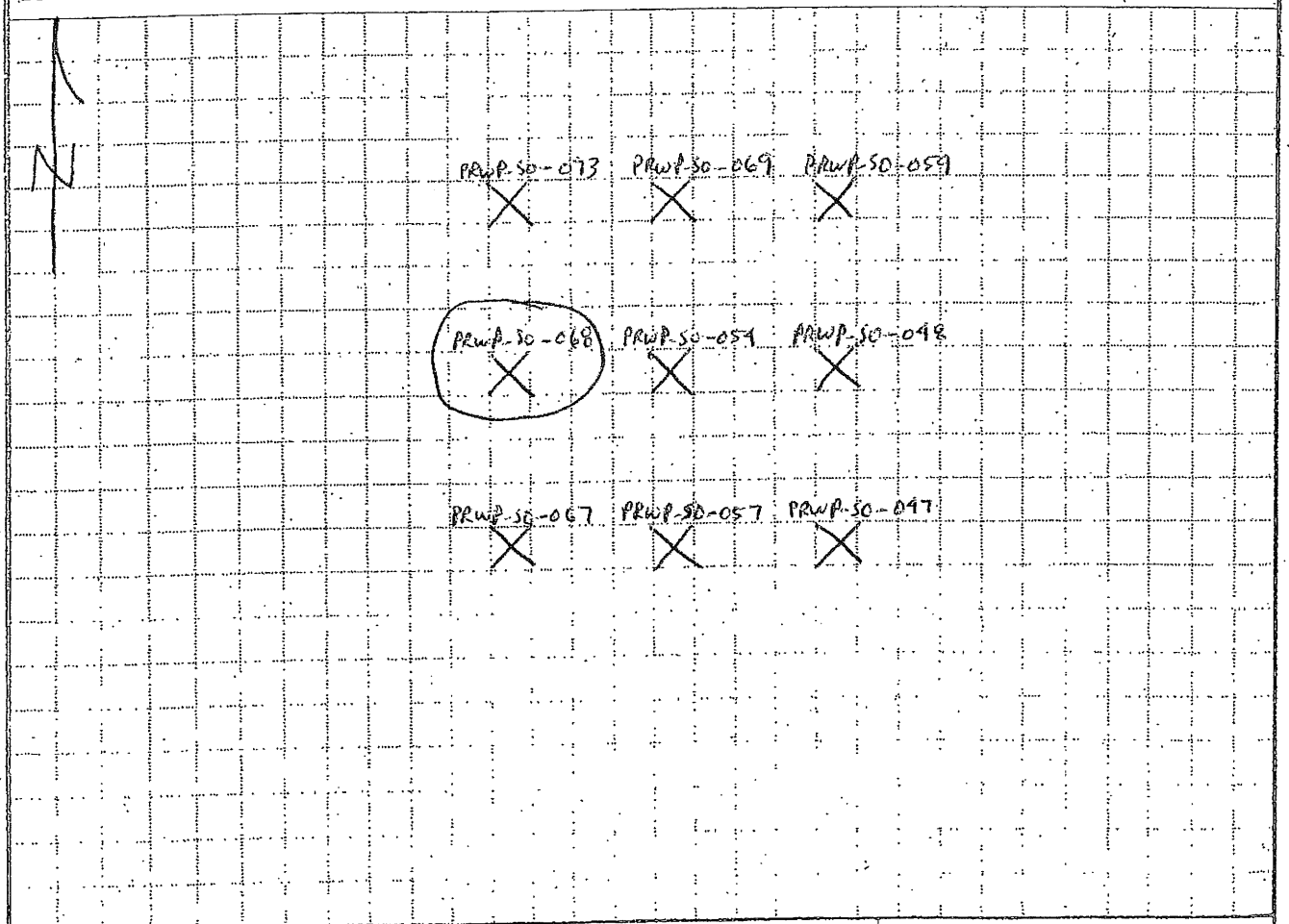
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-068	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-068

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-068

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR3/3) silt with sand, organics, moist, soft. 0.6'	ML					
	1	Yellowish brown (10yR5/6) sand with silt, moist, loose. 2.5'	SM			PRWP-SO-068 (1'-10')	4.5'/5.0'	
	2							
	3	Brown (10yR4/3) clay with silt, sand, moist, medium stiff. 7.2'	CL					
	4							
	5							
	6						5.0'/5.0'	
	7	Dark gray (10yR4/3) clay with silt, sand, moist, medium stiff.						
	8							
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-068

HTRW DRILLING LOG

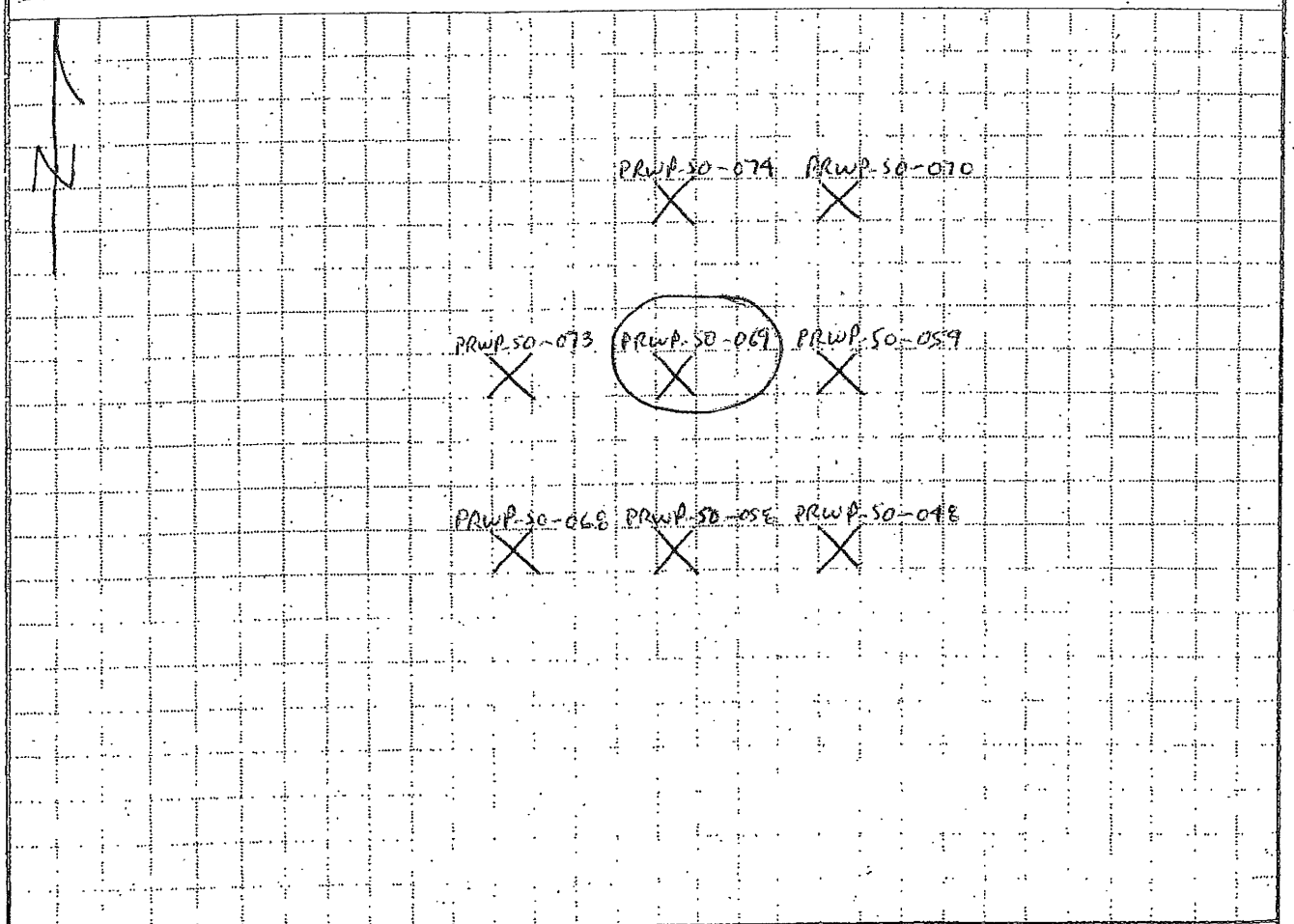
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-069
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBUROEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-069

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-069

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) Silt with sand organics, moist, soft. 0.7'	ML					
	1	Yellowish brown (10YR 5/6) Sand with silt, moist, loose. 3.4'	SM			PRWP-SO-069 (1'-10')	4.5'/5.0'	
	2							
	3							
		Brown (10YR 4/3) clay with silt, trace sand, moist, medium stiff. 8.4'	CL					
	4							
	5							
	6						5.0'/5.0'	
	7							
	8							
		Dark gray (10YR 4/1) clay with silt, sand, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-069

HTRW DRILLING LOG

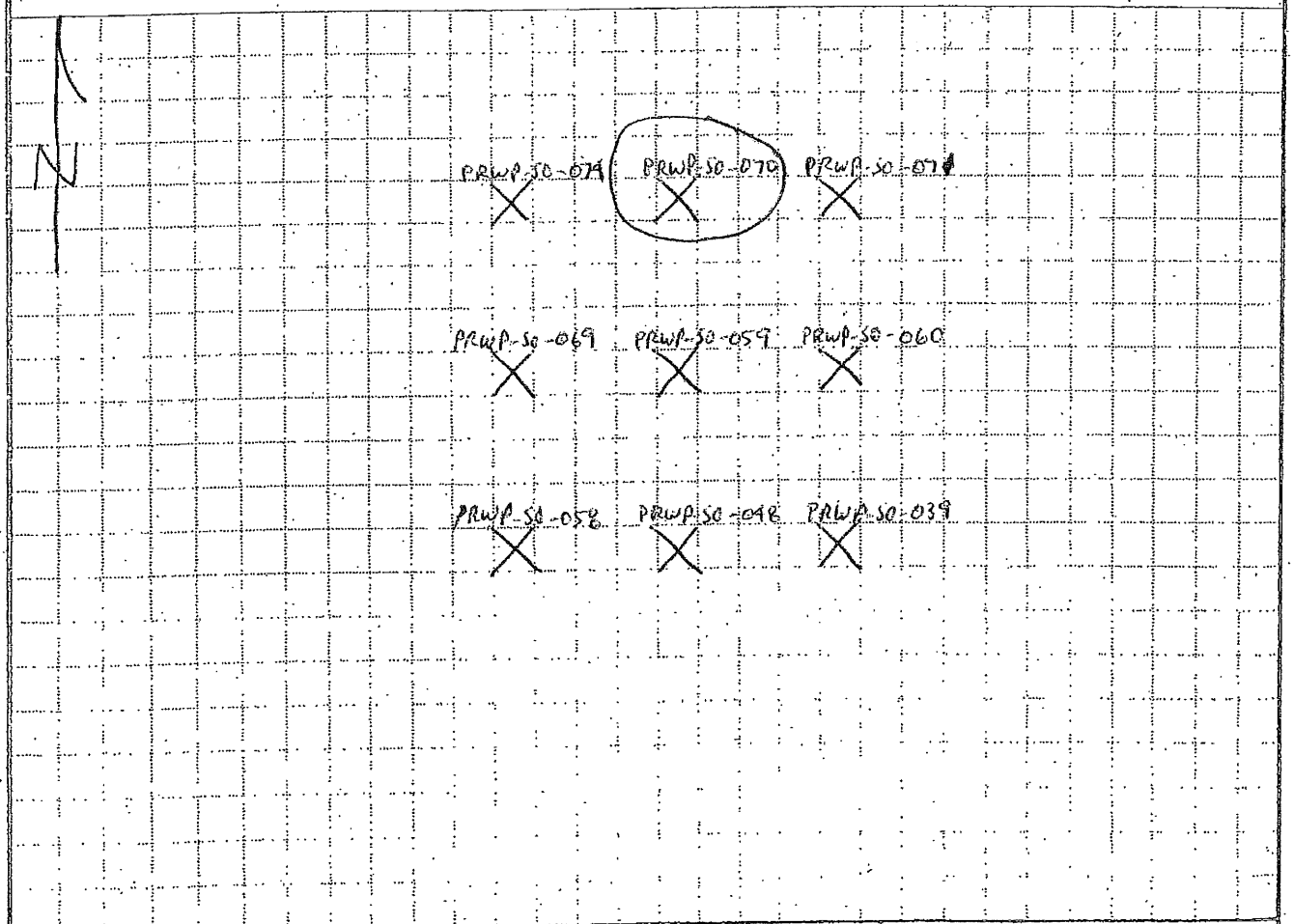
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-070
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-12-10
11. DATE COMPLETED	11-12-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick J. Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-070

Figure 4-2
Drilling Log

Shaw Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-070.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft. 0.3'	ML					
		Yellowish brown (10yR 5/6) sand with silt, moist, loose.	SM					
	1							
						PRWP-SO-070 (1'-10')	4.5'/5.0'	
	2							
	3	3.1'						
		Brown (10yR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
							5.0'/5.0'	
	7							
	8	8.3'						
		Dark gray (10yR 4/1) clay with silt, sand, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-070

HTRW DRILLING LOG

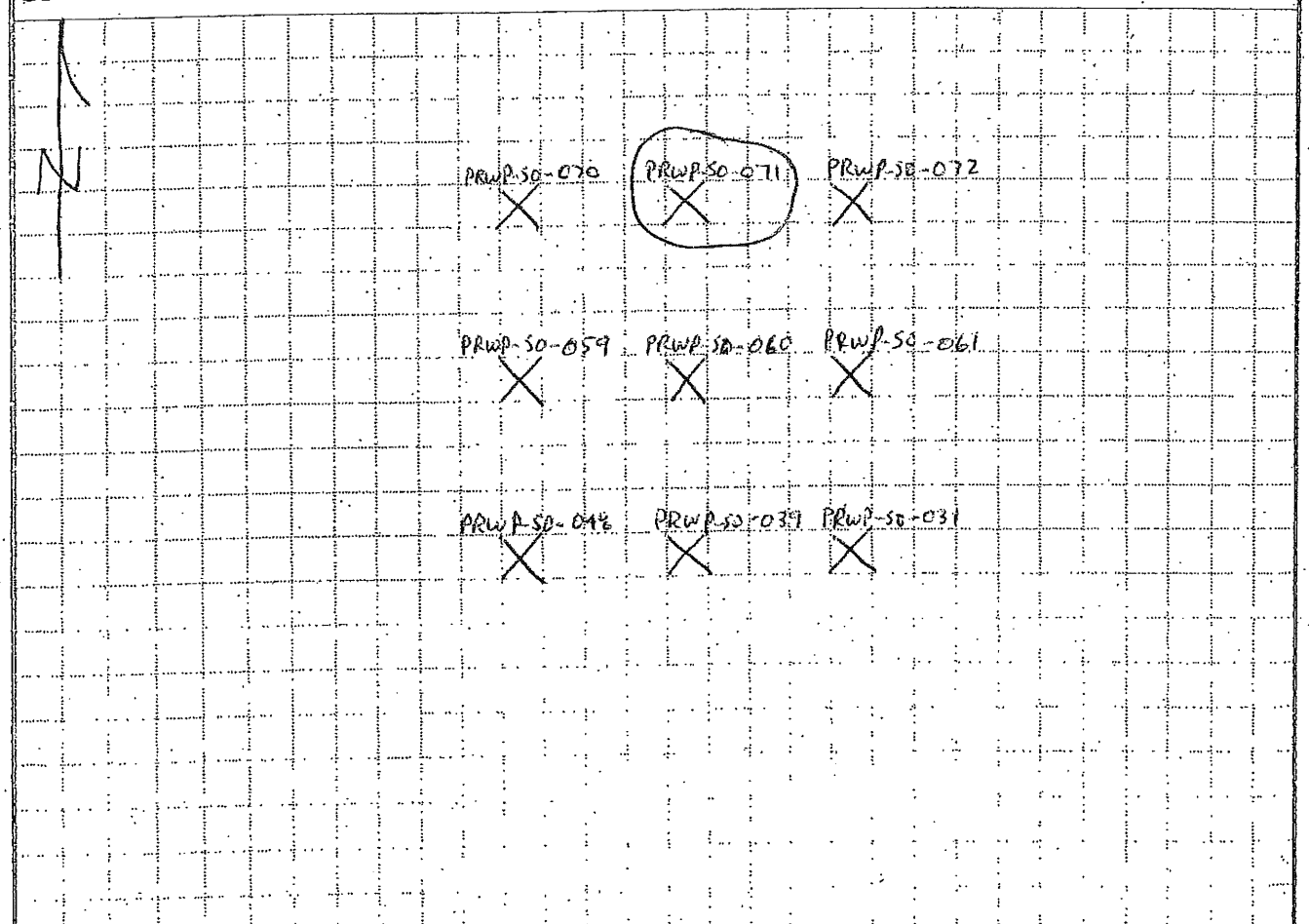
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-071	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-071

Figure 4-2
Drilling Log

Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-071

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR3/3) silt with sand, organics, moist, soft. 0.3'	ML					
		Yellowish brown (10yR5/6) sand with silt, moist, loose.	SM					
	1							
						PRWP-SO-071 (1'-10')	4.5'/5.0'	
	2							
	3	3.1'						
		Brown (10yR4/3) clay with silt, moist, medium stiff.	CL					
	4							
	5							
	6						5.0'/5.0'	
	7	7.7'						
		Dark gray (10yR4/1) clay with silt, moist, medium stiff.						
	8							
	9							
	10	Boring Complete.						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-071

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HTRW DRILLING LOG

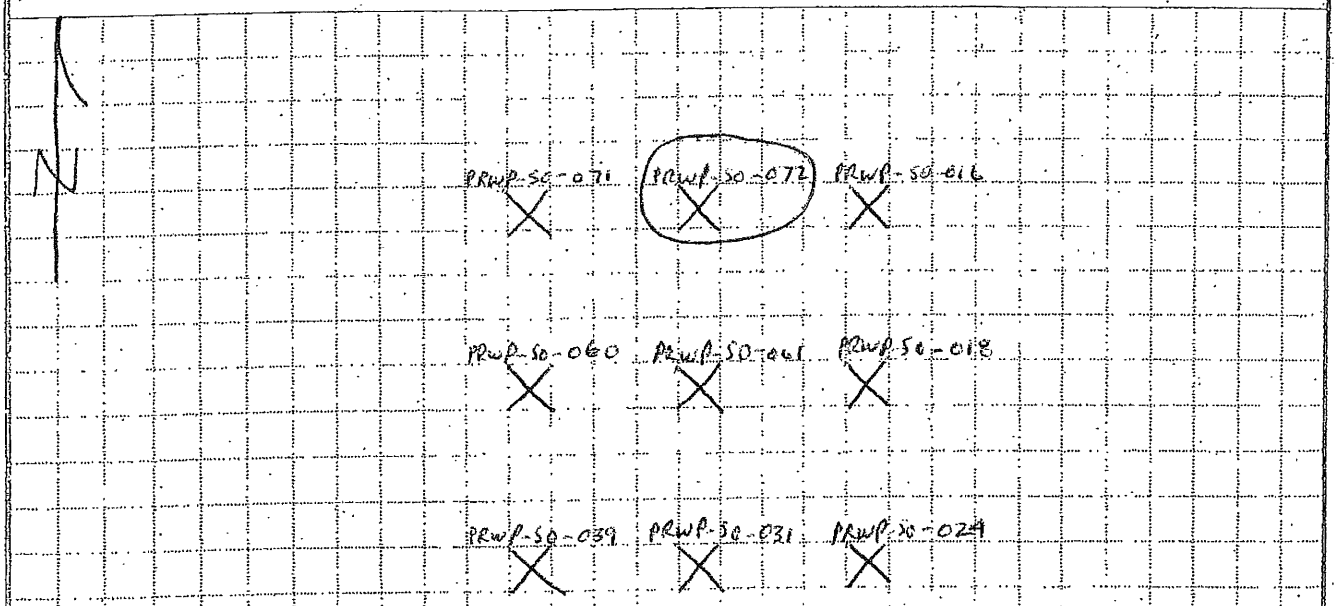
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-072	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erik W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-072

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-072.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
	1	Very dark brown (10YR 2/2) Silt with sand, organics, moist, soft. 1.4'	ML					
	2	Dark yellowish brown (10YR 4/6) Sand with silt, moist, medium dense. 2.8	SM			PRWP-SO-072 (1'-10')	4.5'/5.0'	
	3	Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	4							
	5							
	6							
	7	7.7'					5.0'/5.0'	
	8	Dark gray (10YR 4/1) clay with silt, moist, medium stiff						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-072

HTRW DRILLING LOG

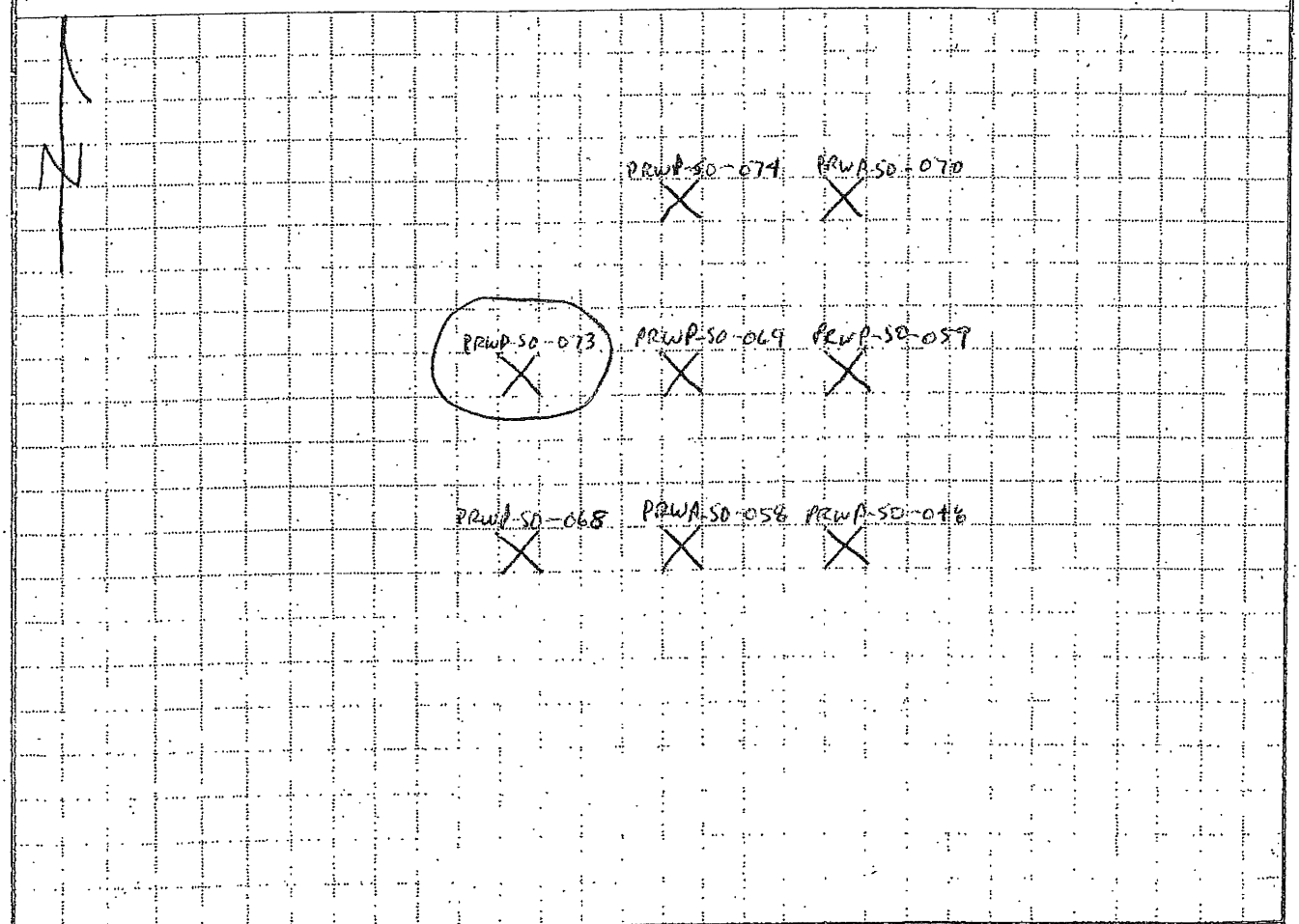
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-073
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO: PRWP-SO-073

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-073.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10yR 3/3) silt with sand, organics, moist, soft.	ML					
	1	1.1'						
		Dark yellowish brown (10yR 4/6) sand with silt, moist, medium	SM			PRWP-SO-073 (1'-10')		
	2						4.5'/5.0'	
	3							
	4	4.2'						
		Brown (10yR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	5							
	6							
	7						5.0'/5.0'	
	8							
	9	9.0'						
		Dark gray (10yR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-073

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HTRW DRILLING LOG

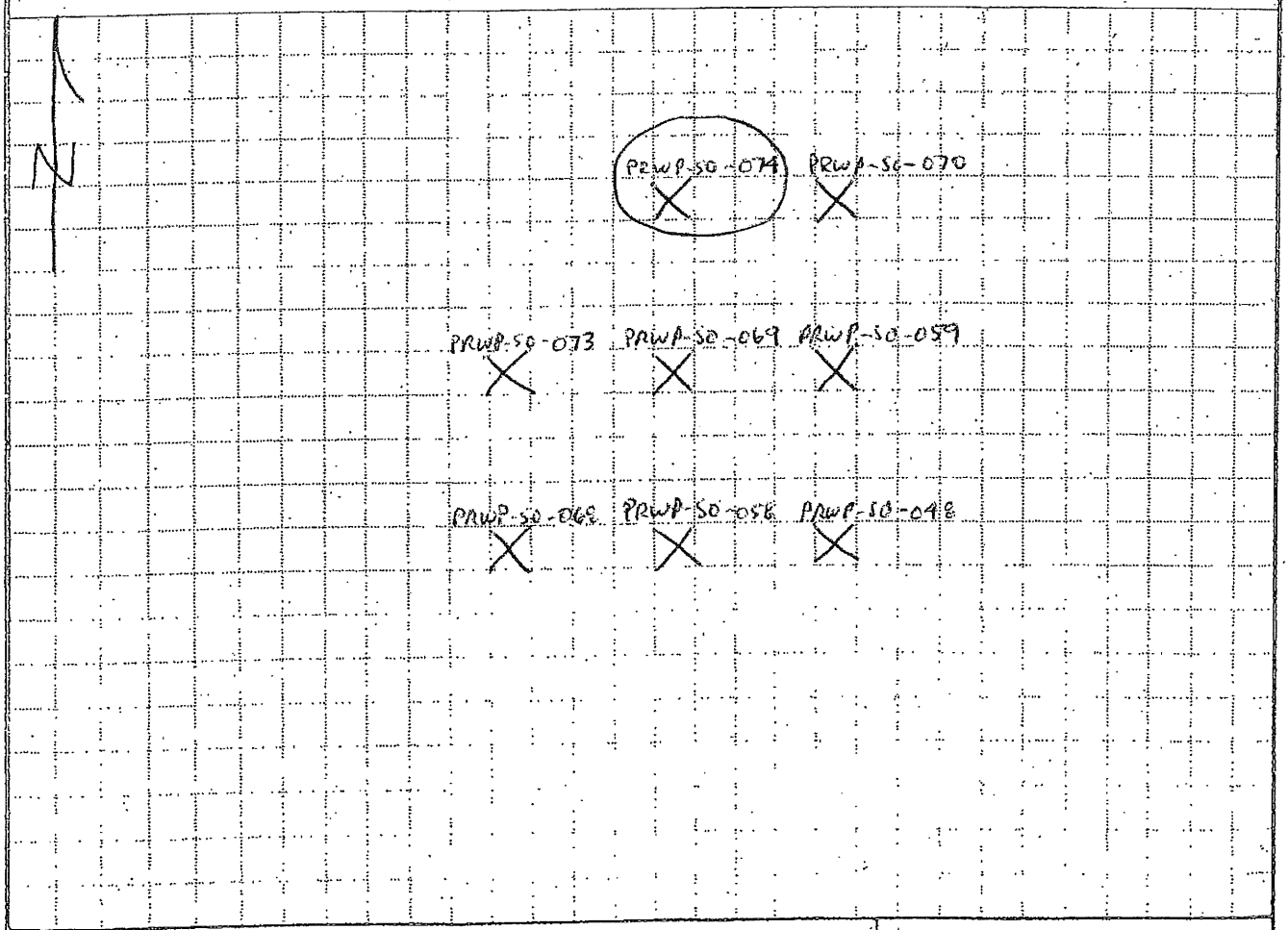
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-074	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Enid W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-074

Figure 4-2
Drilling Log

Shaw Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-074

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Dark brown (10YR 3/3) silt with sand, organics, moist, soft. 0.6'	ML					
	1	Yellowish brown (10YR 5/6) sand with silt, moist, loose	SM					
						PRWP-SO-074 (1'-10')		
	2						4.5'/5.0'	
	3							
	4	4.2'						
		Brown (10YR 4/3) clay with silt, sand, moist, medium stiff.	CL					
	5							
	6							
							5.0'/5.0'	
	7							
	8	8.7'						
	9	Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-074

HTRW DRILLING LOG

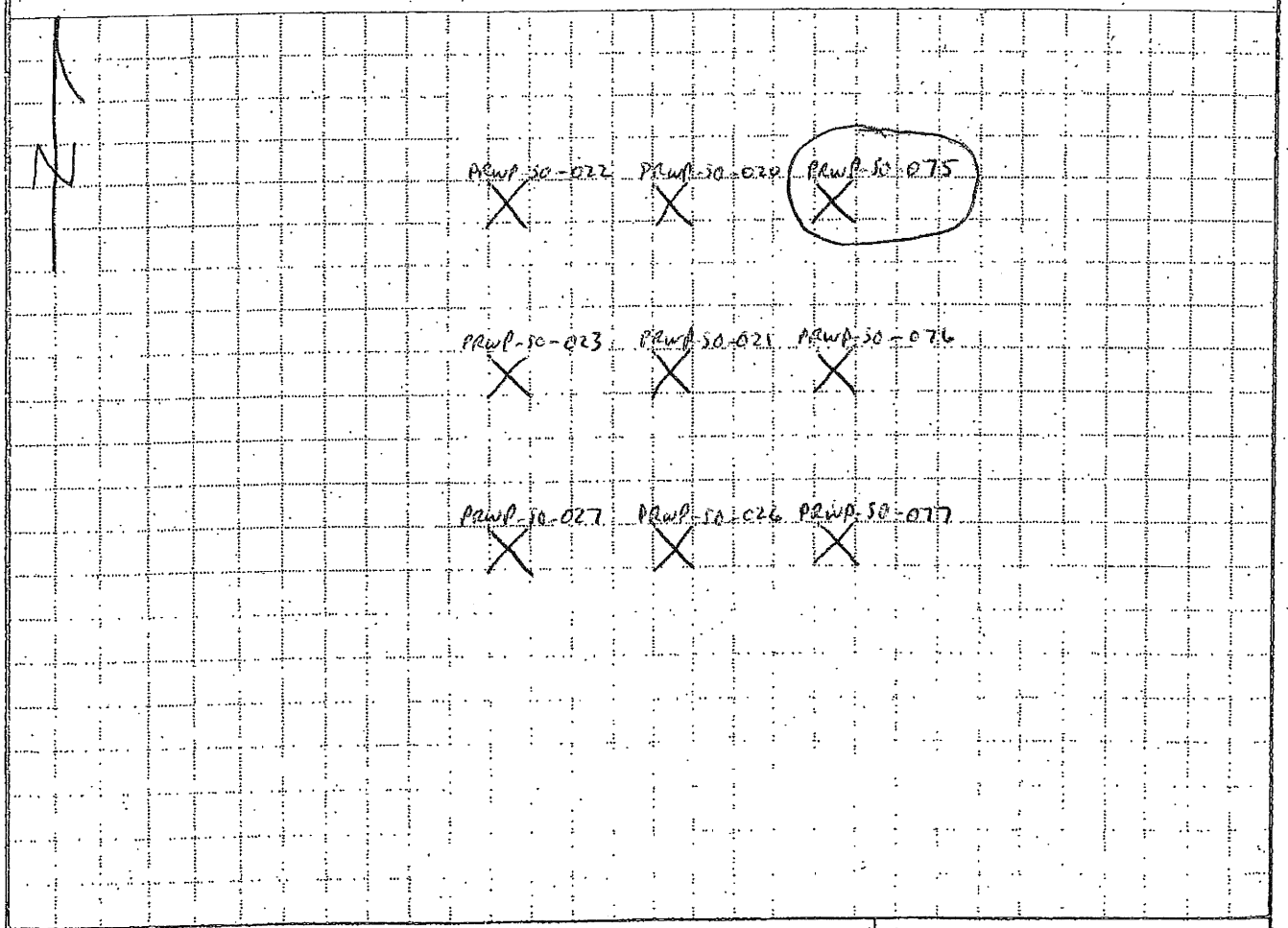
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-075	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-075

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-075

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Lithn	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10YR 2/2) silt with sand, organics, moist, soft. 1.1'	ML					
	1	Dark yellowish brown (10YR 4/6) clay with silt, moist, soft.	CL			PRWP-SO-075 (1'-10')	4.5'/5.0'	
	2							
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	8.4'						
		Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-075

HTRW DRILLING LOG

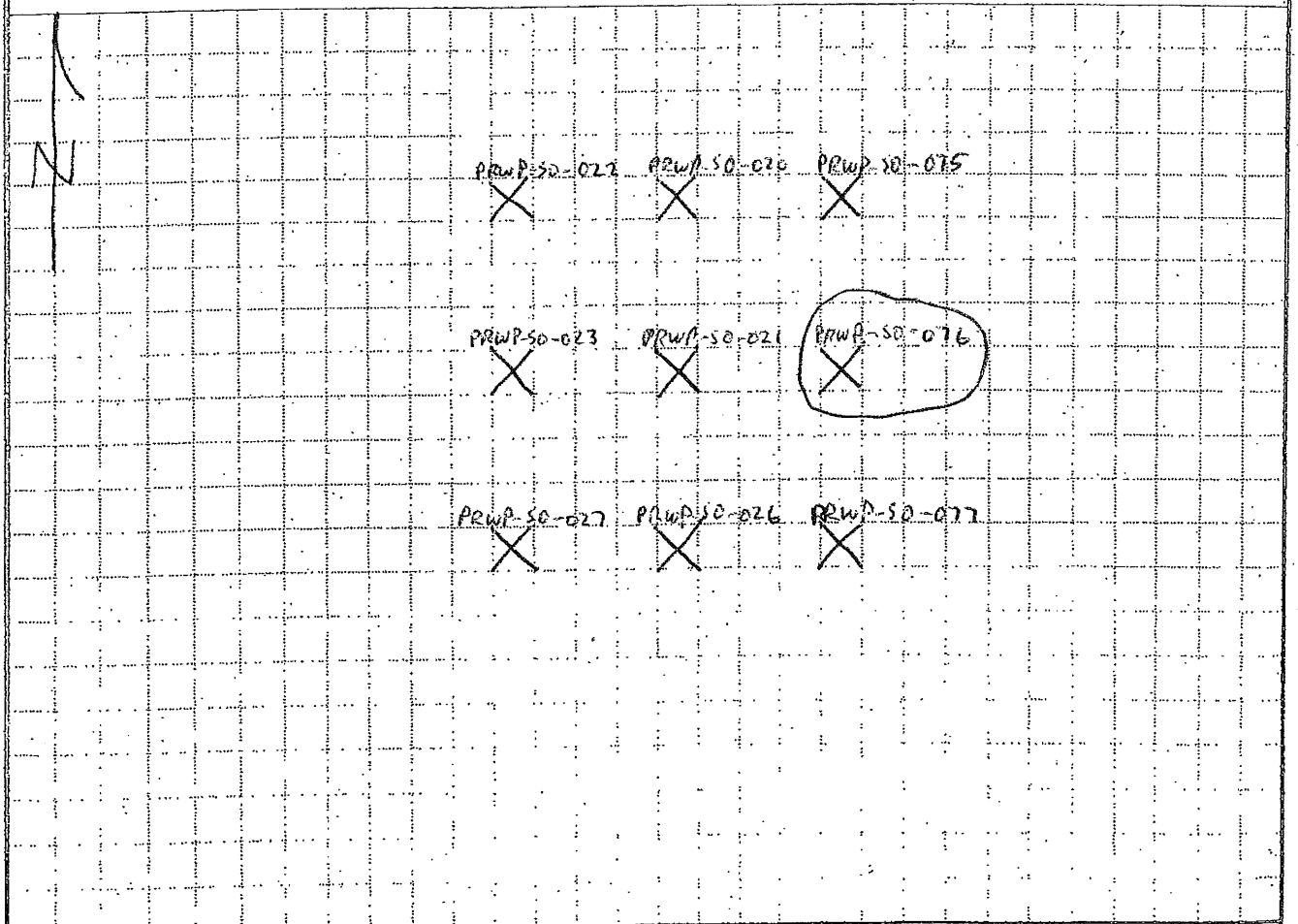
DISTRICT: Nashville		HOLE NUMBER: PRWP-SO-076
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-076

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-076..

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10yR 2/2) silt with sand, organics, moist, soft.	ML					
	1	1.4'						
		Dark yellowish brown (10yR 4/6) clay with silty sand, moist, medium stiff.	CL			PRWP-SO-076 (1'-10')	4.5'/5.0'	
	2							
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
	8							
	9	9.2'						
		Dark gray (10yR 4/1) clay with silty sand, moist, medium stiff.						
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-076

K:\8\PBOW\S-W\SWSAP\Figures\Fig 4-2.xls\contin\9/16/2008\4:31 PM

HTRW DRILLING LOG

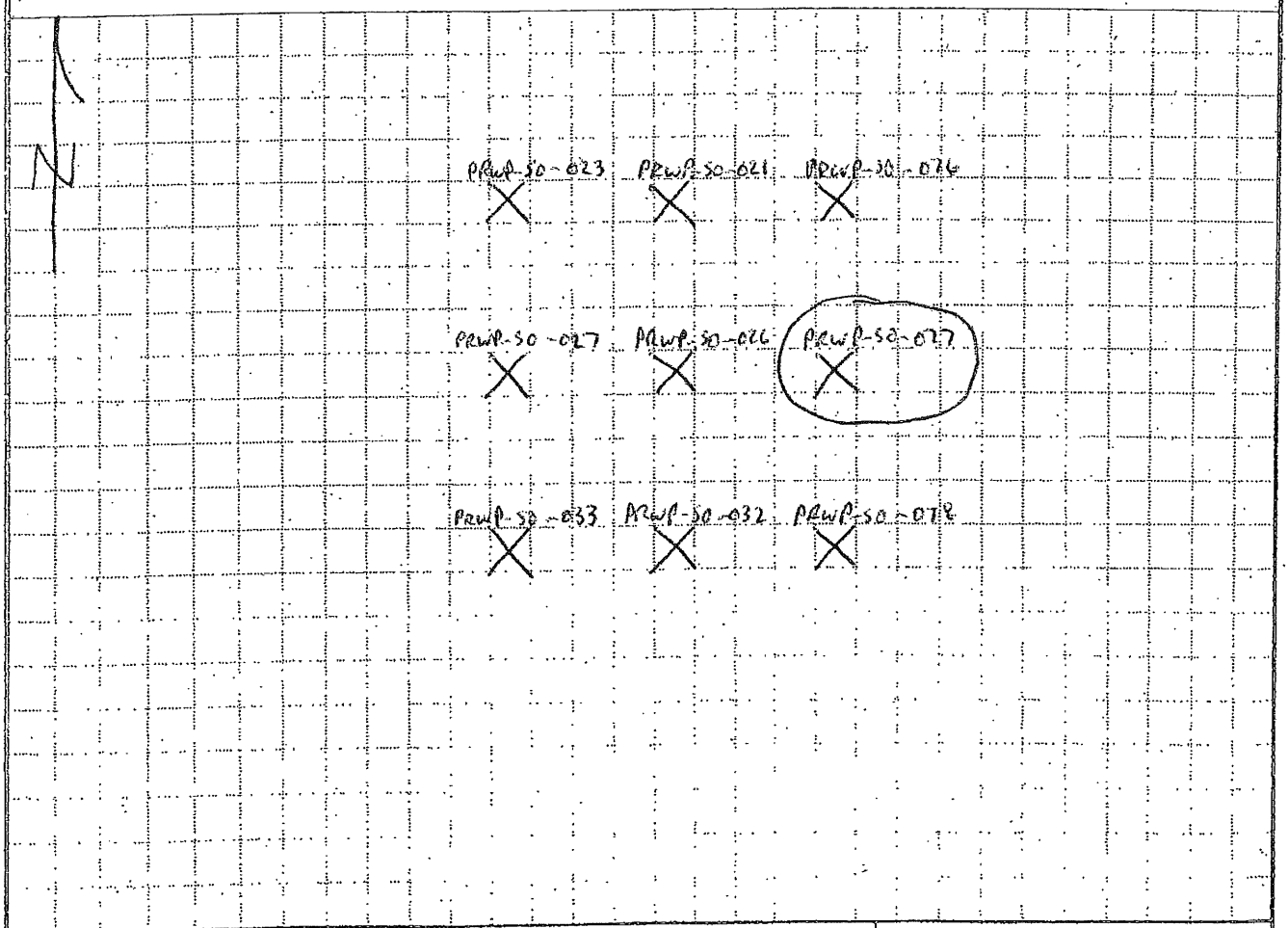
DISTRICT: Nashville	HOLE NUMBER: PRWP-SO-077	
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick W. Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT: PBOW-PRRWP — HOLE NO.: PRWP-SO-077

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-077.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10yR4/3) silt with sand, clay, organics, moist, soft. 0.8	ML					
	1	Very dark brown (10yR2/2) silt with sand, clay, moist, medium stiff. 2.1'				PRWP-SO-077 (1'-10')		
	2	Yellowish brown (10yR5/6) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6							
	7						5.0'/5.0'	
	8							
	9							
	10	Dark gray (10yR4/1) clay with silt, sand moist, medium stiff. Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-077

HTRW DRILLING LOG

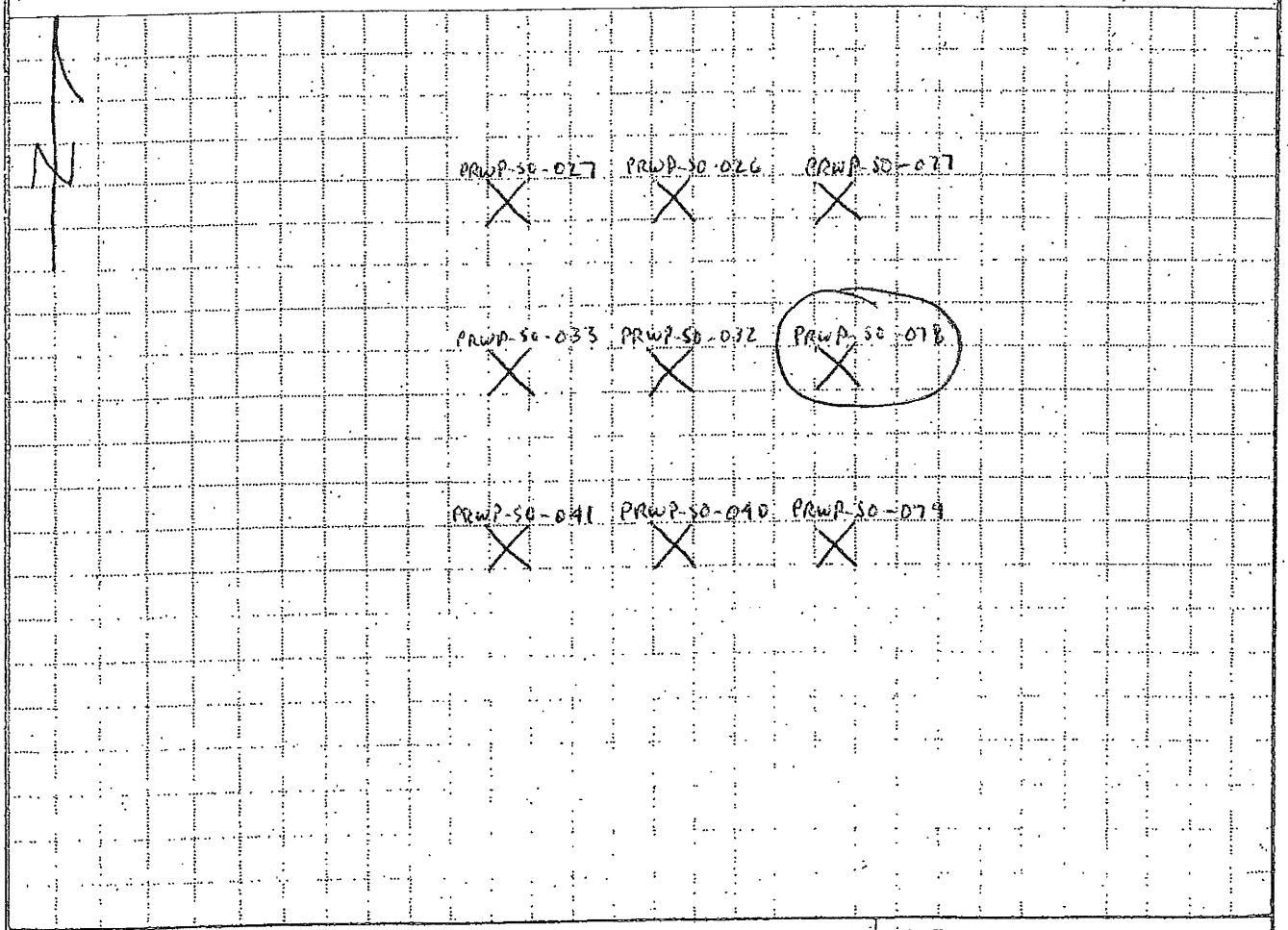
1. COMPANY NAME: Shaw E+I	2. DRILL SUBCONTRACTOR: EnviroCore	DISTRICT: Nashville
		HOLE NUMBER: PRWP-SO-078
		SHEET 1 OF 2 SHEETS
3. PROJECT: PBOW-PRRWP	4. LOCATION: Sandusky, Ohio	
5. NAME OF DRILLER: John Grogan	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 5' long macrocore sample tube with new acetate liners.	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED: 11-12-10	11. DATE COMPLETED: 11-12-10
12. OVERBURDEN THICKNESS: >10.0'	15. DEPTH GROUNDWATER ENCOUNTERED: —	
13. DEPTH DRILLED INTO ROCK: 0	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —	
14. TOTAL DEPTH OF HOLE: 10.0'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS — SCALE: None



PROJECT PBOW-PRRWP — HOLE NO. PRWP-SO-078

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number PRWP-SO-078.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Brown (10YR 4/3) silt with sand, clay, organics, moist, soft. 1.0'	ML					
	1	Very dark brown (10YR 2/2) silt with sand, clay, moist, med. um stiff. 1.5'						
	2	Yellowish brown (10YR 5/6) clay with silt, sand, moist, medium stiff.	CL			PRWP-SO-078 (1'-10')	4.5'/5.0'	
	3							
	4							
	5							
	6						5.0'/5.0'	
	7							
	8	8.0' Dark gray (10YR 4/1) clay with silt, moist, medium stiff.						
	9							
	10	Boring Complete						

Project PBOW-PRRWP

Hole Number: PRWP-SO-078

HTRW DRILLING LOG

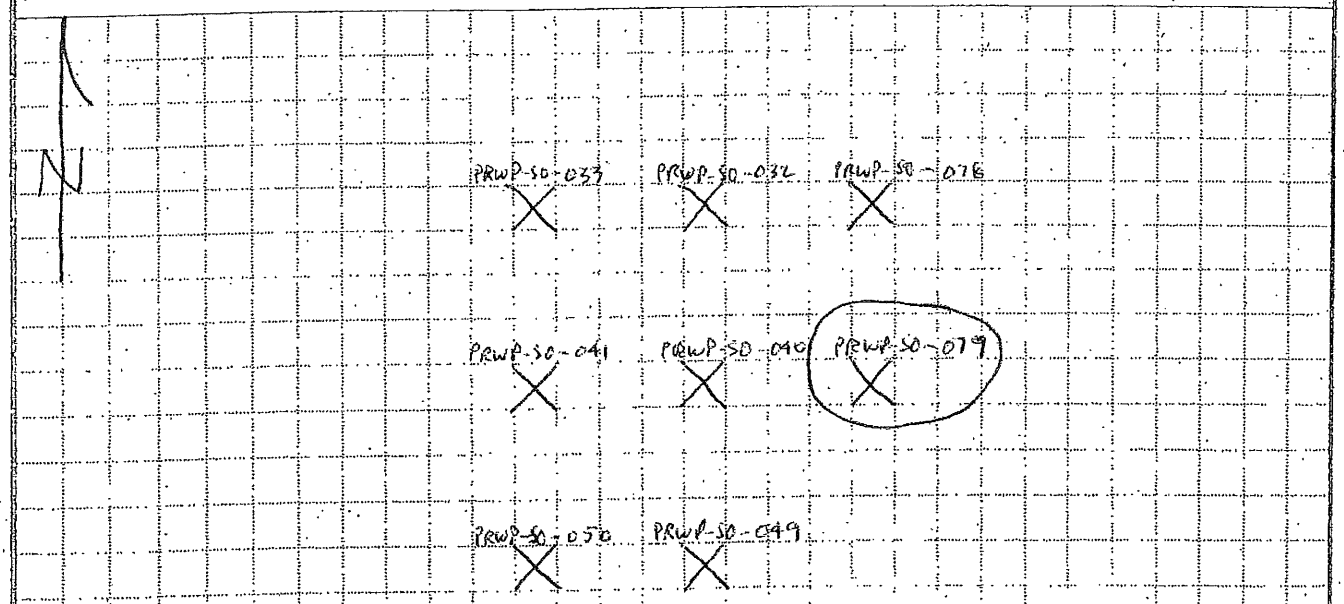
DISTRICT	Nashville
HOLE NUMBER	PRWP-SO-079
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	EnviroCore
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW-PRRWP
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	John Grogan
6. MANUFACTURER'S DESIGNATION OF DRILL	Geoprobe 6620 DT
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	5' long macrocore sample tube with new acetate liners.
8. HOLE LOCATION	
9. SURFACE ELEVATION	
10. DATE STARTED	11-12-10
11. DATE COMPLETED	11-12-10
12. OVERBURDEN THICKNESS	>10.0'
15. DEPTH GROUNDWATER ENCOUNTERED	—
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10.0'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
Yes	—	—	Nitroaromatics	—	—	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	✓	—	—	Erick Weaver

LOCATION SKETCH/COMMENTS SCALE: None



PROJECT PBOW-PRRWP HOLE NO. PRWP-SO-079

Figure 4-2
Drilling Log

Shaw® Shaw Environmental, Inc.

DRILLING LOG

(continuation sheet)

Hole Number: PRWP-SO-079.

Project: PBOW-PRRWP

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Geotech. Sample or Core Box No.	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark brown (10yR 2/2) silt with sand, clay, moist, soft. 1.0'	ML					
	1	Yellowish brown (10yR 5/6) sand with silt, moist, loose. 1.7'	SM			PRWP-SO-079 (1'-10')		
	2	Yellowish brown (10yR 5/6) clay with silt, sand, moist, medium stiff.	CL				4.5'/5.0'	
	3							
	4							
	5							
	6						5.0'/5.0'	
	7	7.8'						
	8	Dark gray (10yR 4/1) clay with silt, sand, moist, medium stiff.						
	9							
	10	Boring Complete						

Project: PBOW-PRRWP

Hole Number: PRWP-SO-079

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 07 2409 ACCT

Location Code: PRRWPA

Sample Number: PR-0001

Sample Name: TP-480

Sampling Method: GRAB

Sample Type: SO

Sample Purpose: REG

Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION

Collection Date: 7-22-09

Collection Time: 1445

Start Depth: 1'

End Depth: 10'

Sample Matrix: SOIL

Sample Team: EW

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

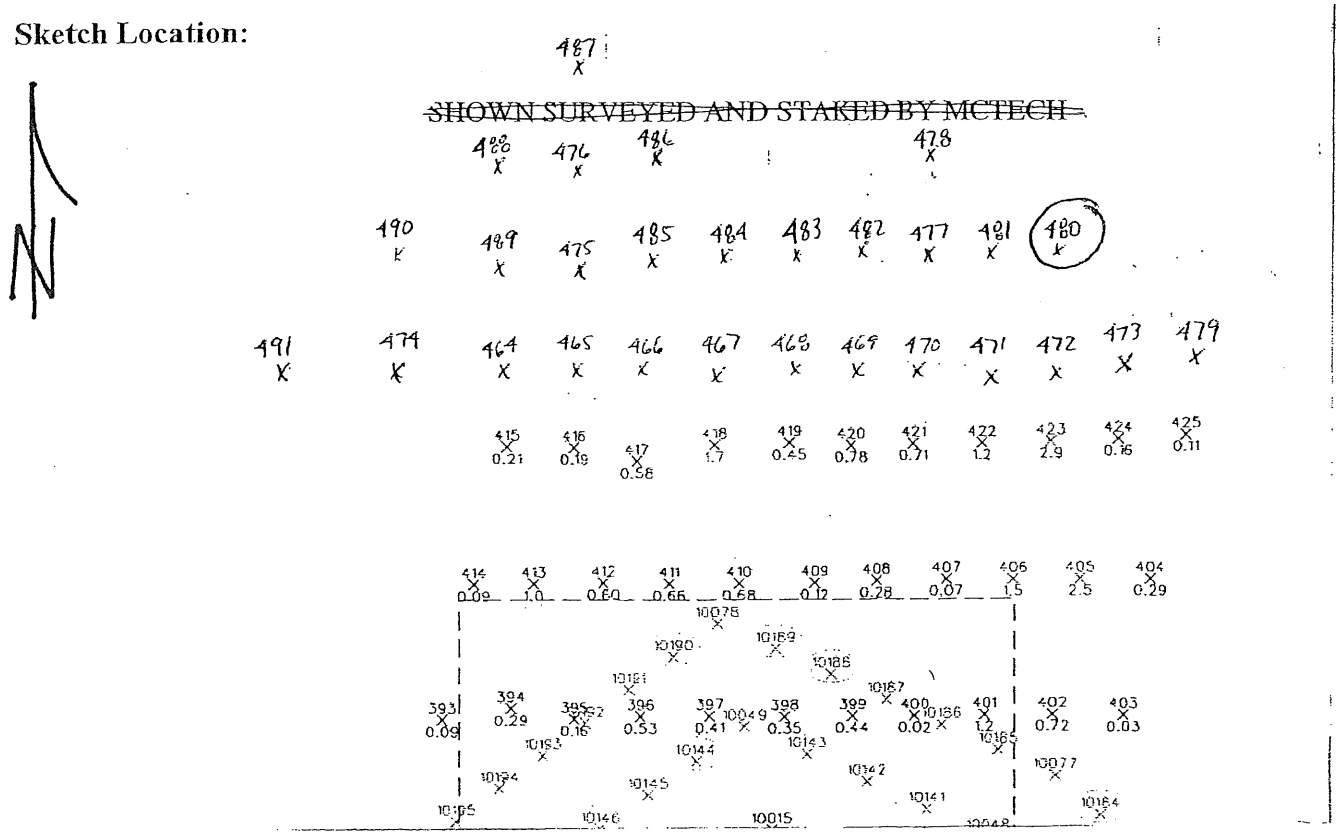
ERPIMS Values:

Sacode:

Lot Control#:

Comments: Also samples PR-0002 (FD) + PR-0003 (FS)

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [signature] 3/10/10

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 07 2409 ACCT

Location Code: PRRWPA

Sample Number: PR-0004

Sample Name: TP-10174

Sampling Method: GRAB

Sample Type: SO

Sample Purpose: REG

Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION

Collection Date: 7-23-09

Collection Time: 1440

Start Depth: 1'

End Depth: 10.5'

Sample Matrix: SOIL

Sample Team: EW

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:

Sacode: _____

Lot Control#: _____

Comments: _____

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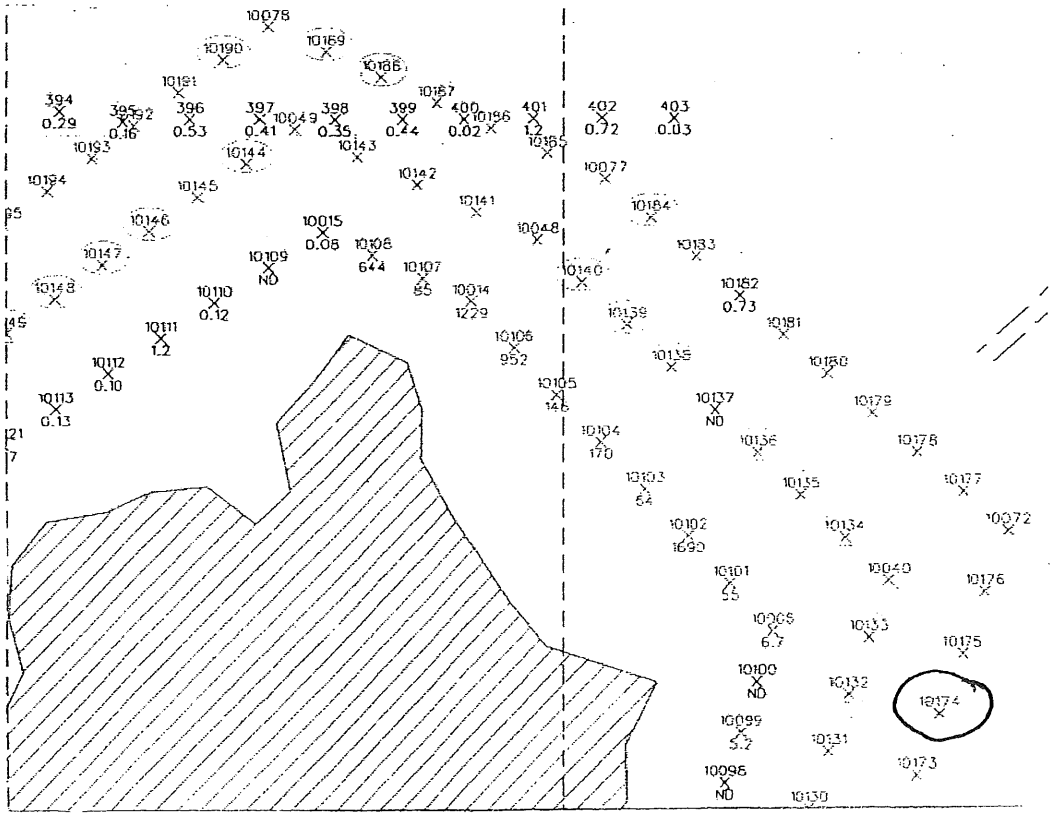


Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [illegible] 3/10/10

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072409 ACCT

Location Code: PRRWPA

Sample Number: PR-0005

Sample Name: TP-10175

Sampling Method: GRAB

Sample Type: SO *Sample Purpose:* REG

Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION

Collection Date: 7-23-09

Collection Time: 1415

Start Depth: 1'

End Depth: 10'

Sample Matrix: SOIL

Sample Team: EW

QC Partners:

(TB) (ER) (FB)

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

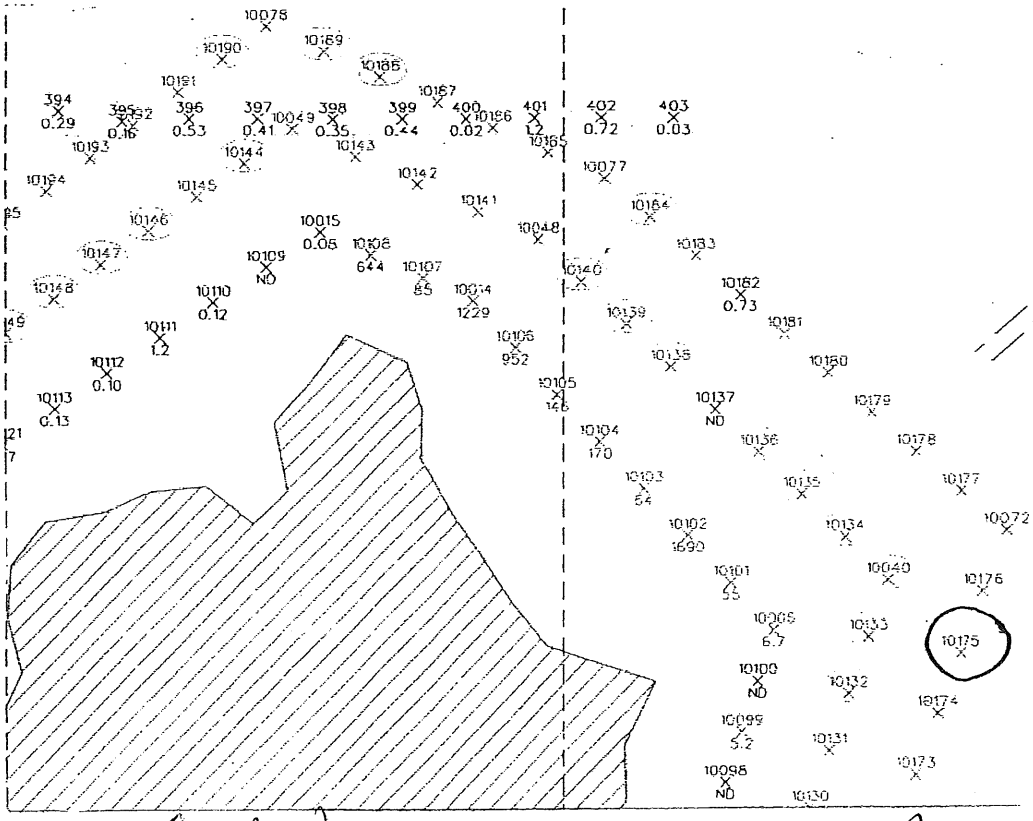
ERPIMS Values:

Sacode:

Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: 3/10/10

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Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072409ACCT

Location Code: PRRWPA

Sample Number: PR-0006

Sample Name: TP-10176

Sampling Method: GRAB

Sample Type: SO *Sample Purpose:* REG

Sampling Equip: Mini Excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION

Collection Date: 7-23-09

Collection Time: 1350

Start Depth: 1'

End Depth: 11'

Sample Matrix: SOIL

Sample Team: EW

QC Partners:

(TB) (ER) (FB)

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

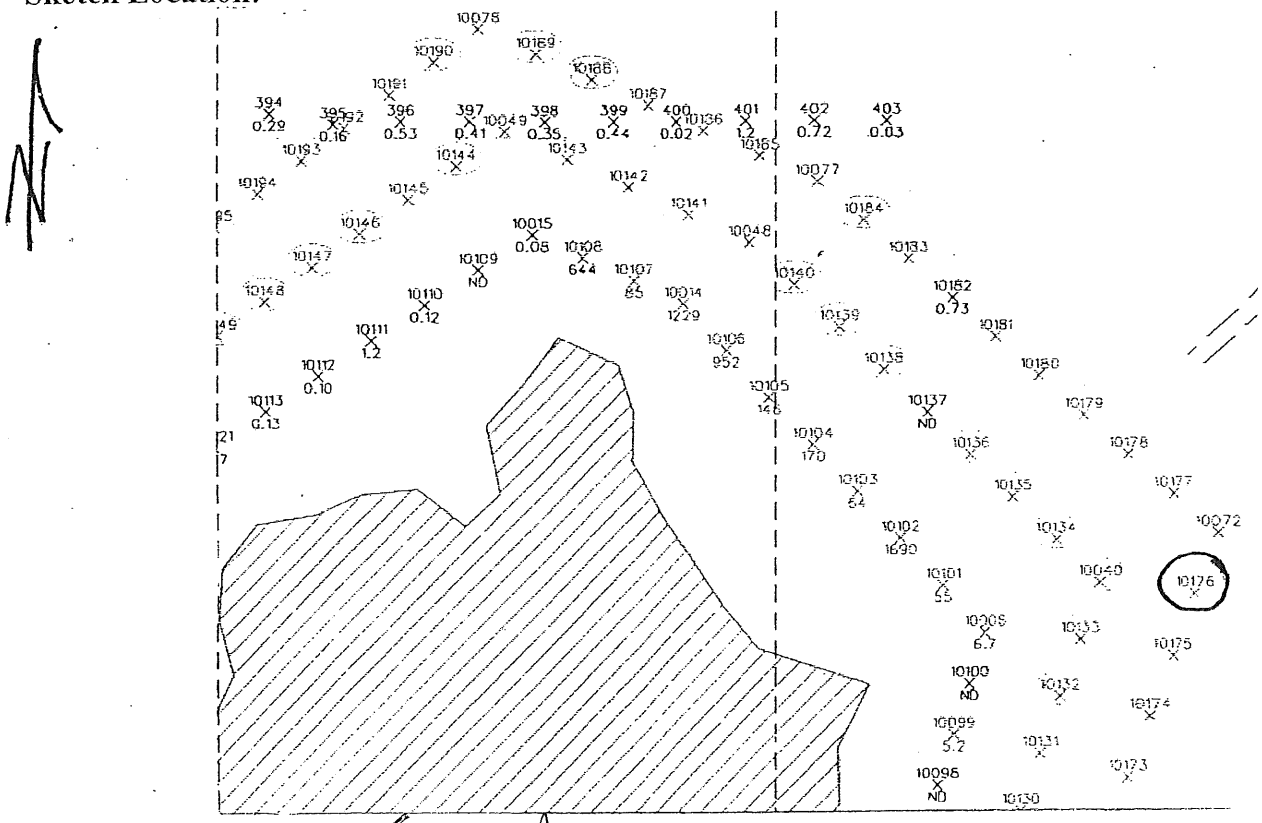
ERPIMS Values:

Sacode:

Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: 3/10/10

Sample Collection Log

Shaw E & I, Inc.

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409ACCT

Location Code: PRRWPA

Sample Number: PR-0007

Sample Name: TP-10184

Sampling Method: GRAB

Sample Type: SO

Sample Purpose: REG

Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION

Collection Date: 7-23-09

Collection Time: 1510

Start Depth: 1

End Depth: 10

Sample Matrix: SOIL

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

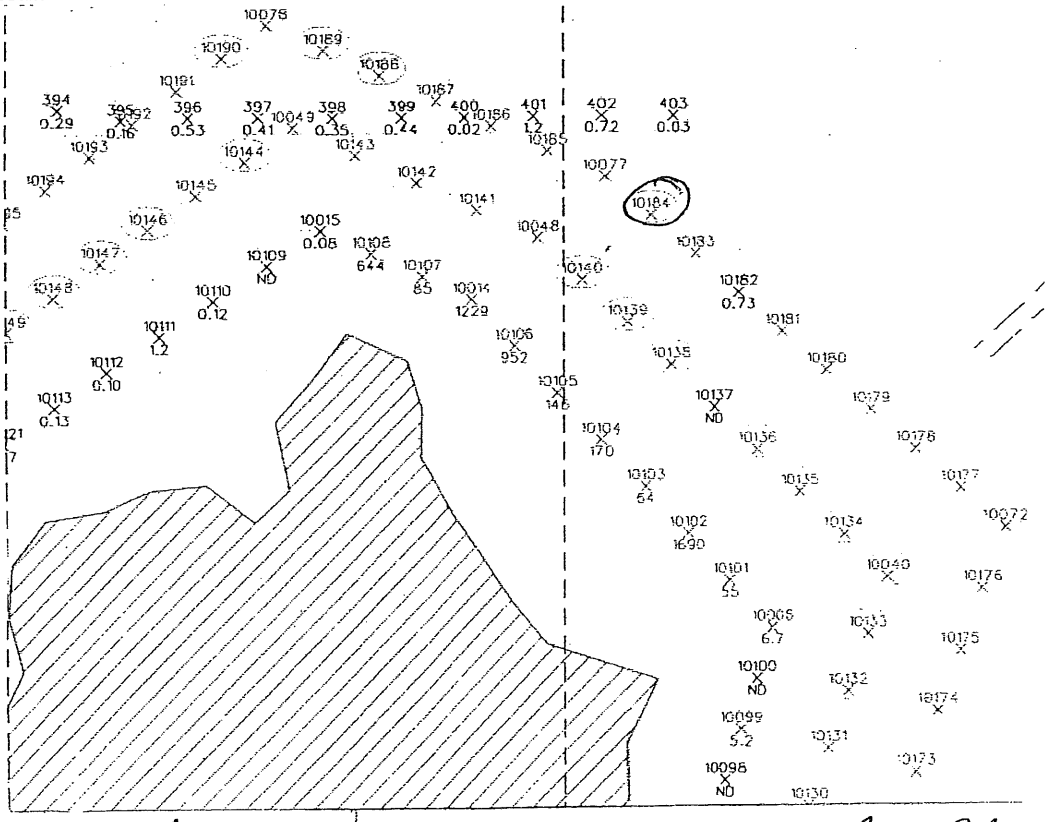
ERPIMS Values:

Sacode: _____

Lot Control#: _____

Comments:

Sketch Location:



Logged BY / Date: E Wilhower

Reviewed BY / Date: [illegible] 3/10/16

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Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409 ACCT

Location Code: PRRWPA
Sample Number: PR-0008
Sample Name: TP-479
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION
Collection Date: 7-22-09
Collection Time: 1600
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) (ER) (FB)

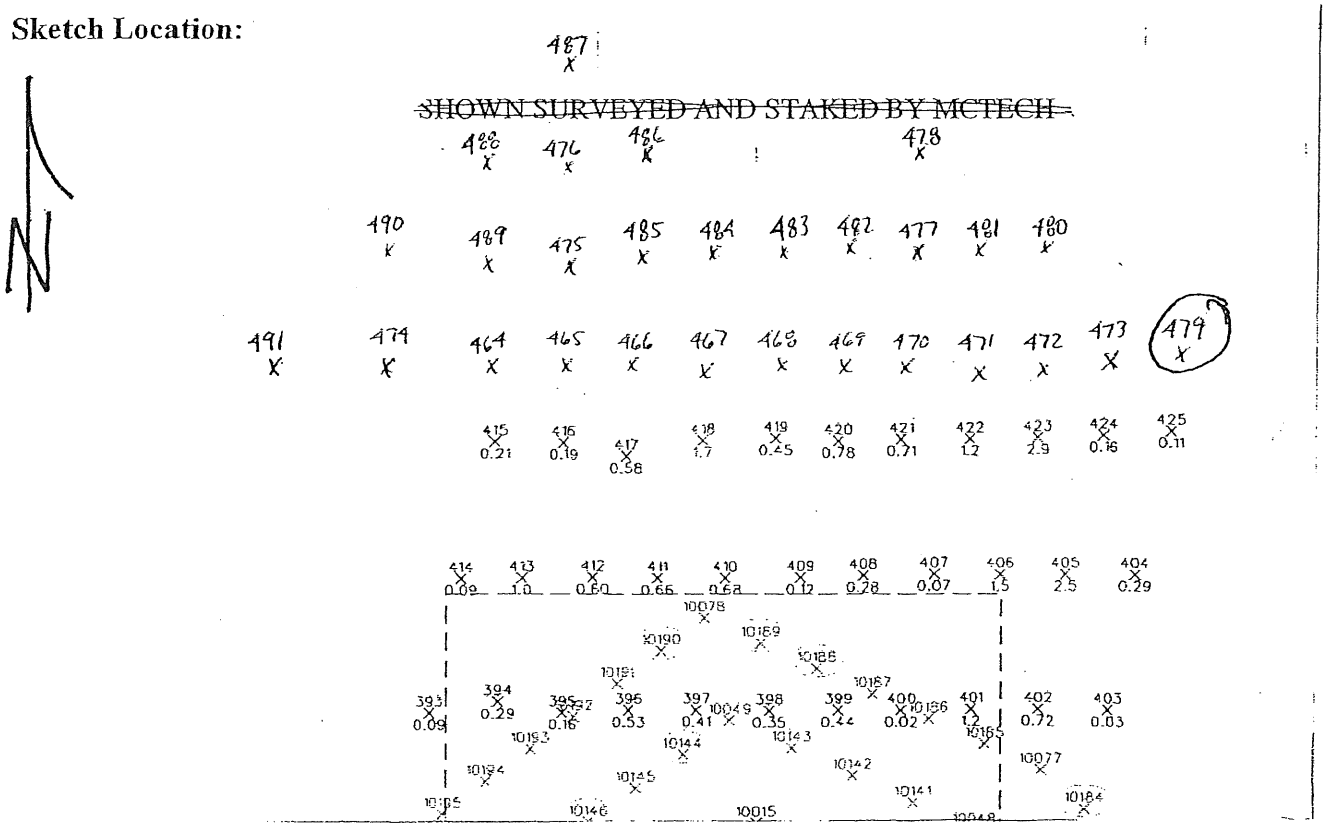
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MJG 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072409 ACCT

Location Code: PRRWPA
Sample Number: PR-0009
Sample Name: TP-481
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-22-09
Collection Time: 1630
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

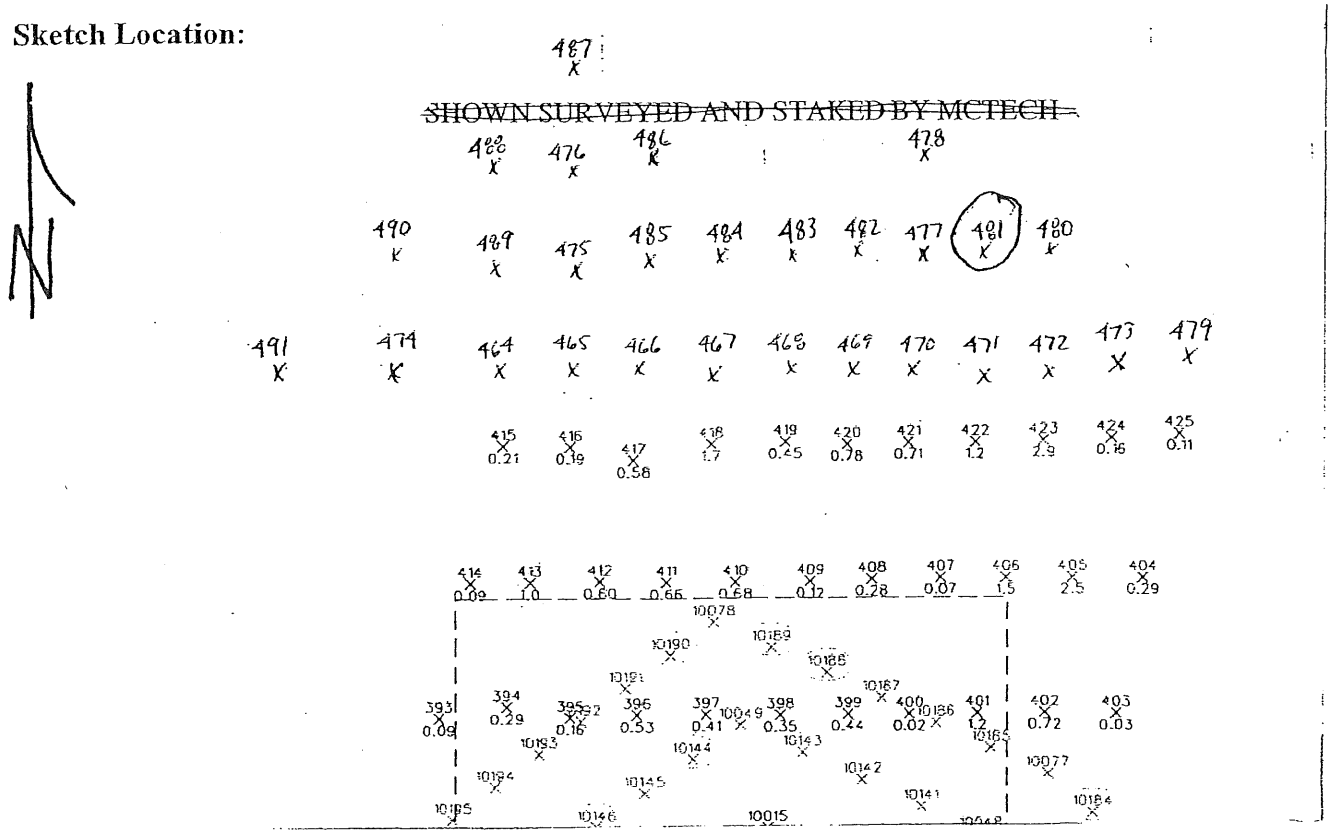
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. Wilkowa

Reviewed BY / Date: [signature] 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409ACCT

Location Code: PRRWPA
Sample Number: PR-0010
Sample Name: TP-478
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-22-09
Collection Time: 0810
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode: _____
Lot Control#: _____

Comments: _____

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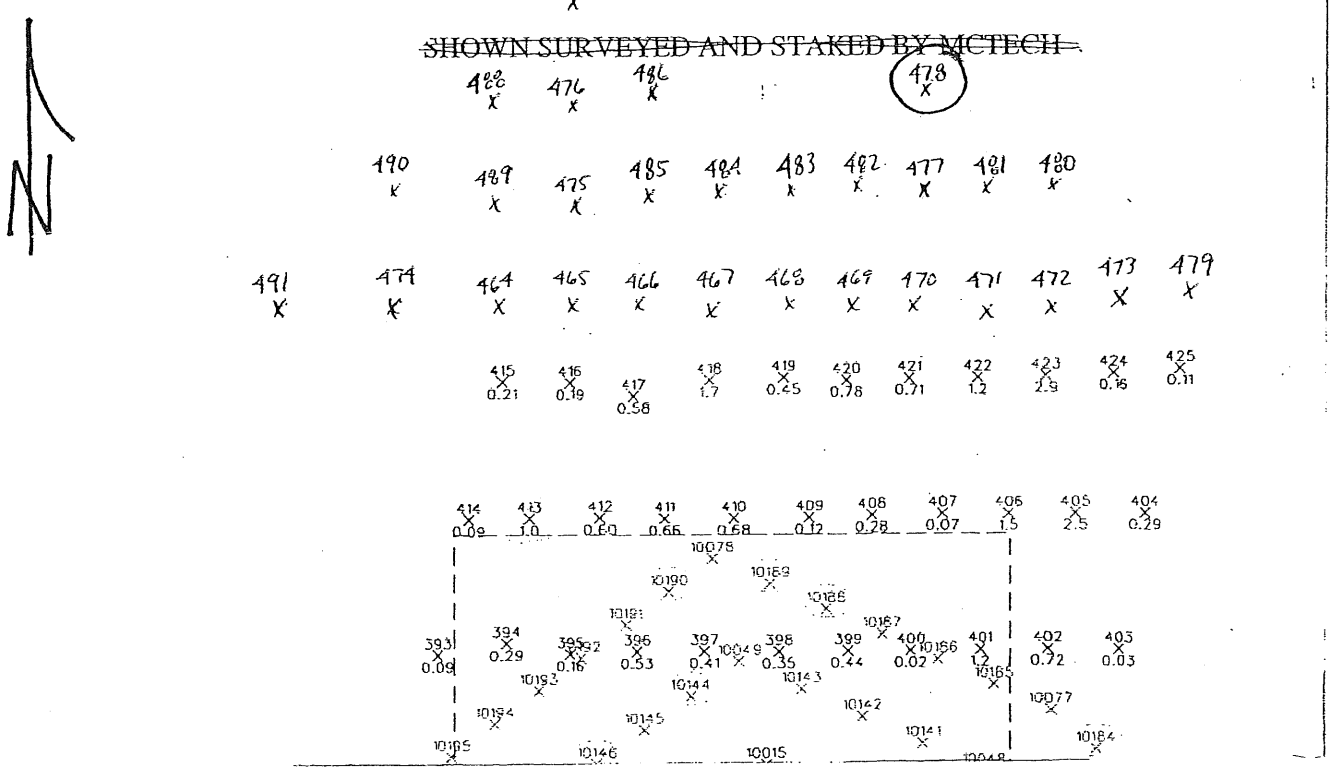

Logged BY / Date: E. W. Weaver

Reviewed BY / Date: 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072409ACCT

Location Code: PRRWPA
Sample Number: PR-0011
Sample Name: TP-477
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-22-09
Collection Time: 0840
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

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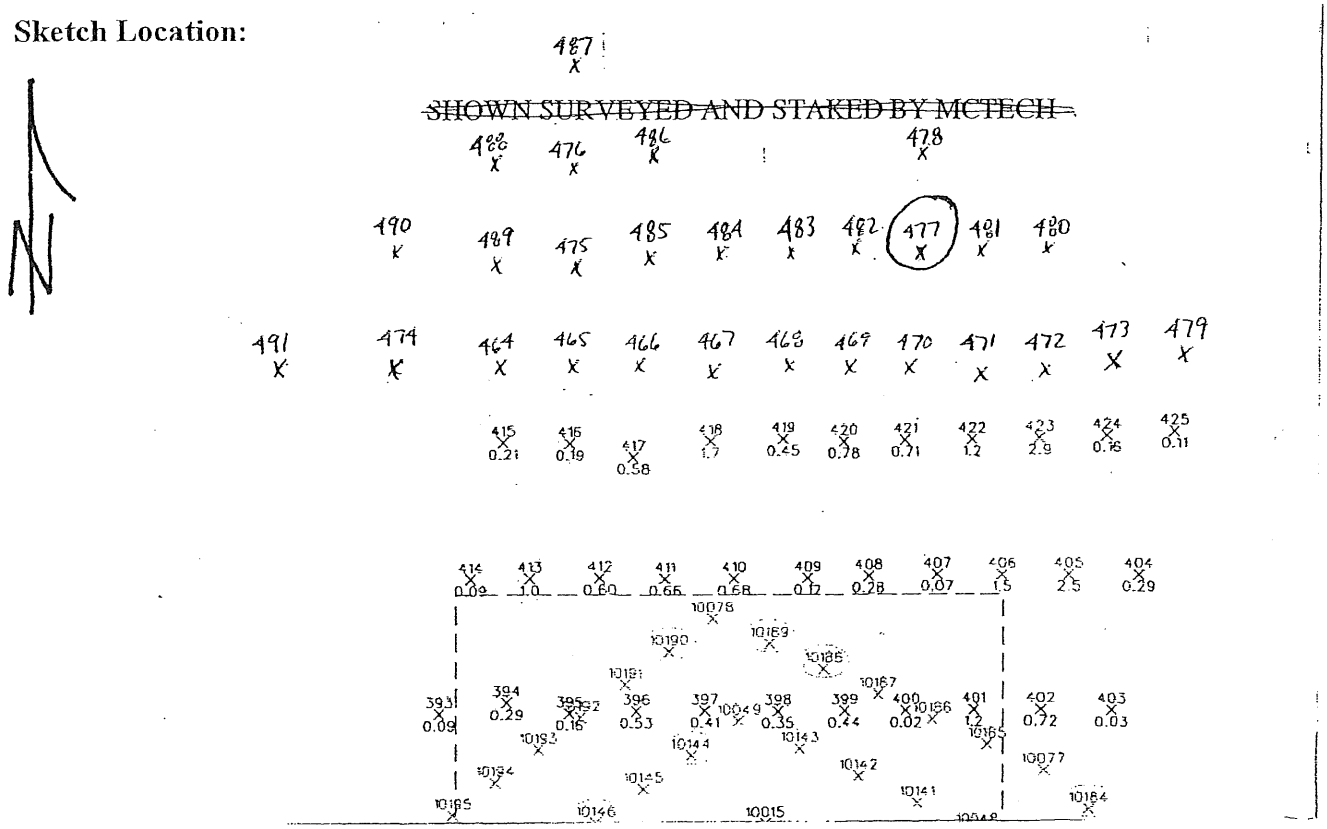


Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MJB 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 07 2409 ACCT

Location Code: PRRWPA
Sample Number: PR-0012
Sample Name: TP-482
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-22-09
Collection Time: 1650
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

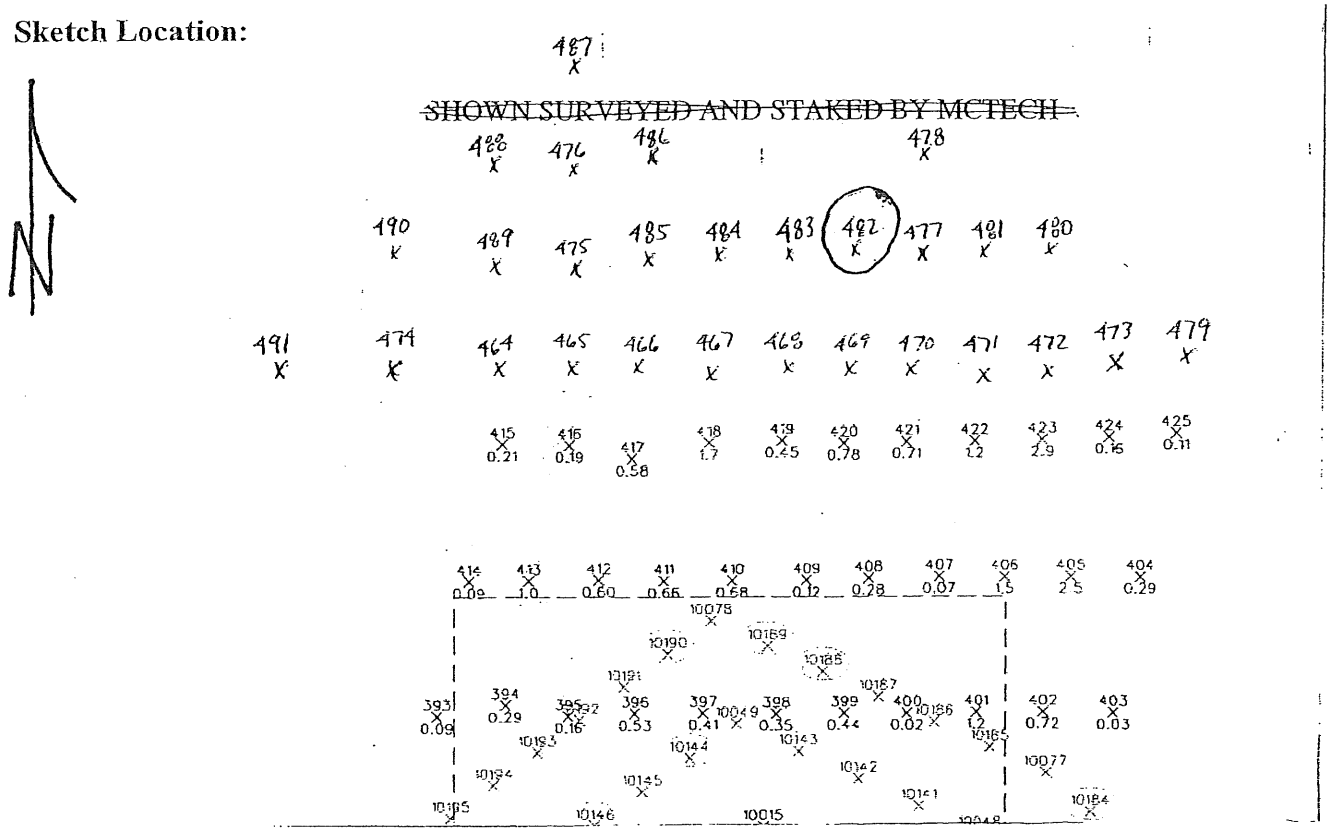
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. Weaver

Reviewed BY / Date: MJD 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409ACCT

Location Code: PRRWPA
Sample Number: PR-0013
Sample Name: TP-486
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-23-09
Collection Time: 0835
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

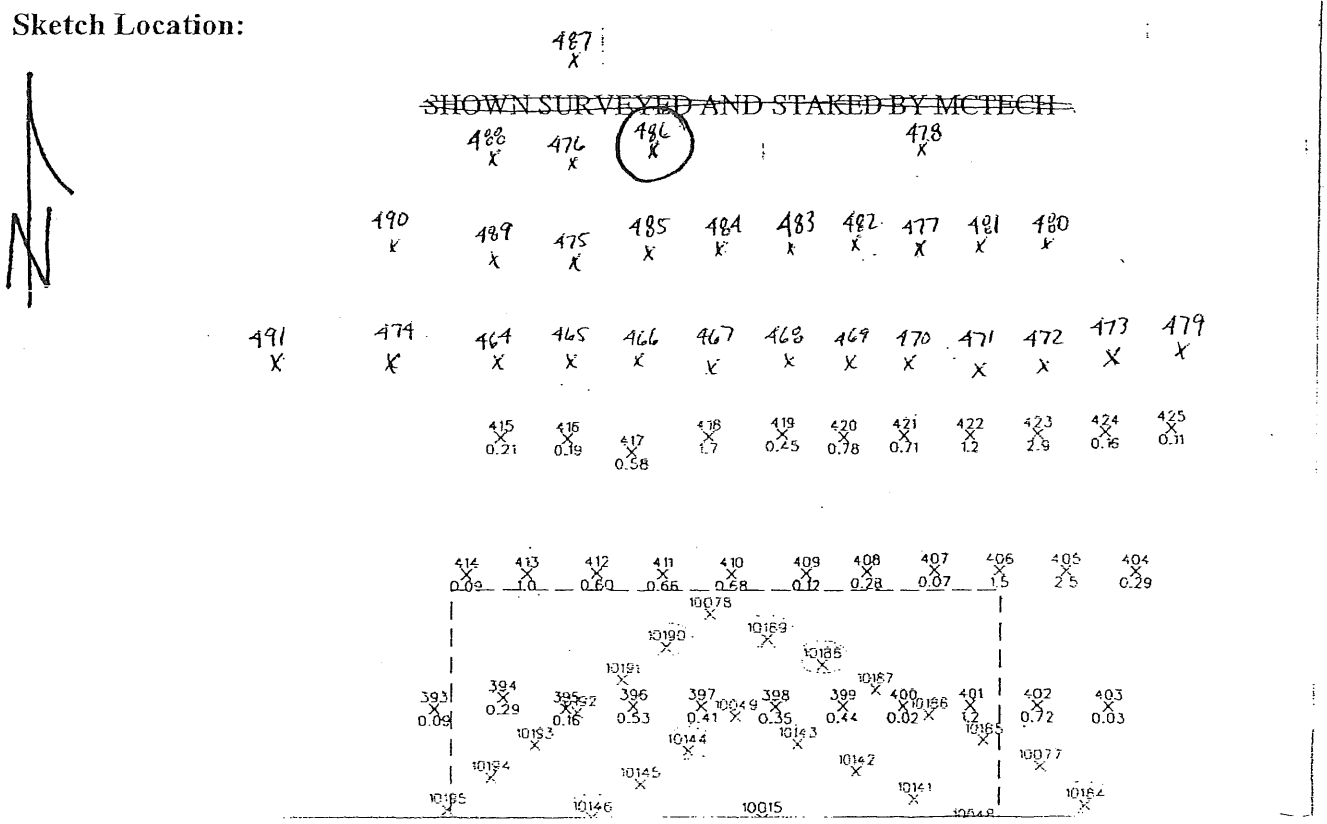
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [signature] 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409ACCT

Location Code: PRRWPA
Sample Number: PR-0014
Sample Name: TP-487
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-23-09
Collection Time: 0800
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

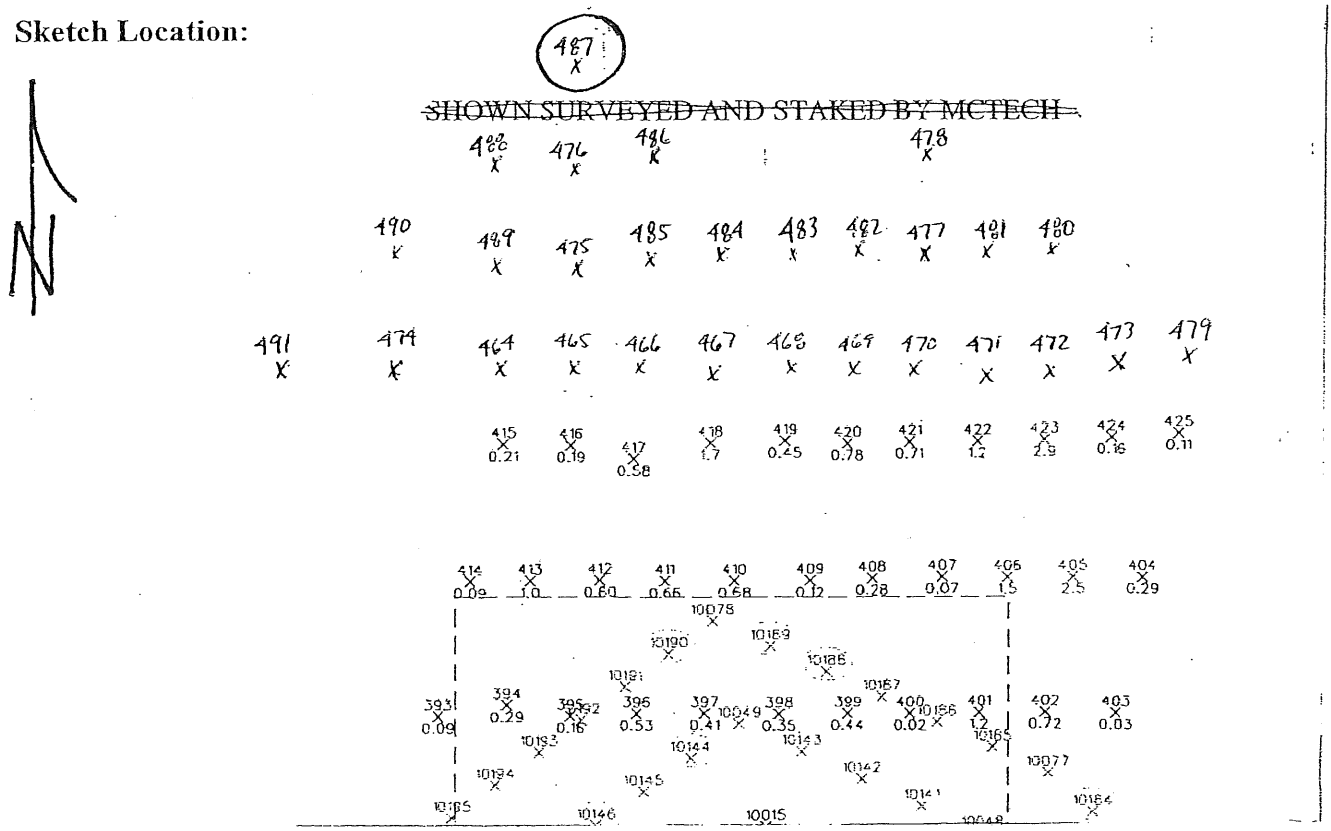
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Secode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409 ACCT

Location Code: PRRWPA
Sample Number: PR-0015
Sample Name: TP-488
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-23-09
Collection Time: 0900
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

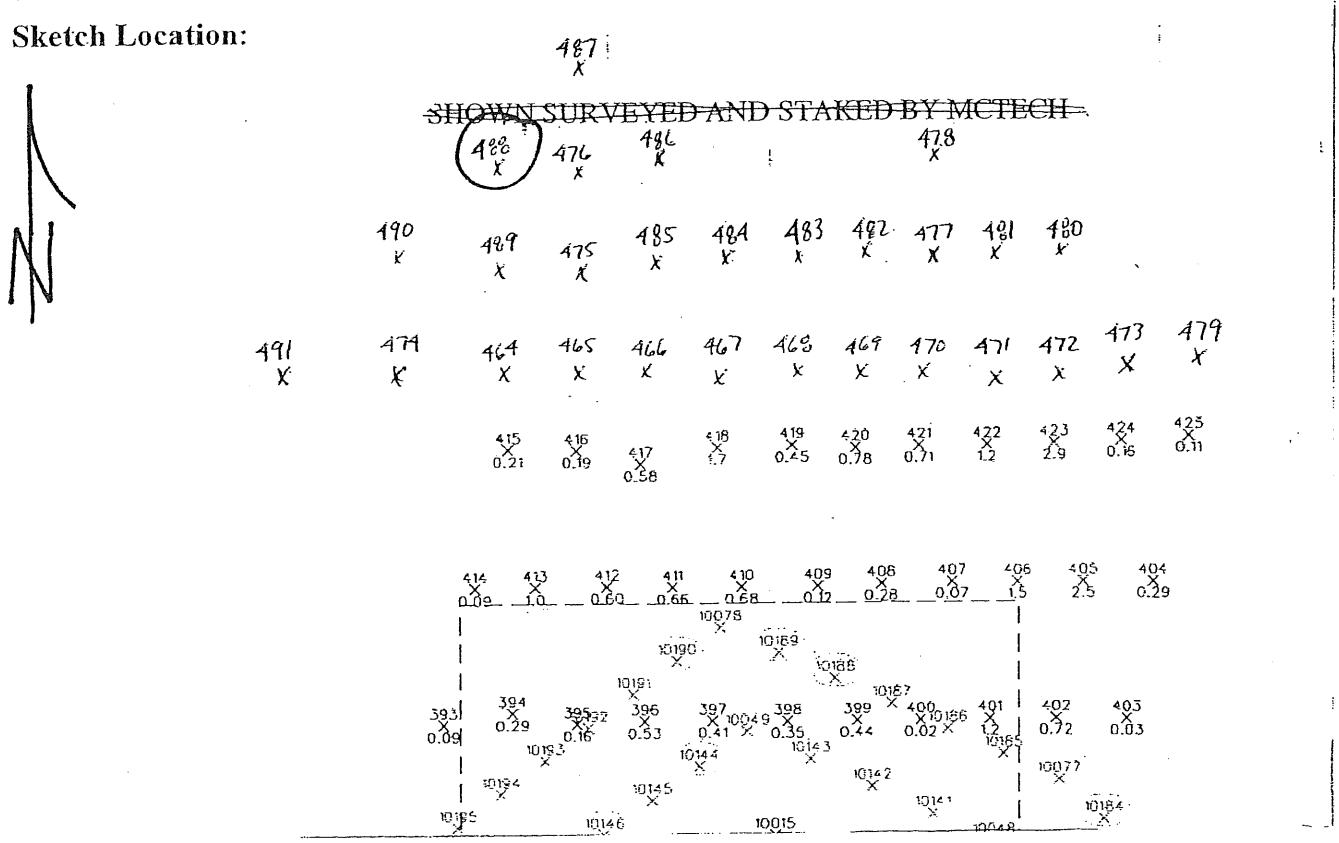
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072409ACCT

Location Code: PRRWPA
Sample Number: PR-0016
Sample Name: TP-10149
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-22-09
Collection Time: 1405
Start Depth: 1'
End Depth: 8'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

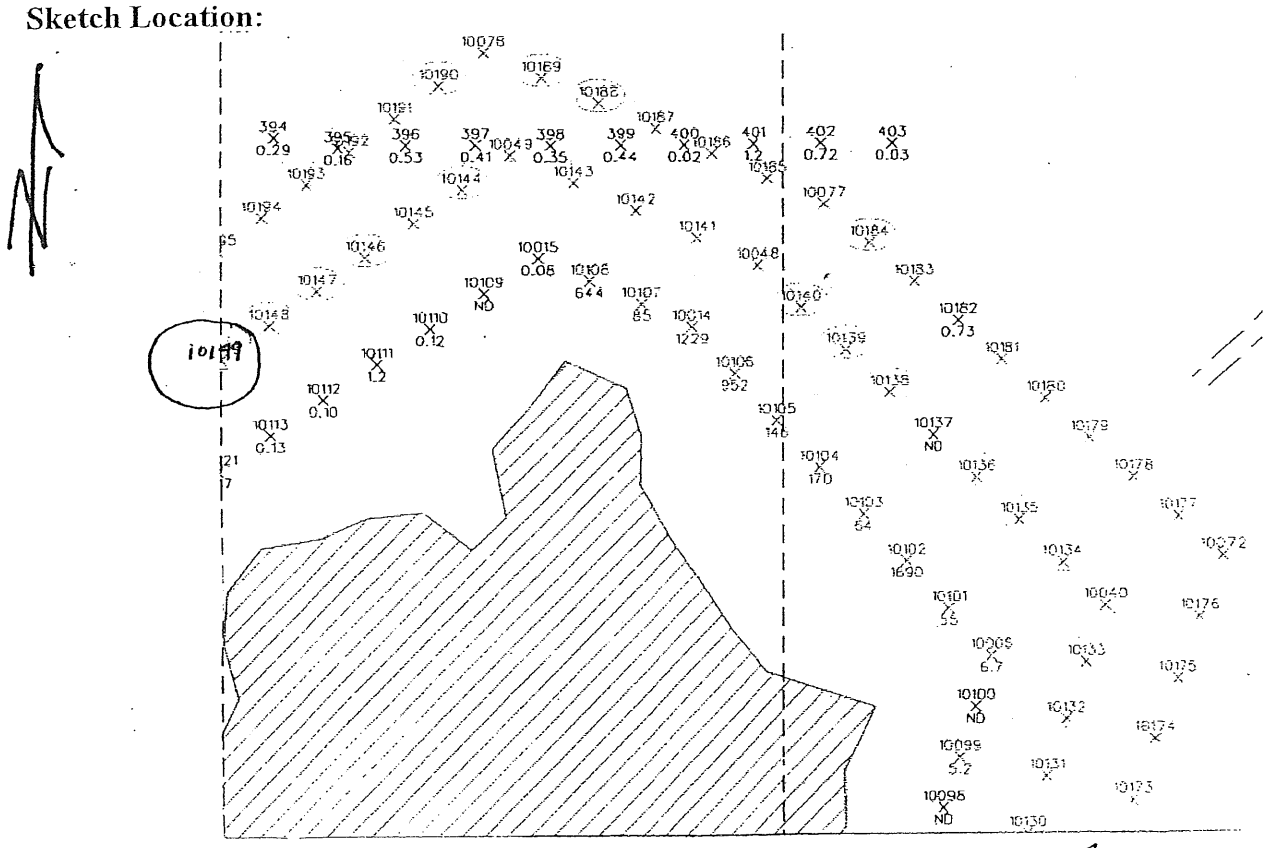
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. Wilbanks

Reviewed BY / Date: 3/10/10

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACCT

Location Code: PRRW PA

Sample Number: PR-0017

Sample Name: TP-10060

Sampling Method: GRAB

Sample Type: SO

Sample Purpose: REG

Sampling Equip: Mini excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION

Collection Date: 7-24-09

Collection Time: 1050

Start Depth: 1'

End Depth: 10'

Sample Matrix: SOIL

Sample Team: EW

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

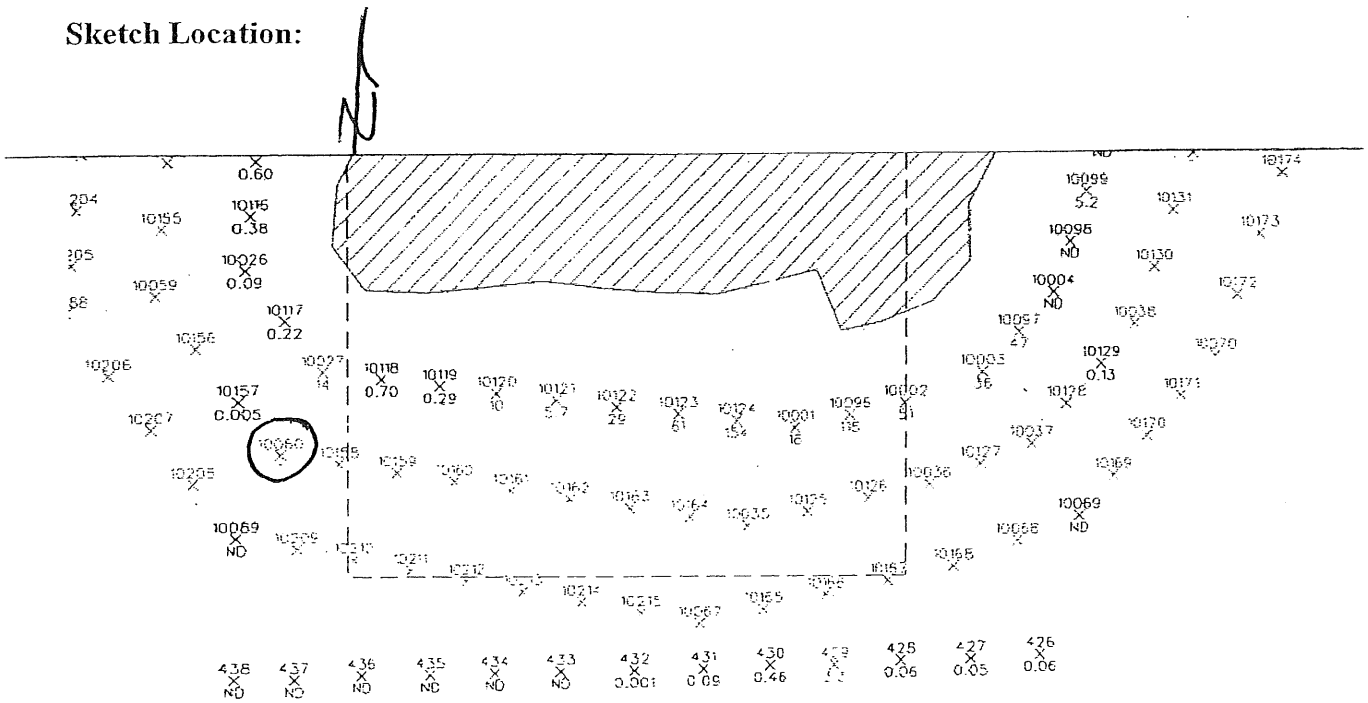
ERPIMS Values:

Sacode: _____

Lot Control#: _____

Comments: _____

Sketch Location:



Logged BY / Date: E. Wilson

Reviewed BY / Date: MGS 31/10/2

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809 ACCT

Location Code: PRRWPA
Sample Number: PR-0018 includes (MS + MSD)
Sample Name: TP-10158
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: Mini excavator, disposable gloves, 2 ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1120
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) (ER) (FB)

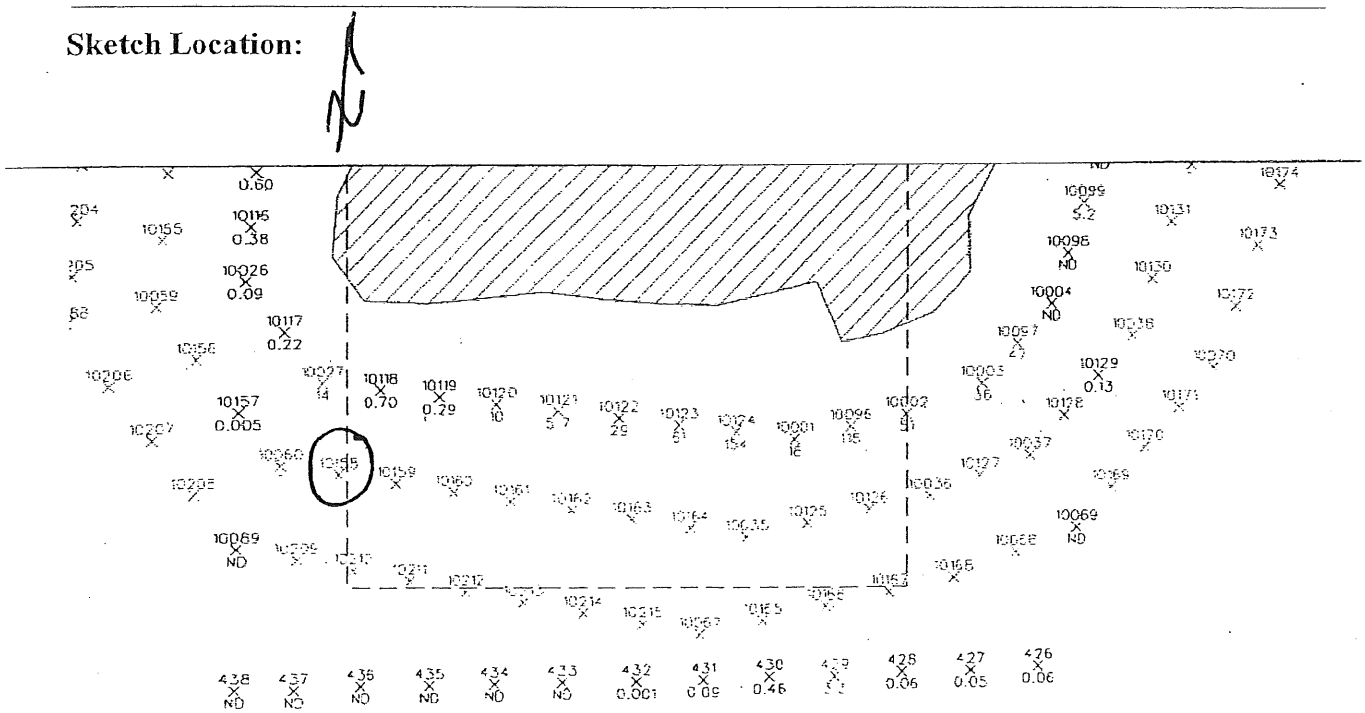
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also PR-0034 (FD) + PR-0035 (FS)

Sketch Location:



Logged BY / Date: E-W Weaver *Reviewed BY / Date:* [illegible] 3/10/16

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809 ACCT

Location Code: PRRWPA
Sample Number: PR-0019
Sample Name: TP-10159
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1015
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

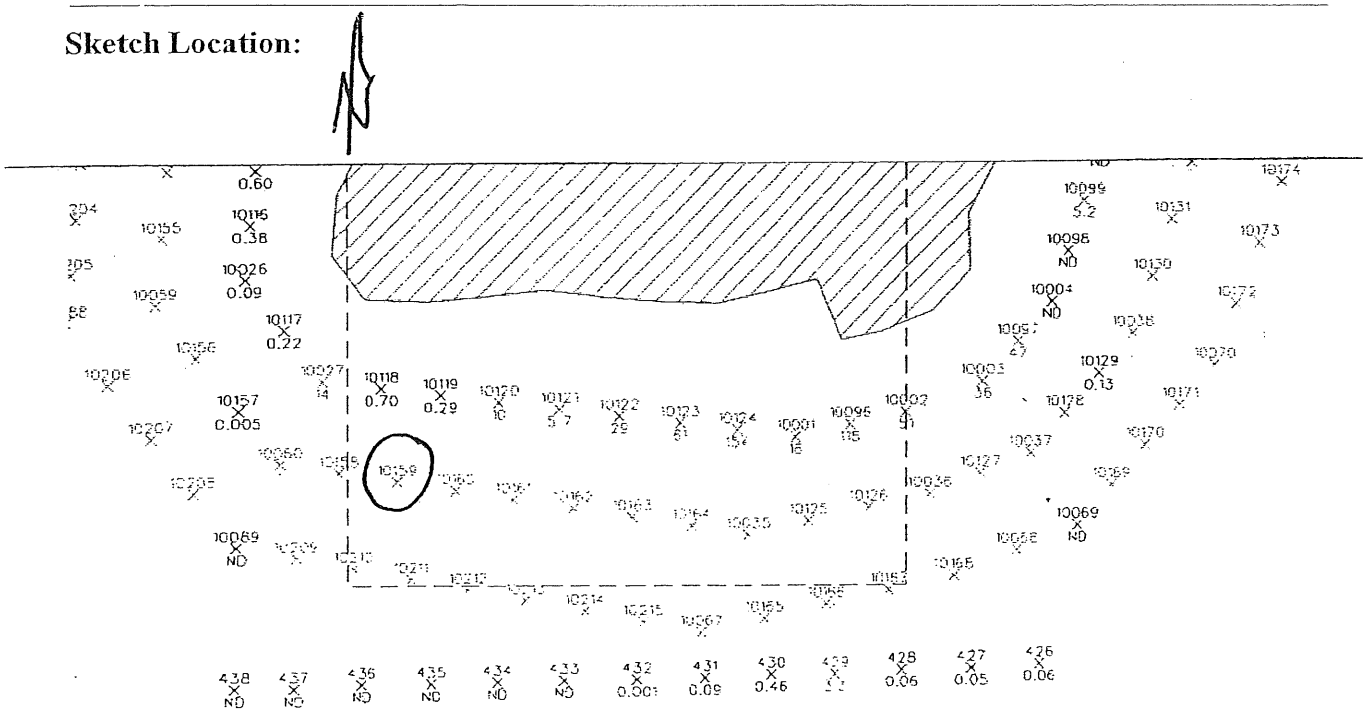
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: 3/10/16

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809 ACCJ

Location Code: PRRWPA
Sample Number: PR-0020
Sample Name: TP-10160
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposible gloves, 2 ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1145
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

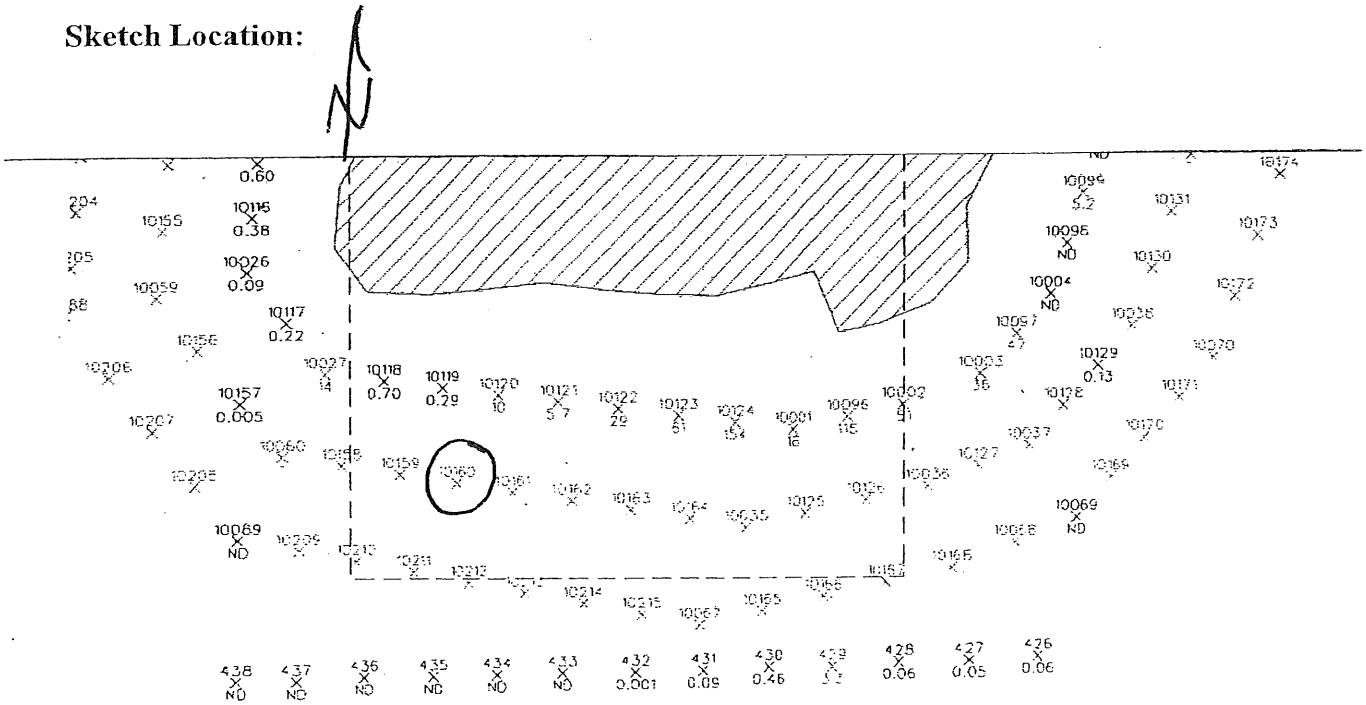
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode: _____
Lot Control#: _____

Comments: _____

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACCT

Location Code: PRRWPA
Sample Number: PR-0021
Sample Name: TP-10161
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 0945
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

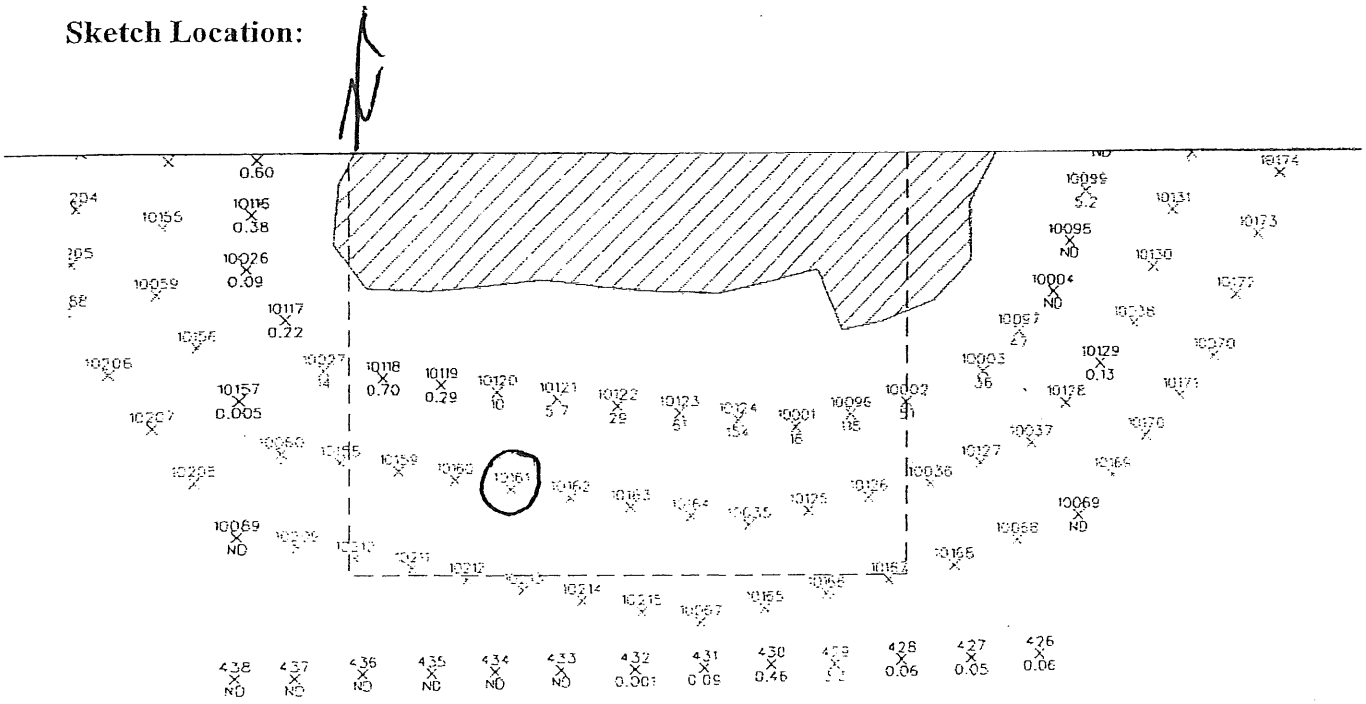
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MJS 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809ACT

Location Code: PRRWPA
Sample Number: PR-0022
Sample Name: TP-10162
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1210
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

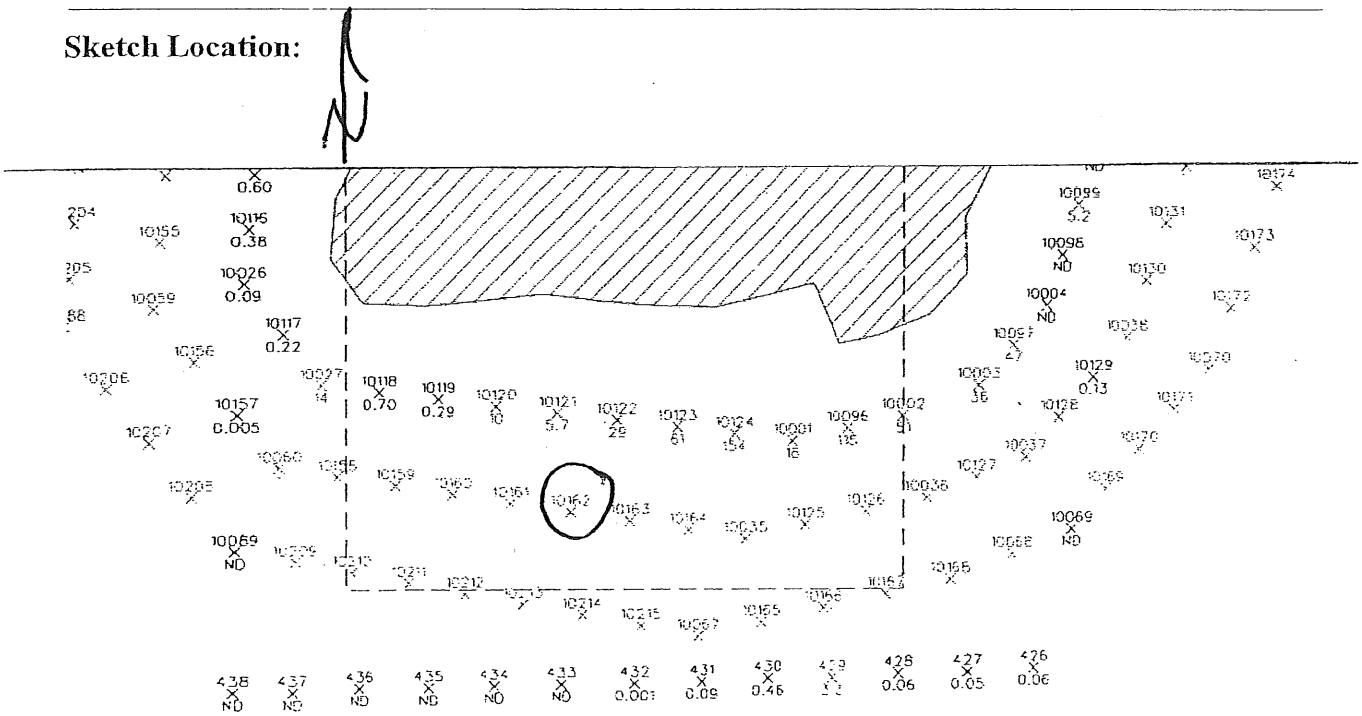
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* MAS 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACCT

Location Code: PRRWPA

Task: SO DELINEATION

Sample Number: PR-0023

Collection Date: 7-24-09

Sample Name: TP-10163

Collection Time: 0915

Sampling Method: GRAB

Start Depth: 1'

Sample Type: SO

Sample Purpose: REG

End Depth: 10'

Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

Sample Matrix: SOIL

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

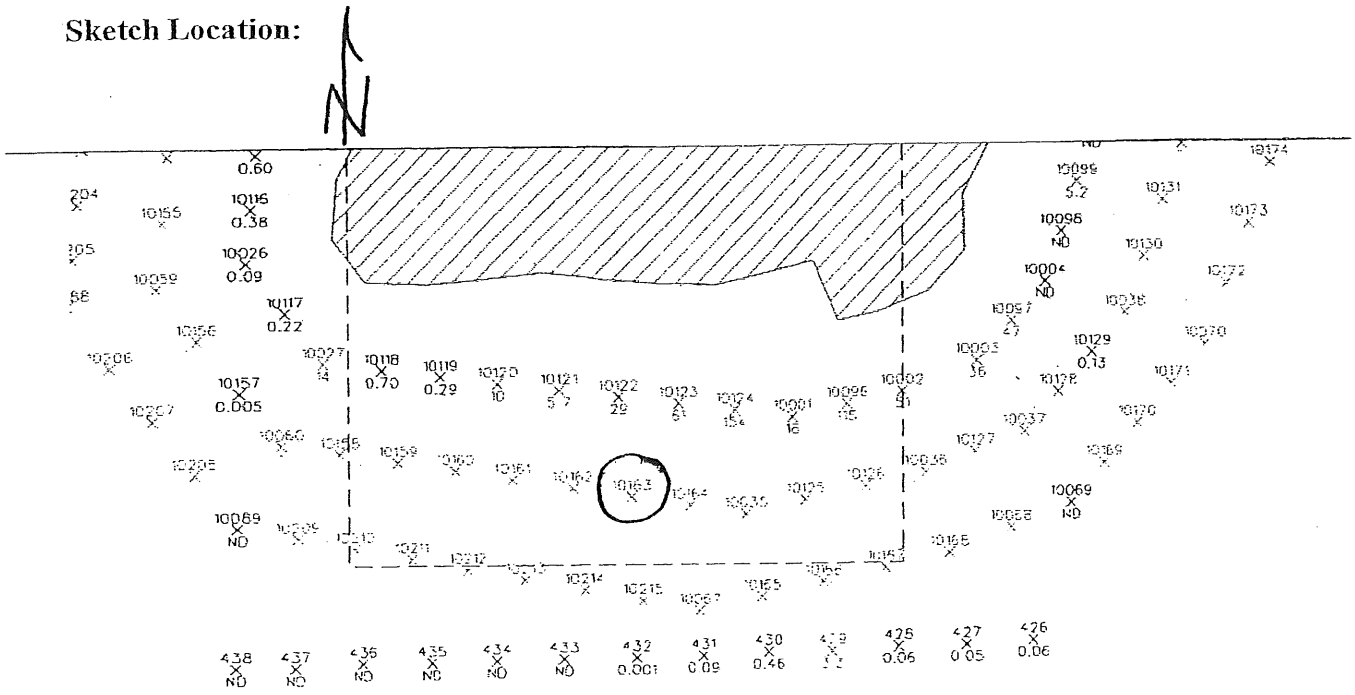
ERPIMS Values:

Sacode:

Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809 ACCT

Location Code: PRRWPA
Sample Number: PR-0024
Sample Name: TP-10164
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock bags
QC Partners:
(TB) _____ (ER) _____ (FB) _____

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1410
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

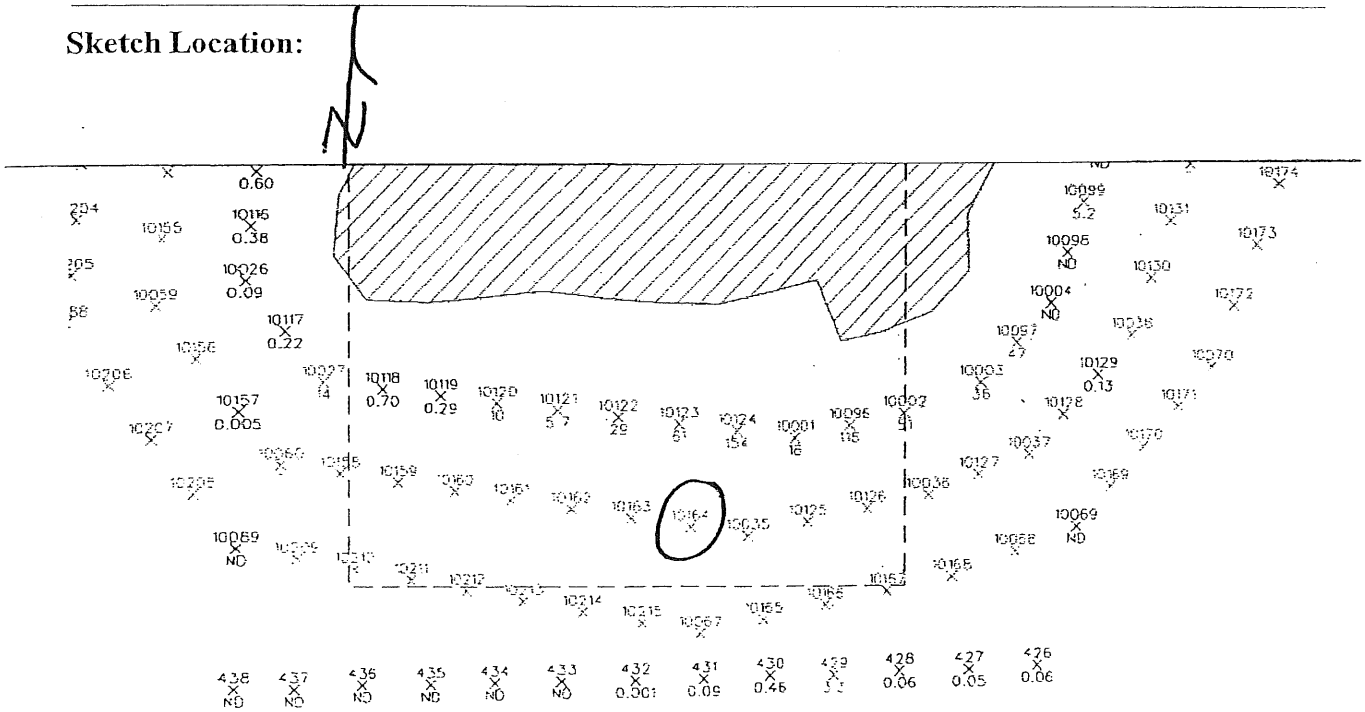
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MJB 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809AELT

Location Code: PRRWPA
Sample Number: PR-0025
Sample Name: TP-10035
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION
Collection Date: 7-23-09
Collection Time: 1650
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

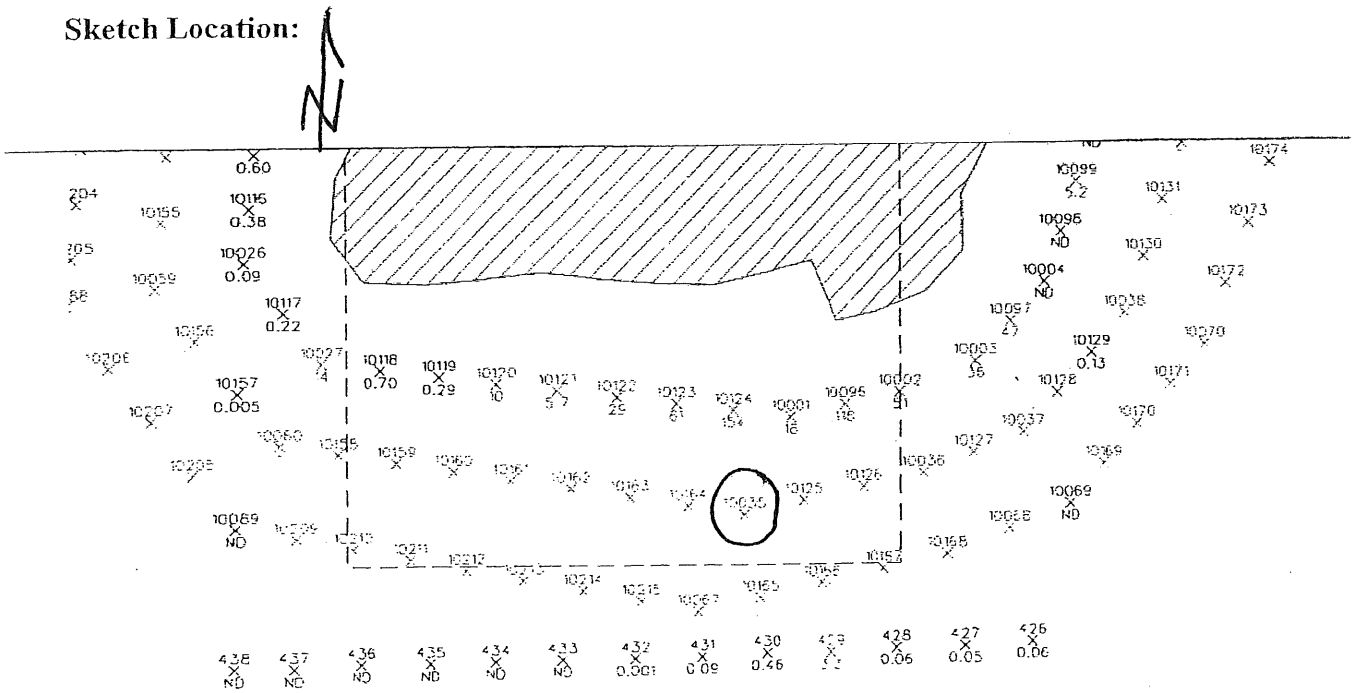
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode: _____
Lot Control#: _____

Comments: _____

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACT

Location Code: PRRWPA
Sample Number: PR-0026
Sample Name: TP-10125
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1430
Start Depth: 1'
End Depth: 10.5'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

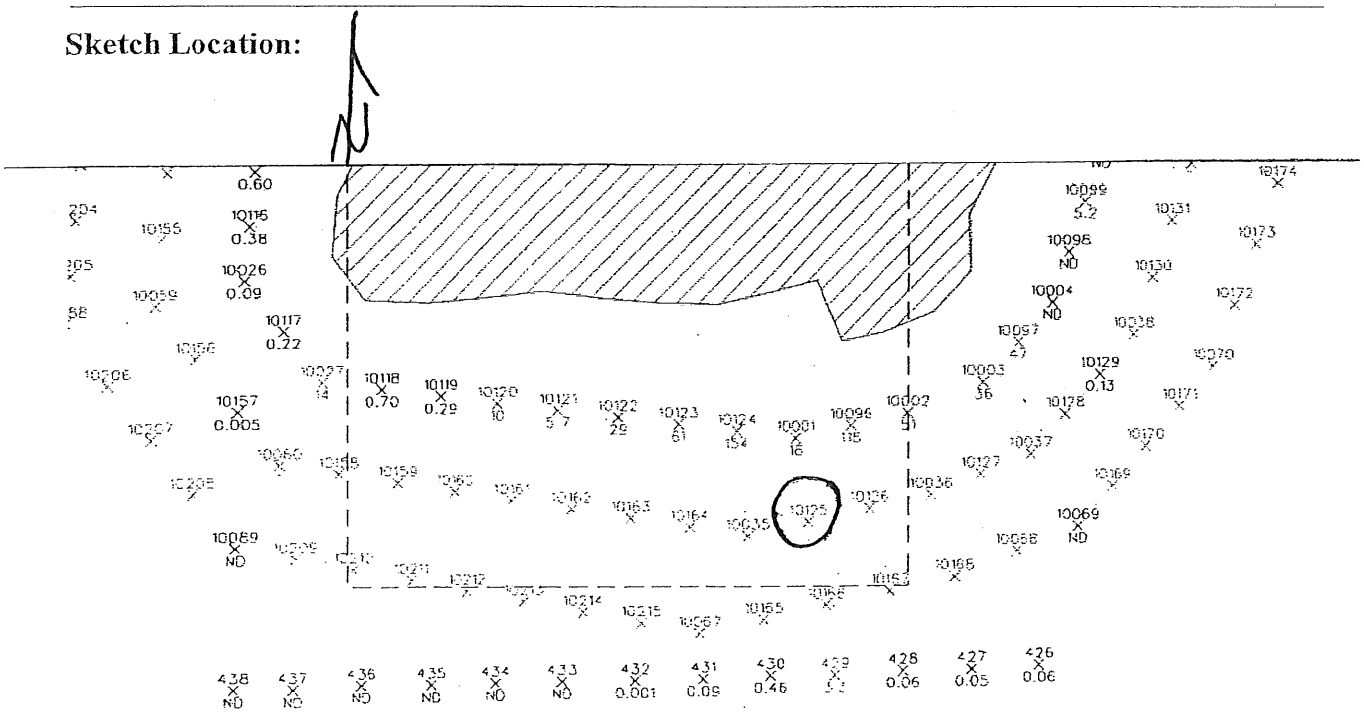
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Warner

Reviewed BY / Date: MJB 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACCT

Location Code: PRRWPA

Sample Number: PR-0027

Sample Name: TP-10126

Sampling Method: GRAB

Sample Type: SO

Sample Purpose: REG

Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Task: SO DELINEATION

Collection Date: 7-23-09

Collection Time: 1705

Start Depth: 1'

End Depth: 5.5'

Sample Matrix: SOIL

Sample Team: EW

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

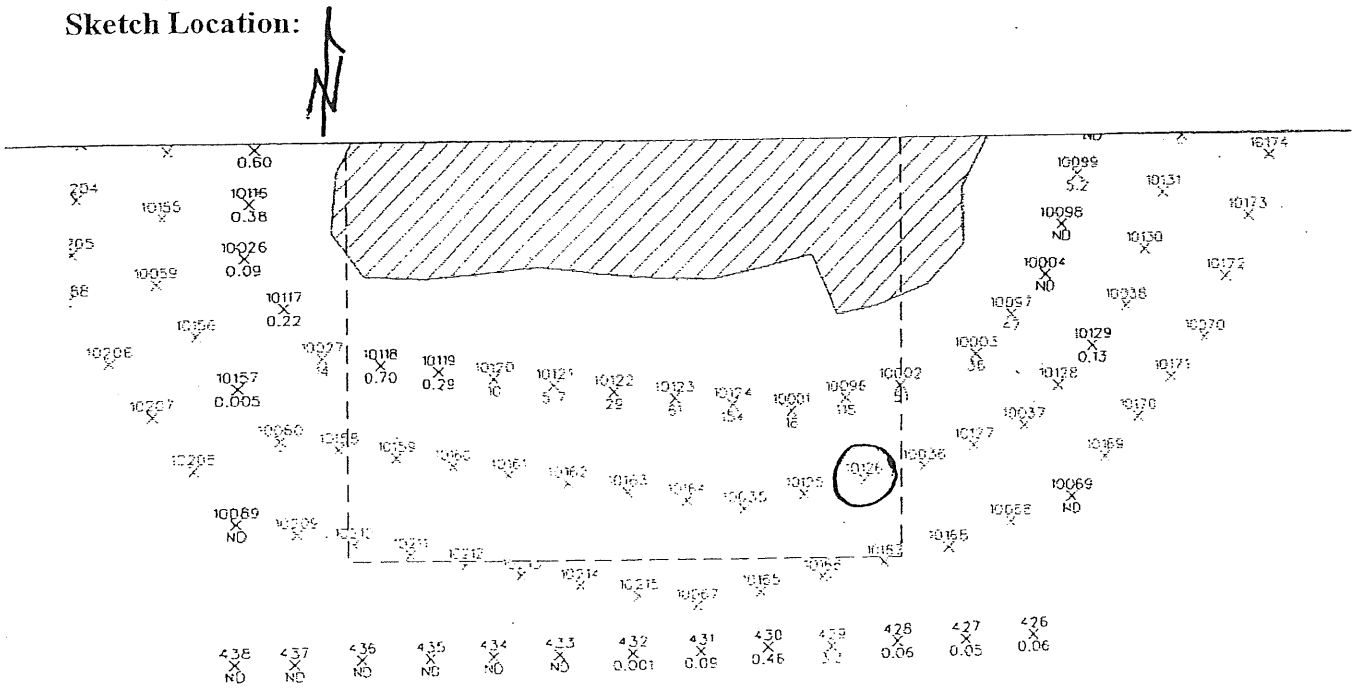
ERPIMS Values:

Sacode:

Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [illegible] 3/10/10

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809ACCT

Location Code: PRRWPA
Sample Number: PR-0028
Sample Name: TP-10036
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1455
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) _____ (ER) _____ (FB) _____

Sample Team: EW

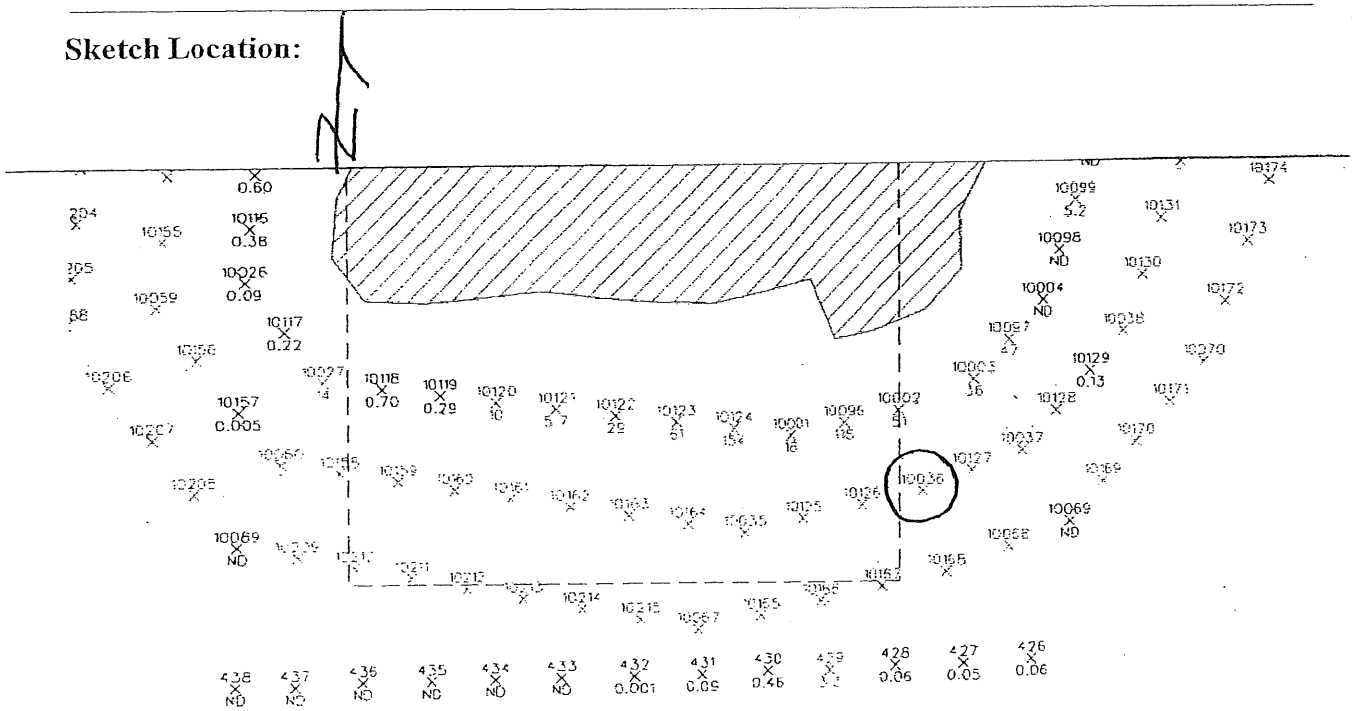
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Warren

Reviewed BY / Date: [illegible] 3/16/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACCT

Location Code: PRRWPA
Sample Number: PR-0029
Sample Name: TP-10127
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 0820
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

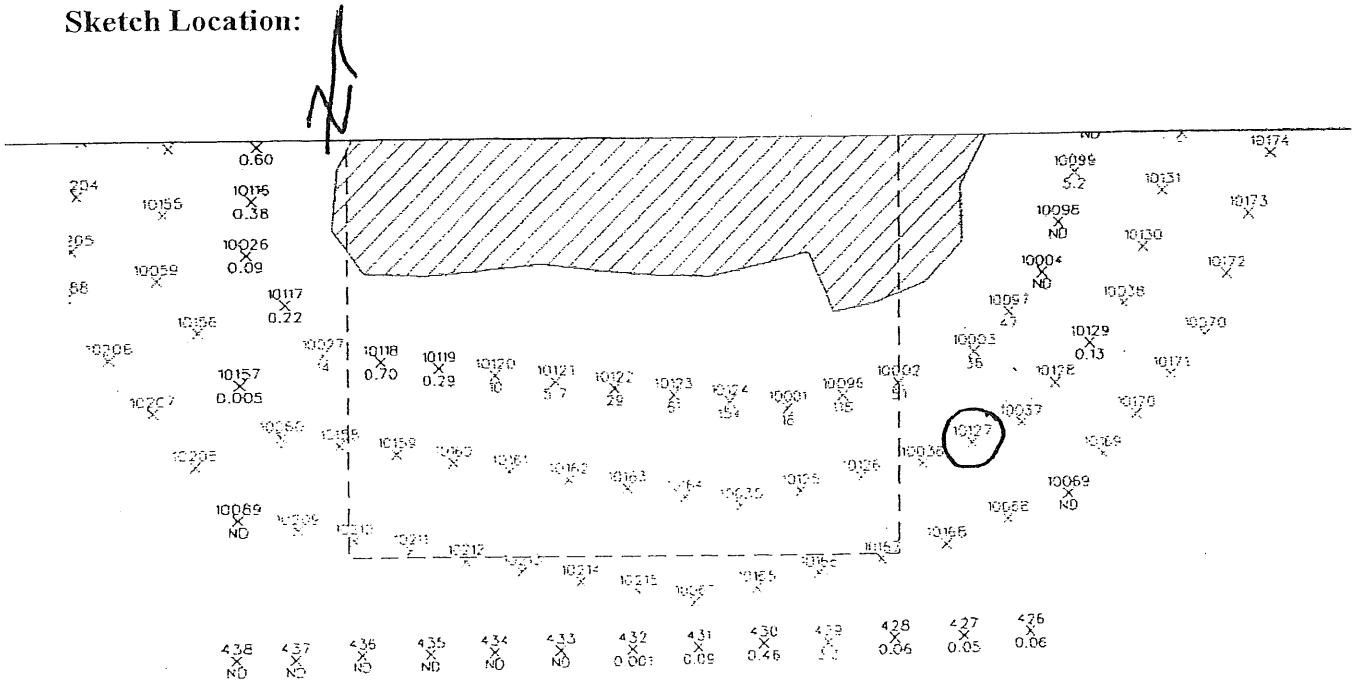
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB072809ACCT

Location Code: PRRWPA
Sample Number: PR-0030
Sample Name: TP-10037
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: mini excavator, disposable gloves, ziplock baggie

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1520
Start Depth: 1'
End Depth: 8.5'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

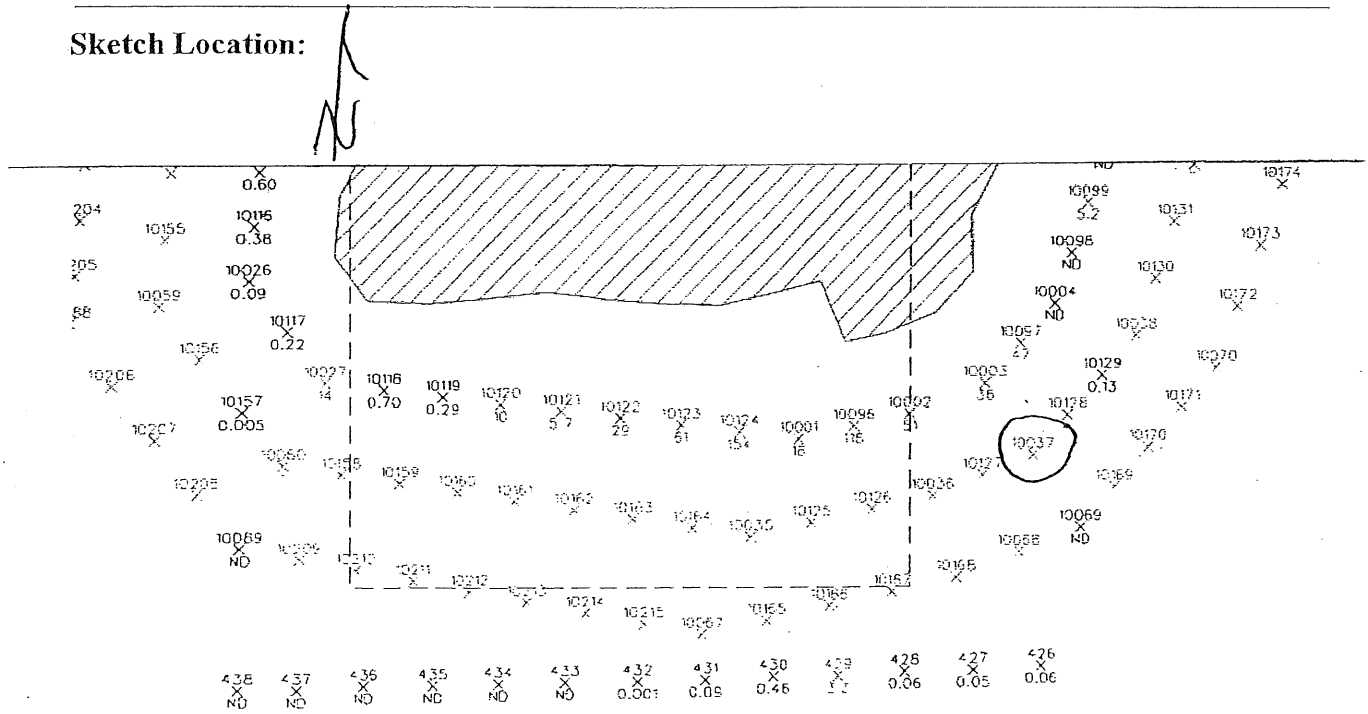
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode: _____
Lot Control#: _____

Comments: _____

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MGS 3/10/10

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Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 072809 ACCT

Location Code: PRRWPA
Sample Number: PR-0031 includes (MS + MSD)
Sample Name: TP-10128
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: Mini excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 0850
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) (ER) (FB)

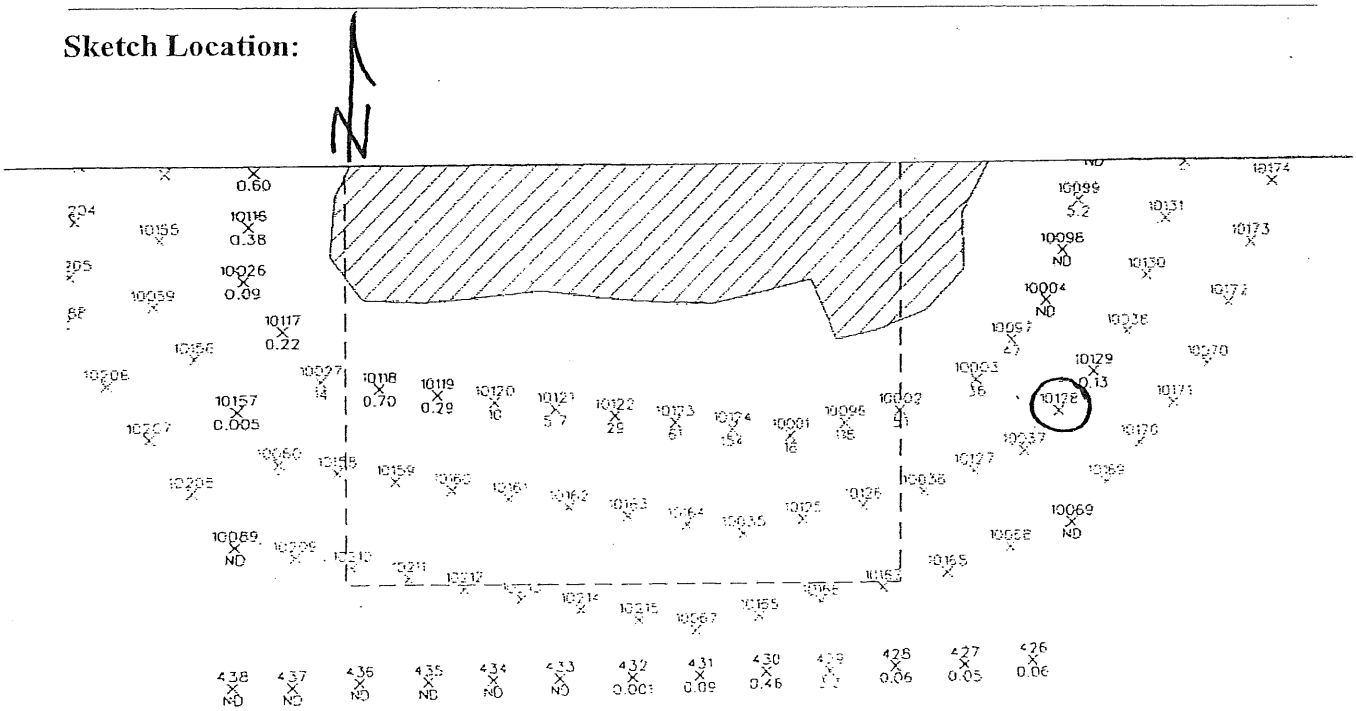
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also PR-0032 (FD) + PR-0033 (FS)

Sketch Location:



Logged BY / Date: Eric W. Weaver *Reviewed BY / Date:* MGG 3/10/10

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 073089 ACCT

Location Code: PRRWPA

Sample Number: PR-0036

Sample Name: TP-492

Sampling Method: GRAB

Sample Type: SO

Sample Purpose: REG

Sampling Equip: Mini Excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION

Collection Date: 7-24-09

Collection Time: 1700

Start Depth: 1'

End Depth: 10'

Sample Matrix: SOIL

Sample Team: EW

QC Partners:

(TB) _____ (ER) _____ (FB) _____

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

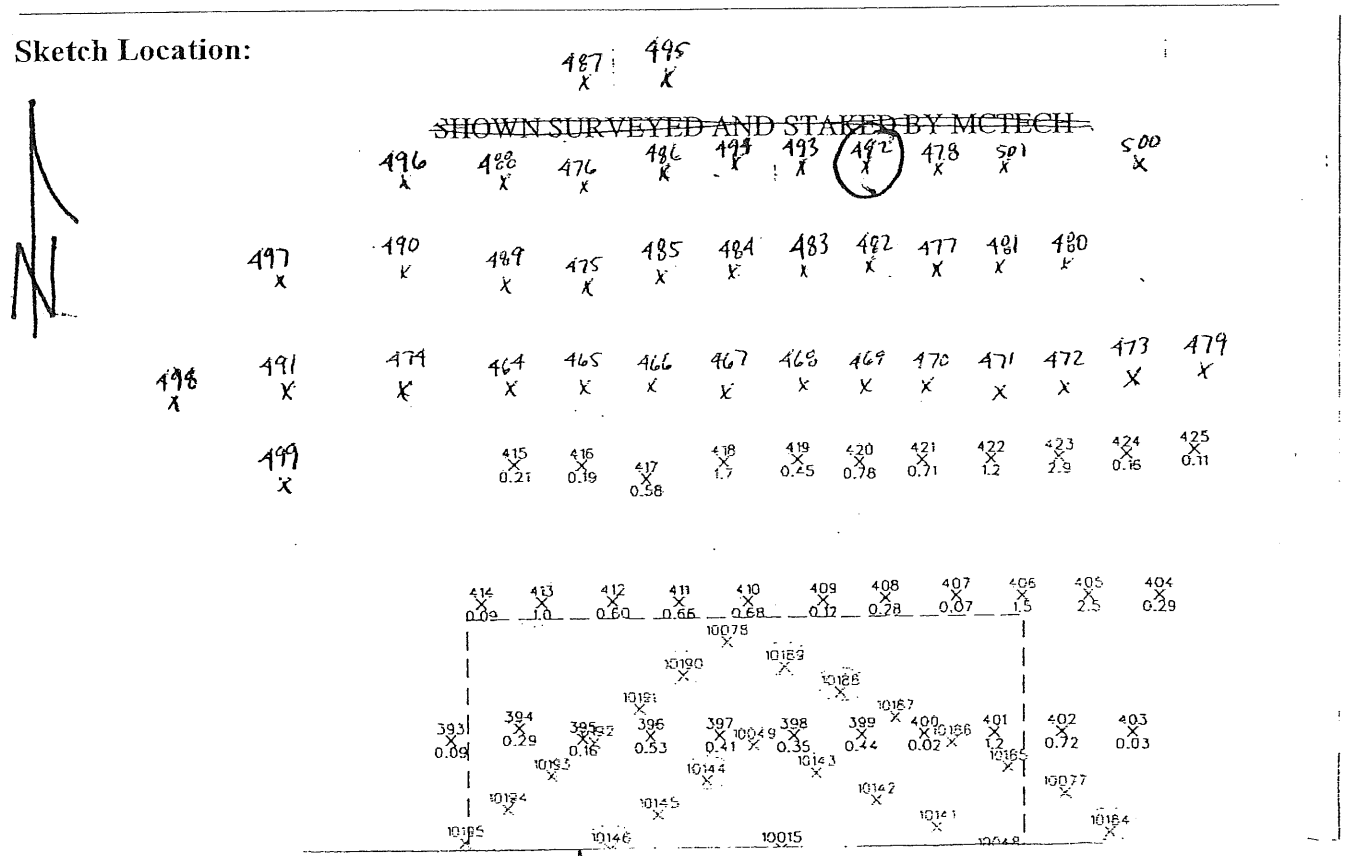
ERPIMS Values:

Sacode: _____

Lot Control#: _____

Comments: _____

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MGA 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009 ACCT

Location Code: PRRWPA
Sample Number: PR-0037
Sample Name: TP-493
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1725
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

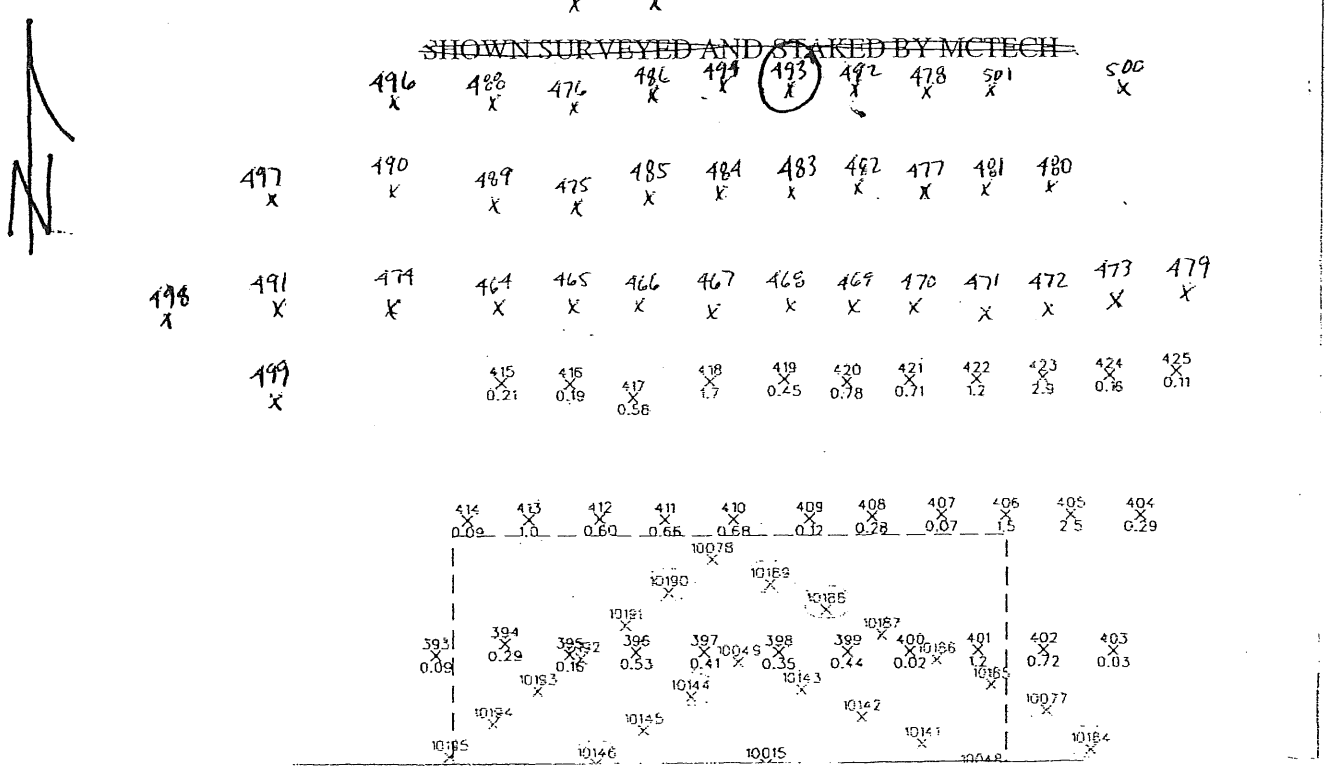
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 073009 ACCT

Location Code: PRRWPA
Sample Number: PR-0038
Sample Name: TP-500
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1620
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

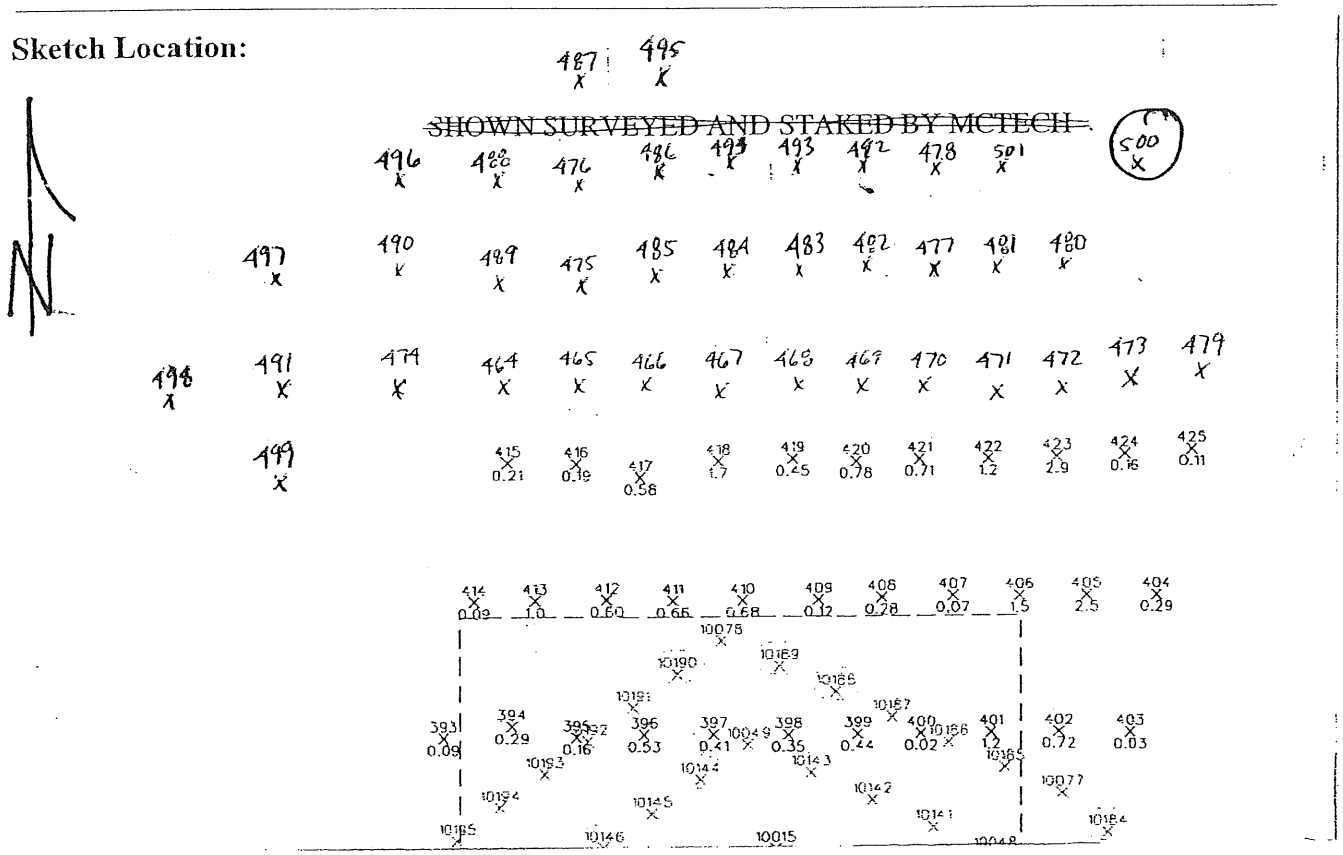
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MJB 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009 ACCT

Location Code: PRRWPA
Sample Number: PR-0039
Sample Name: TP-501
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-24-09
Collection Time: 1645
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

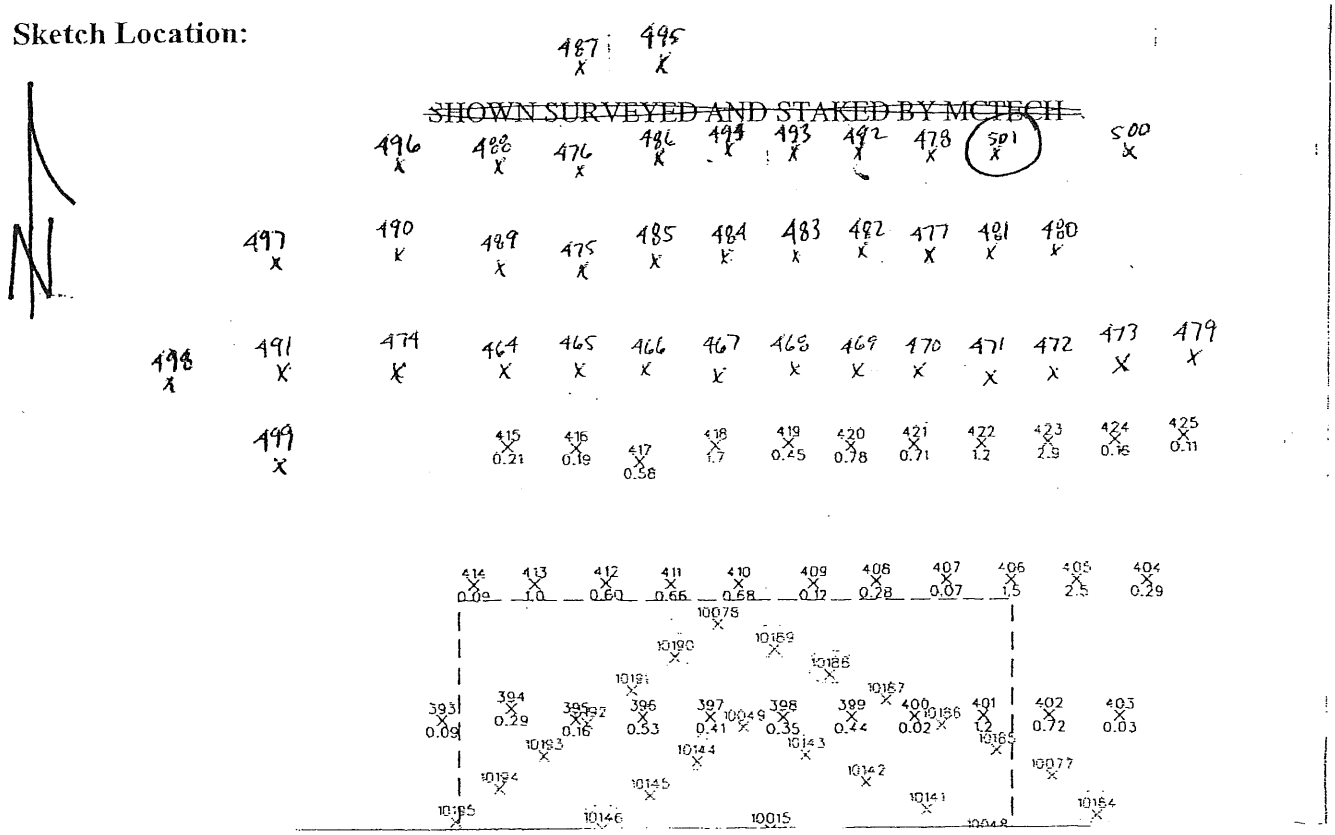
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [illegible] 3/10/16

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009ACCT

Location Code: PRRWPA
Sample Number: PR-0040
Sample Name: TP-494
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-27-09
Collection Time: 0830
Start Depth: 1'
End Depth: 9.5'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) (ER) (FB)

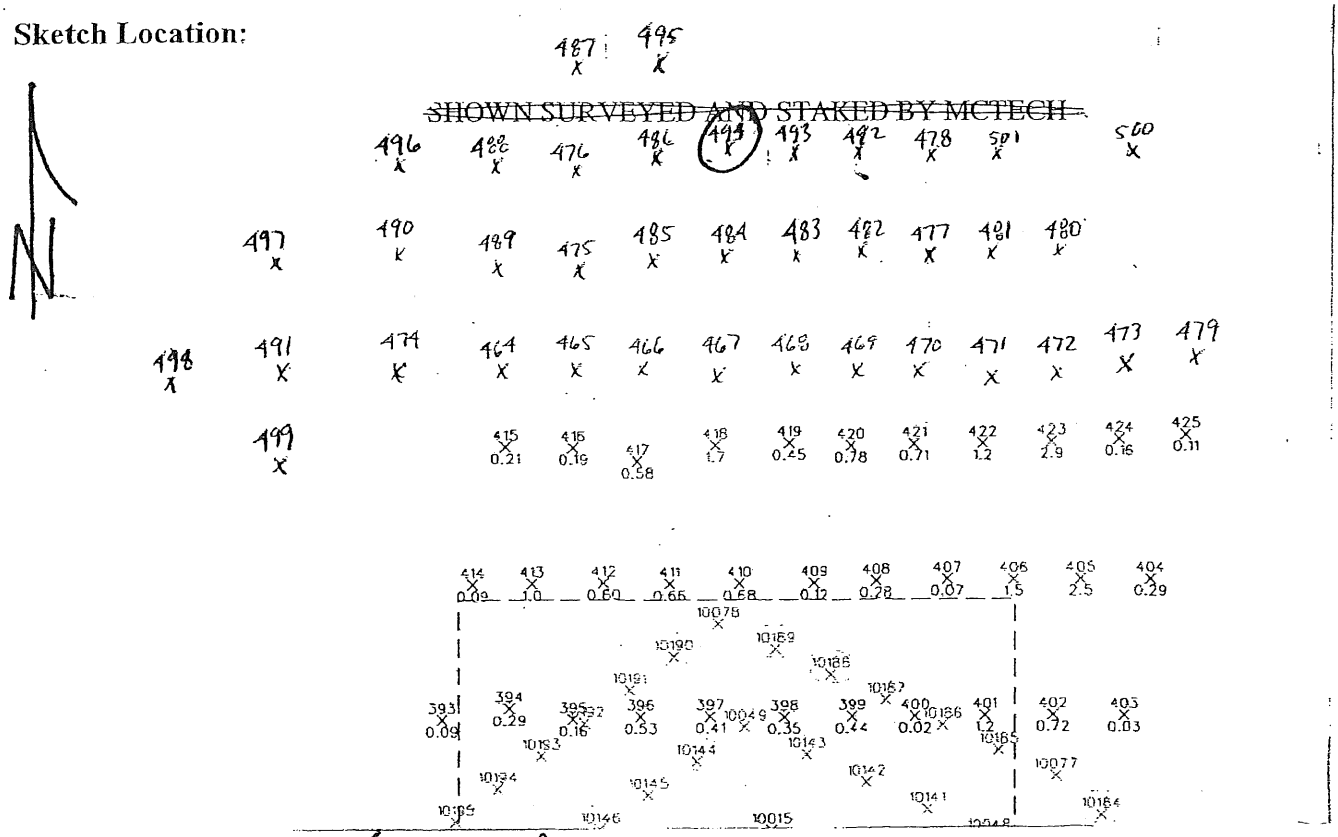
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: MJB 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009 ACCT

Location Code: PRRWPA
Sample Number: PR-0041
Sample Name: TP-495
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-27-09
Collection Time: 0850
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

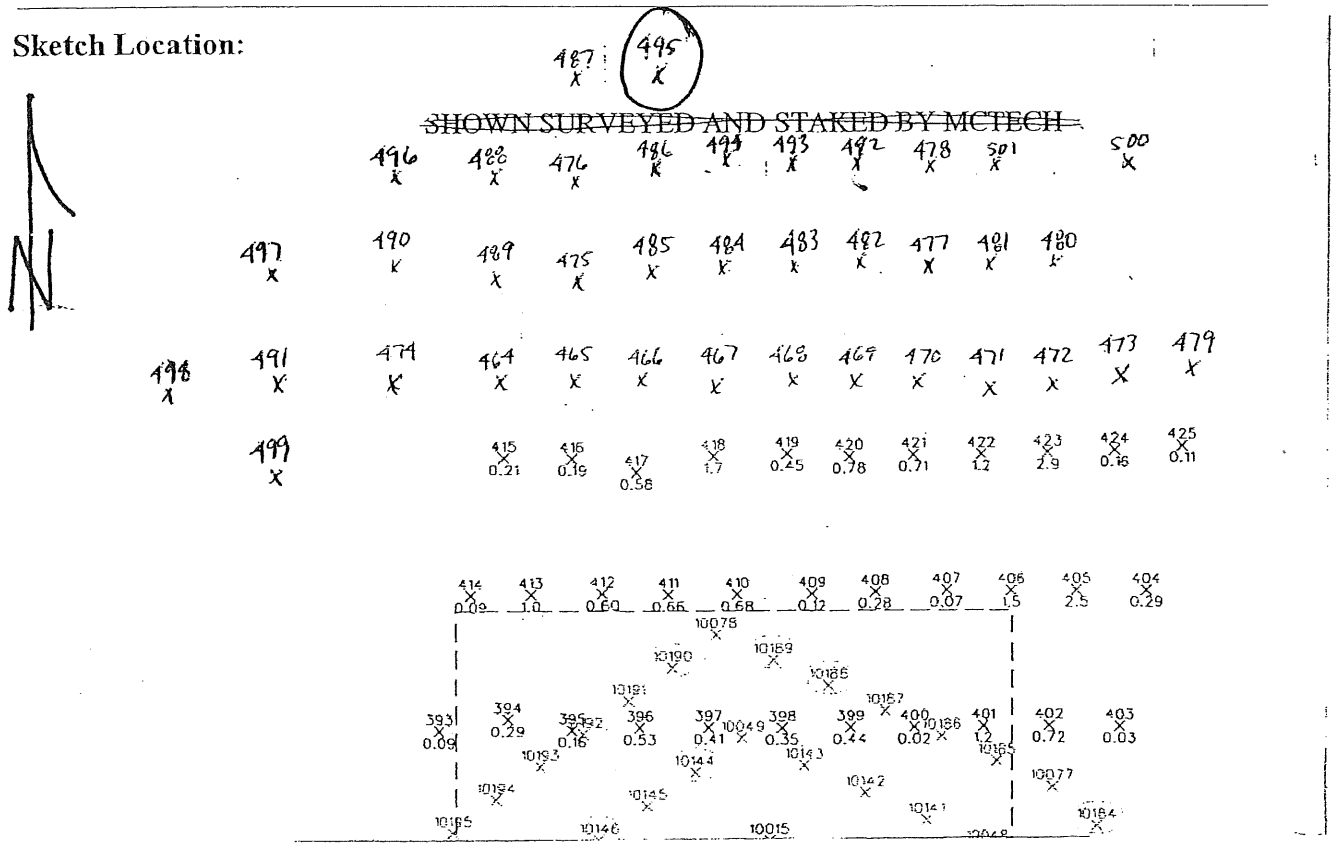
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver

Reviewed BY / Date: [illegible] 8/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009ACCT

Location Code: PRRWPA
Sample Number: PR-0042
Sample Name: TP-496
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-27-09
Collection Time: 0910
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

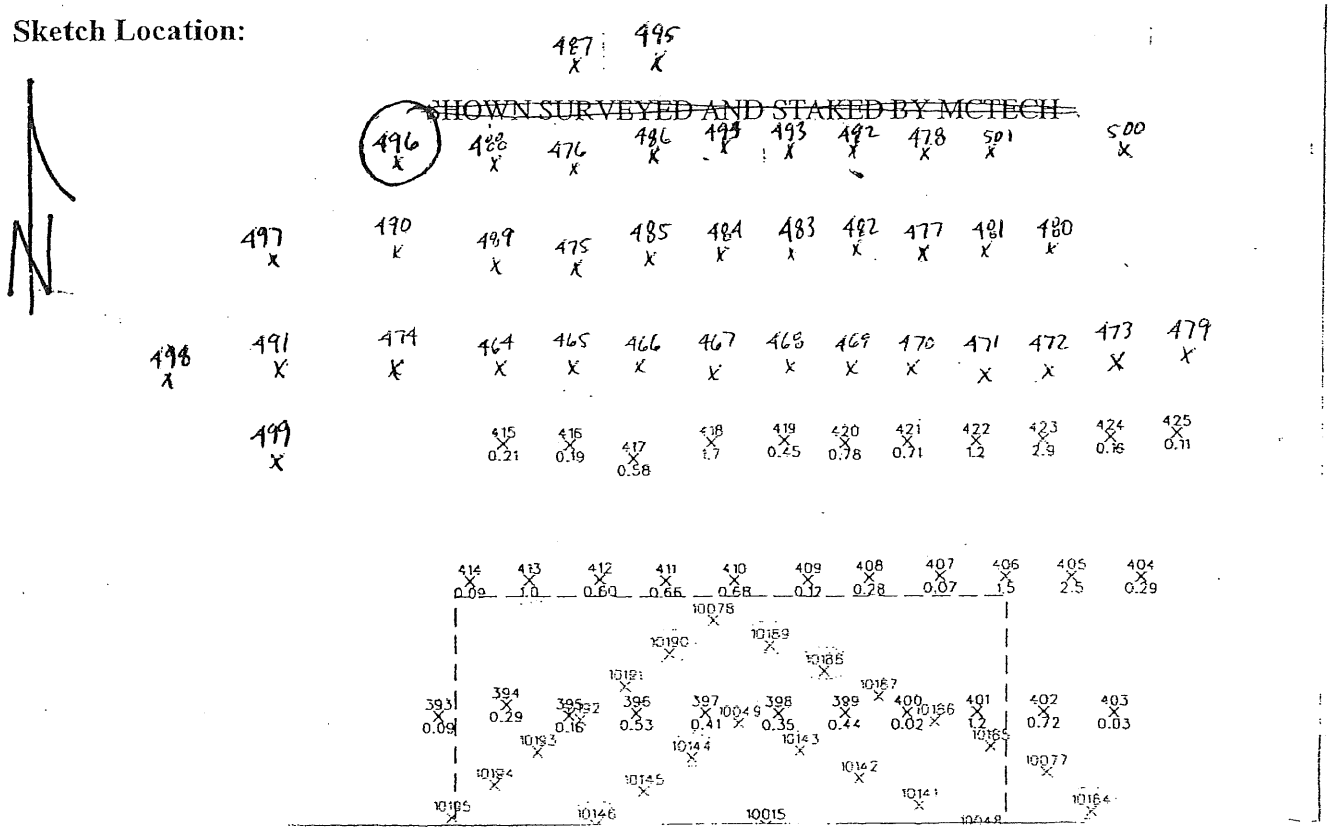
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* MJG 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009ACCT

Location Code: PRRWPA
Sample Number: PR-0043
Sample Name: TP-497
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION
Collection Date: 7-27-09
Collection Time: 0930
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

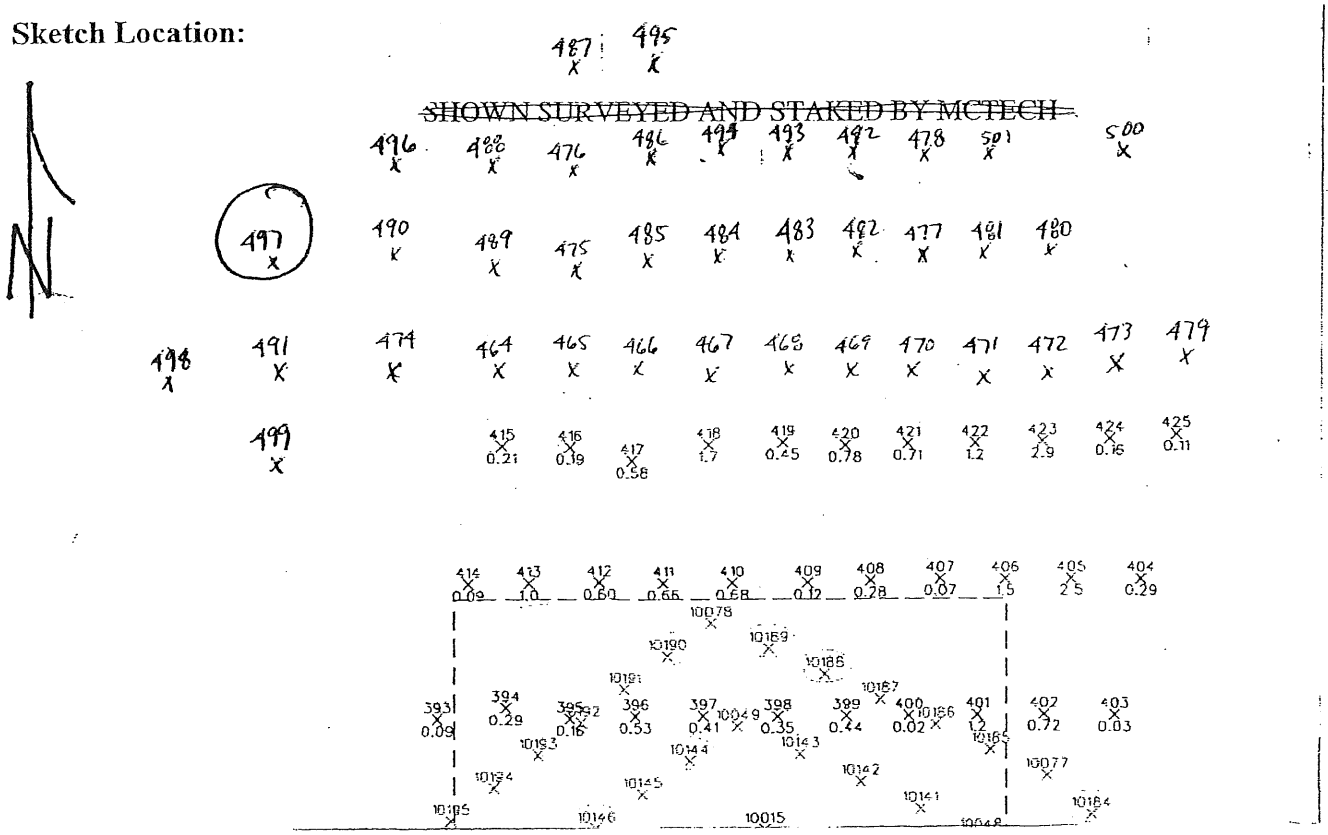
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* MG 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB073009ACCT

Location Code: PRRWPA
Sample Number: PR-0044
Sample Name: TP-498
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Mini Excavator, disposable gloves, ziplock baggies

Task: SO DELINEATION
Collection Date: 7-27-09
Collection Time: 0950
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) _____ (ER) _____ (FB) _____

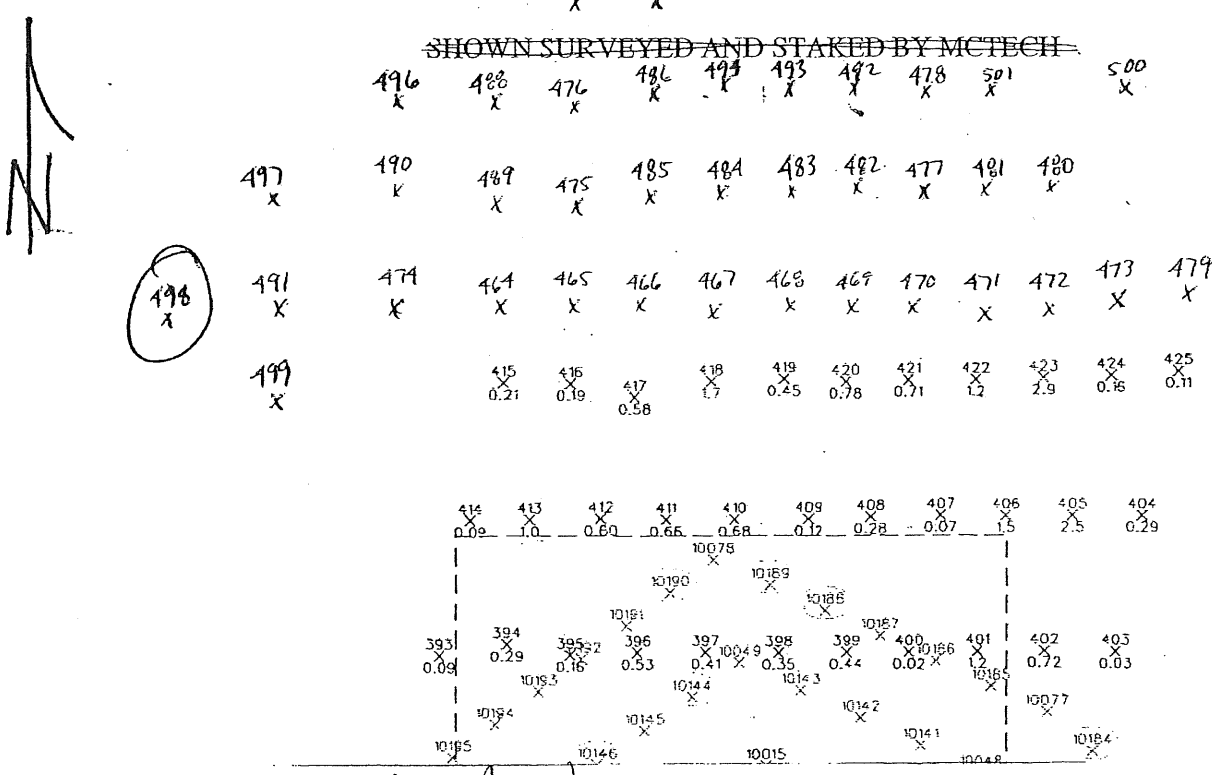
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E W Weaver *Reviewed BY / Date:* MGS 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 073009 ACLT

Location Code: PRRWPA
Sample Number: PR-0045 includes (MS+MSD)
Sample Name: TP-499
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: Mini Excavator, disposable gloves, zip lock baggies

Task: SO DELINEATION
Collection Date: 7-27-09
Collection Time: 1025
Start Depth: 1'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW

QC Partners:
(TB) (ER) (FB)

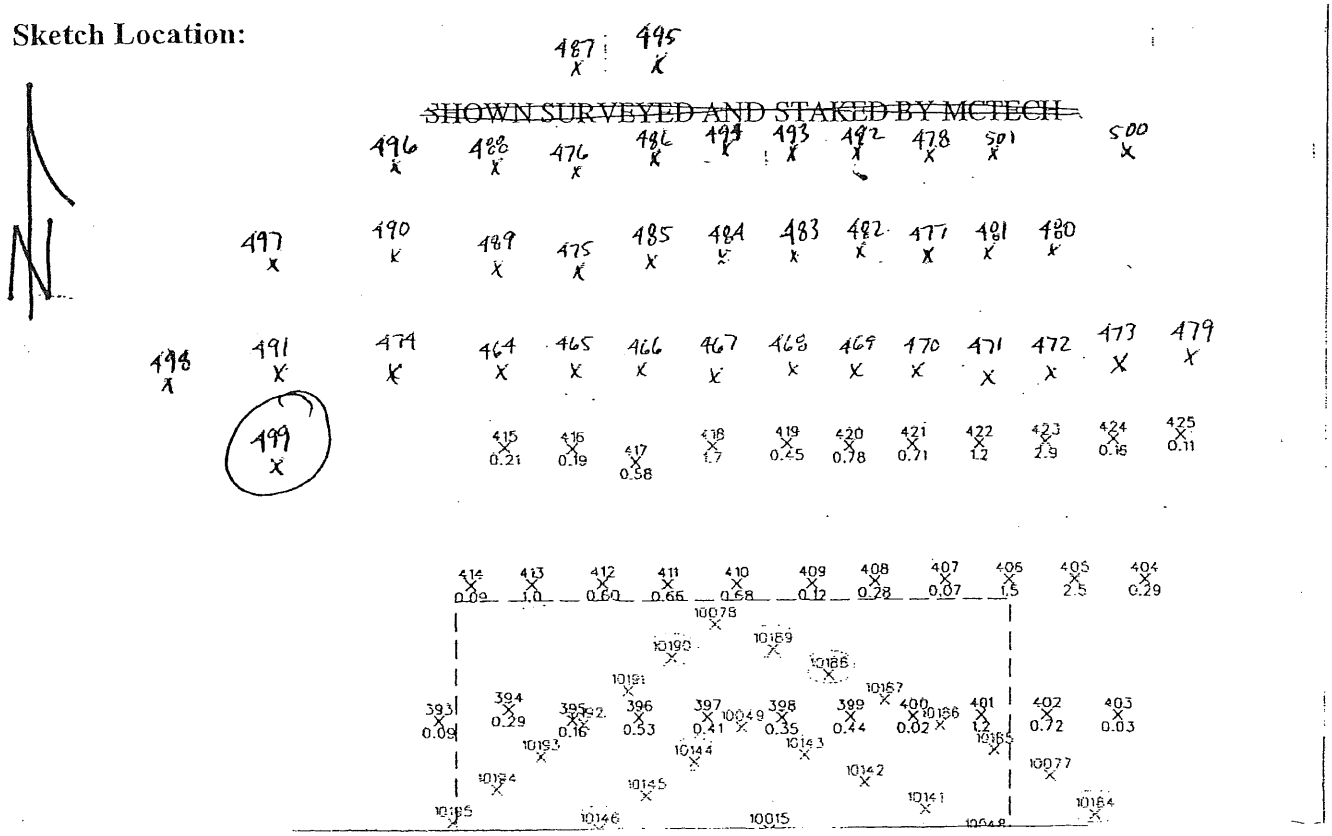
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also PR-0046 (FD) + PR-0047 (FS)

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-00502**
Sample Number: **PR0050**
Sample Name: **PB-PR-00502-SO-PR0050**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Spl. spoon, 2 ziplock baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1340
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

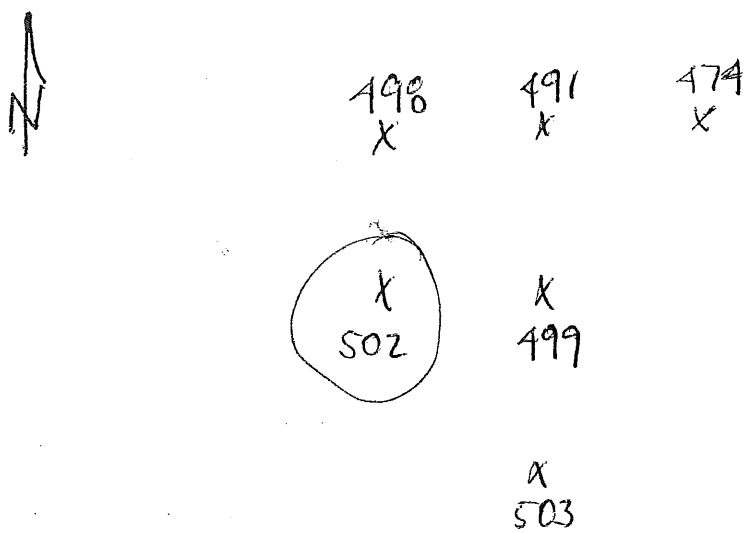
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sampling to 10' bgs.

Sketch Location:



Logged BY / Date: Eric W. Weaver 8-18-09 *Reviewed BY / Date:* Edward S. Weaver 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-00503**
Sample Number: **PR0051**
Sample Name: **PB-PR-00503-SO-PR0051**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split spoon sampler, 2 Ziplock baggie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1418
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

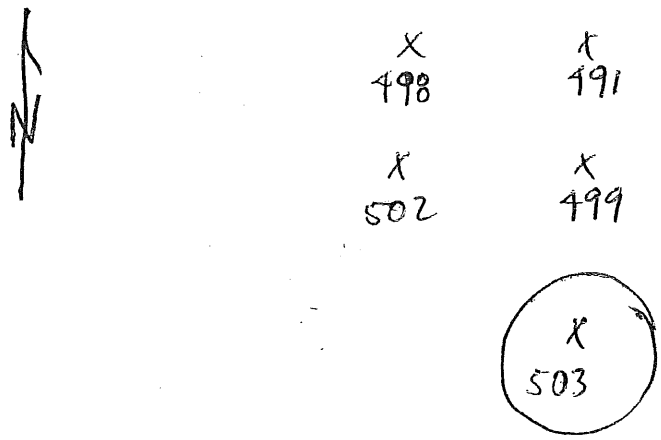
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Sampled 0-10'.

Sketch Location:



Logged BY / Date: [signature] 8-18-09

Reviewed BY / Date: Edward S. Weaver 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-00504**
Sample Number: **PR0052**
Sample Name: **PB-PR-00504-SO-PR0052**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Spoon sampler, ziplock bags, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1505
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

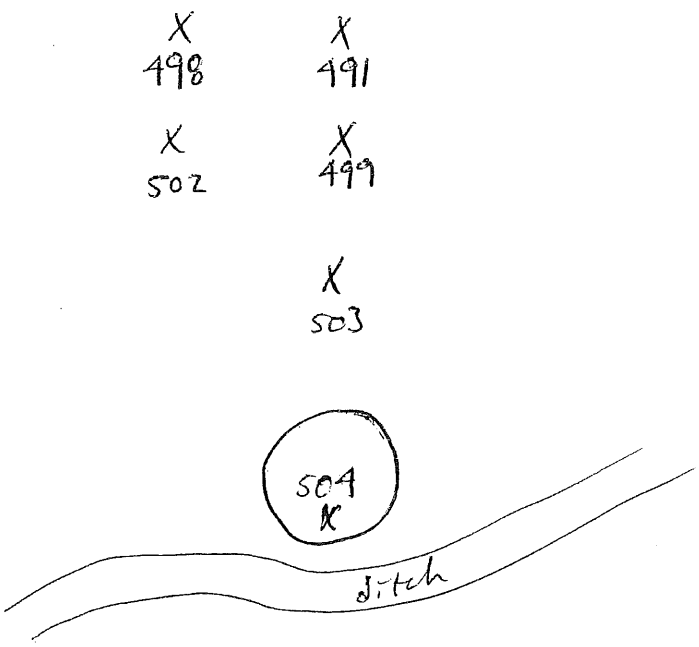
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10'.

Sketch Location:



Logged BY / Date: 8-18-09 *Reviewed BY / Date:* 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB08 2009 ACCT

Location Code: **PR-00505**
Sample Number: **PR0053**
Sample Name: **PB-PR-00505-SO-PR0053**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: 4oz. spoon samplers, ziplock baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1610
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) — (ER) — (FB) —

Sample Team: EW

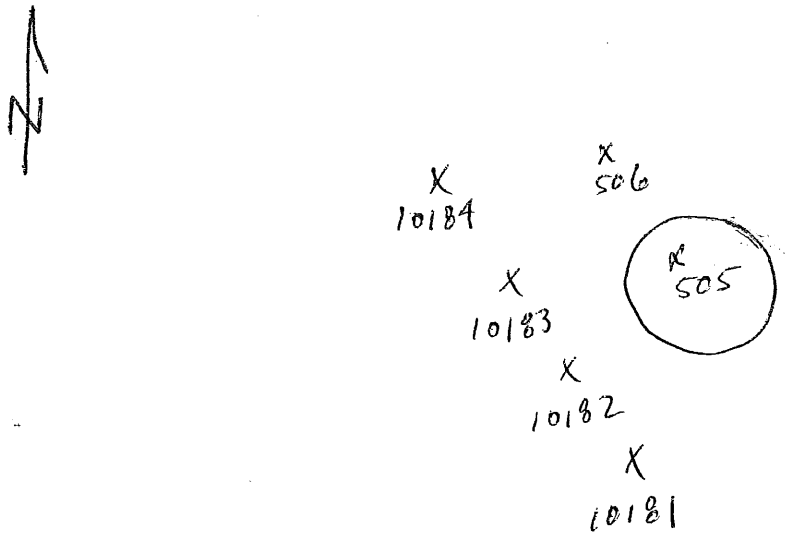
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Directpush sample to 10' bgs.
Also collected MS, MSD, FD + FS at this location.

Sketch Location:



Logged BY / Date: 8-18-09 *Reviewed BY / Date:* 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-00505**
Sample Number: **PR0053-MS**
Sample Name: **PB-PR-00505-SO-PR0053-MS**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **MS**
Sampling Equip: Splitspoon sampler, ziplock bags/ds, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1610
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

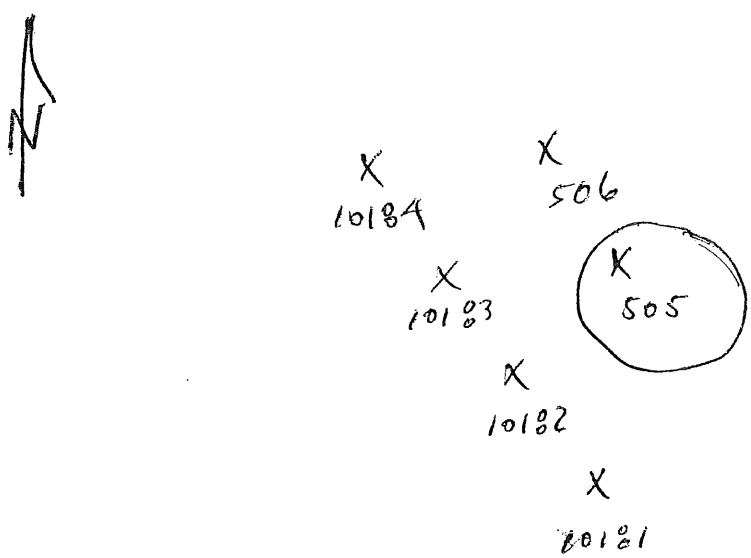
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs. Also collected the Regular, MSD, PD & FS at this location.

Sketch Location:



Logged BY / Date: Eric W Weaver 8-18-09 *Reviewed BY / Date:* Edward S Weaver 2/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-00505**
Sample Number: **PR0053-MSD**
Sample Name: **PB-PR-00505-SO-PR0053-MSD**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **MSD**
Sampling Equip: Split spoon sampler, ziplock bags, sie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1610
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

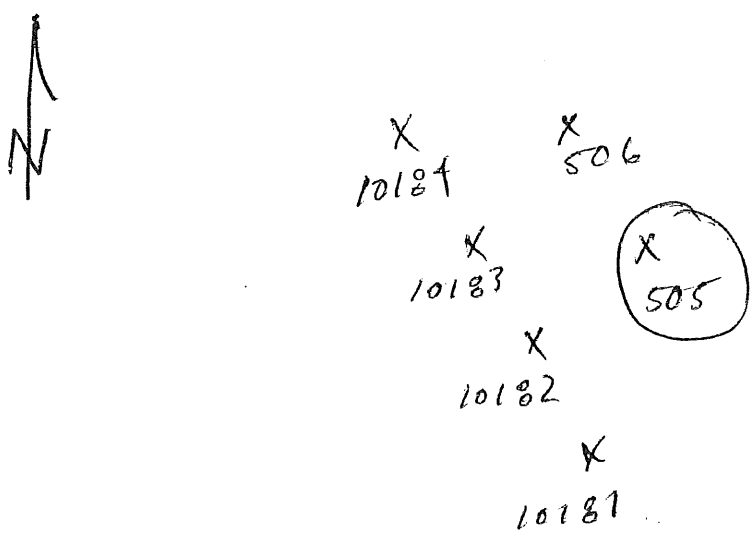
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs. Also collected the Regular, MS, FD & RS samples at this location

Sketch Location:



Logged BY / Date: Eric W. Weaver 8-18-09 *Reviewed BY / Date:* Edward K. Weaver 2/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB08 2009 ACCT

Location Code: **PR-00505**
Sample Number: **PR0054**
Sample Name: **PB-PR-00505-SO-PR0054**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **FD**
Sampling Equip: Split spoon sampler, ziplock baggies, disposable gloves.

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1610
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

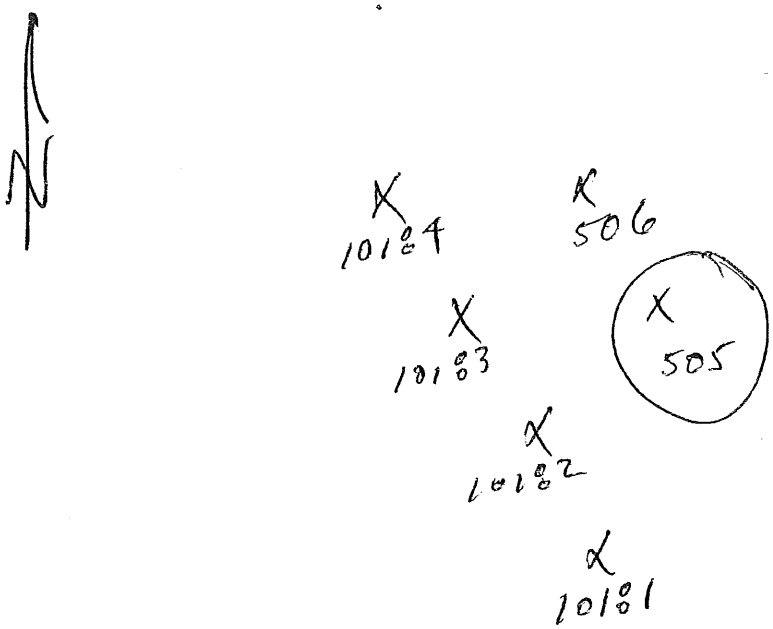
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs. Also collected the regular, MS, MSD and RS at this location.

Sketch Location:



Logged BY / Date: 8-18-09 *Reviewed BY / Date:* 2/9/09

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 082009 ~~ACCT~~ TA EW

Location Code: **PR-00505**

Sample Number: **PR0055**

Sample Name: **PB-PR-00505-SO-PR0055**

Sampling Method: **DP**

Sample Type: **SB** *Sample Purpose:* **FS**

Sampling Equip: 4 lid spoon sampler, 2 ziplock baggies, disposable gloves

Task: **PR-AUG09**

Collection Date: 8-18-09

Collection Time: 1610

Start Depth: 0'

End Depth: 10'

Sample Matrix: **SOIL**

Sample Team: EW

QC Partners:

(TB) — (ER) — (FB) —

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

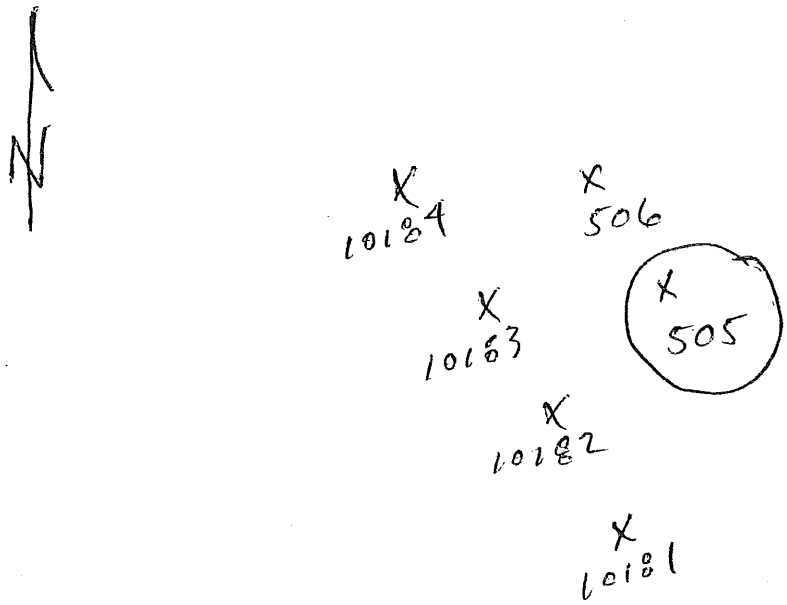
ERPIMS Values:

Sacode:

Lot Control#:

Comments: Direct push sample to 10' bgs. Also collected the regular, MS, MSD and FD samples at this location

Sketch Location:



Logged BY / Date: E.W. Weaver 8-18-09 *Reviewed BY / Date:* Edward E. Weaver 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-00506**
Sample Number: **PR0056**
Sample Name: **PB-PR-00506-SO-PR0056**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split spoon sampler, ziplock baggie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-18-09
Collection Time: 1648
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

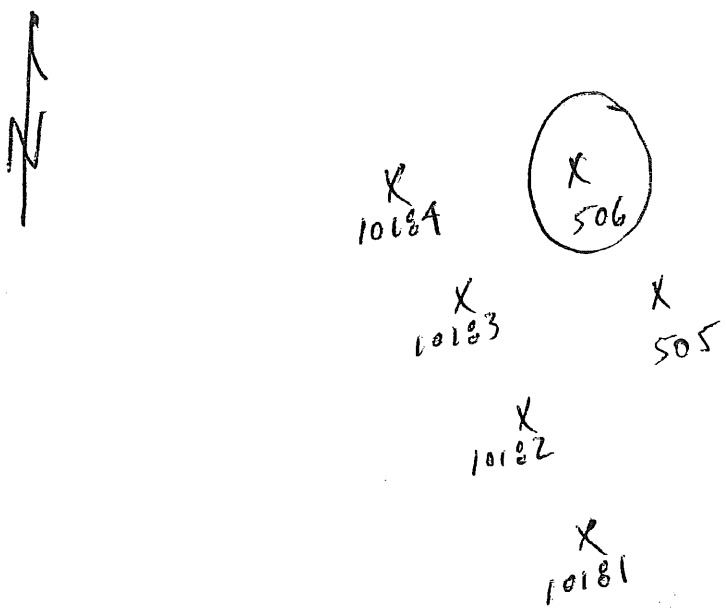
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-18-09 *Reviewed BY / Date:* Edward K. Weaver 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10138**
Sample Number: **PR0057**
Sample Name: **PB-PR-10138-SO-PR0057**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split spoon Sampler, ziplock baggie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 0807
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

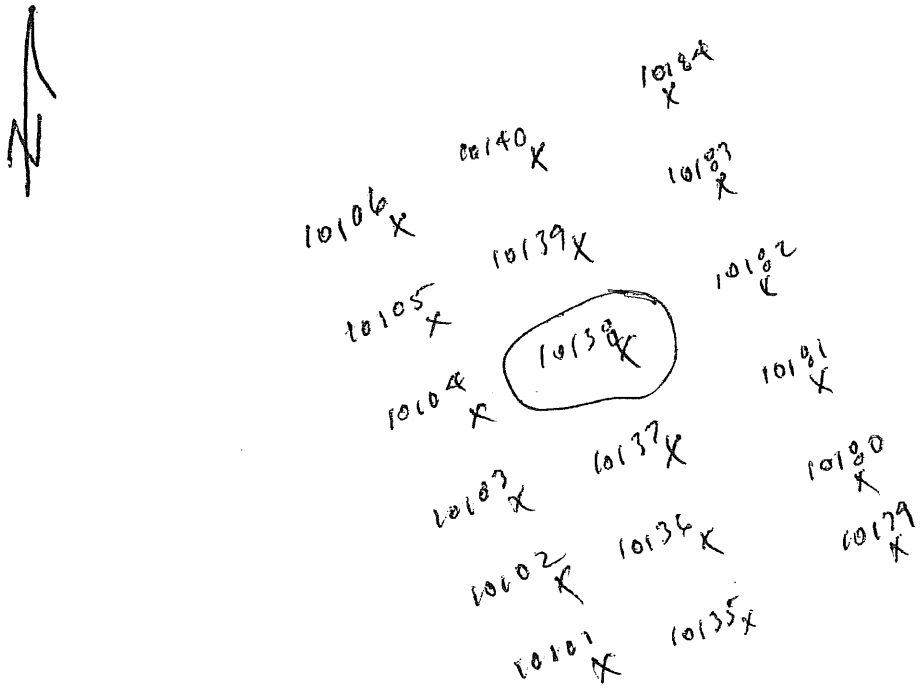
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sampling to 10' bgs.

Sketch Location:



Logged BY / Date: Eric W. Weaver 8-19-09 *Reviewed BY / Date:* Edward W. Weaver 2/9/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10139**
Sample Number: **PR0058**
Sample Name: **PB-PR-10139-SO-PR0058**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split spoon sampler, 2 plastic baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 0836
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

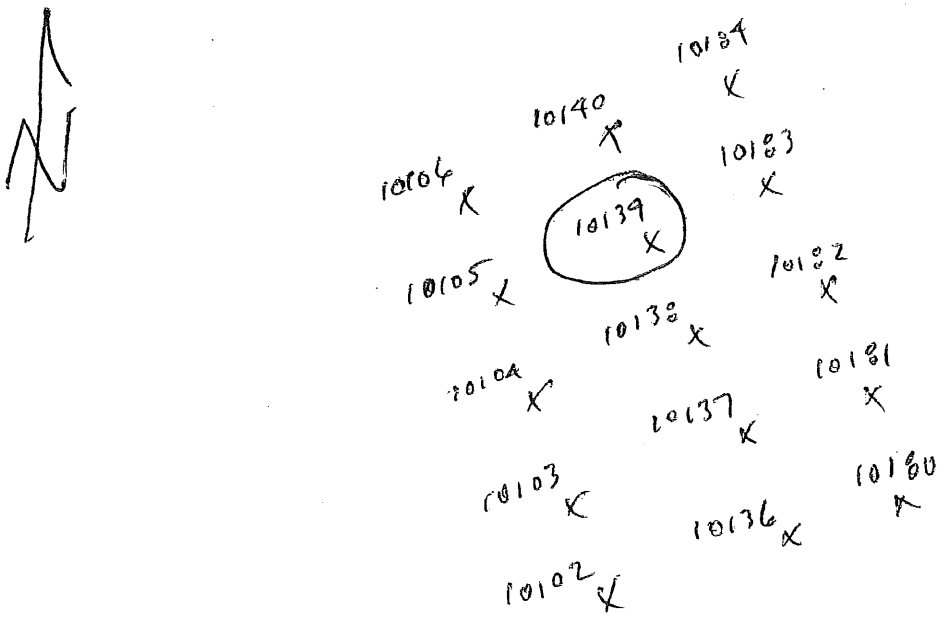
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: Eric W. Weaver 8-18-09 *Reviewed BY / Date:* Edward E. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-10140**
Sample Number: **PR0059**
Sample Name: **PB-PR-10140-SO-PR0059**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Spoon sampler, 2 ziplock baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 0900
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

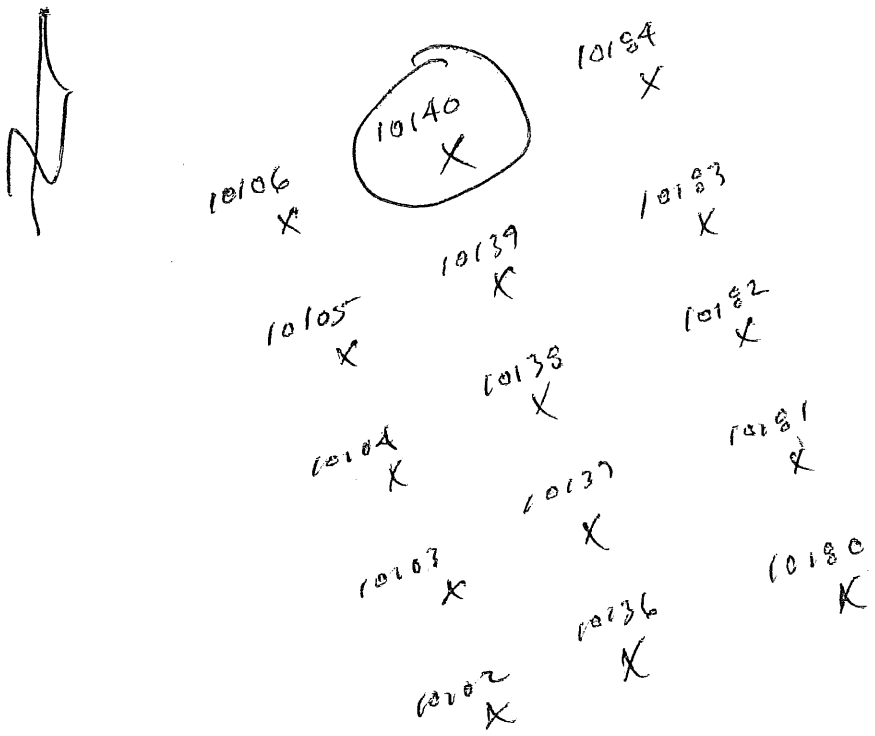
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct Push sample to 10' bgs.

Sketch Location:



Logged BY / Date: 8-19-09 *Reviewed BY / Date:* 2-9-10

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009.ACCT

Location Code: **PR-10132**

Sample Number: **PR0060**

Sample Name: **PB-PR-10132-SO-PR0060**

Sampling Method: **DP**

Sample Type: **SB** *Sample Purpose:* **REG**

Sampling Equip: Split spoon sampler, 2 ziplock baggies, disposable gloves

Task: **PR-AUG09**

Collection Date: 8-19-09

Collection Time: 0945

Start Depth: ~~Raw~~ 1'

End Depth: ~~Raw~~ 11'

Sample Matrix: **SOIL**

QC Partners:

(TB) — (ER) — (FB) —

Sample Team: EW

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

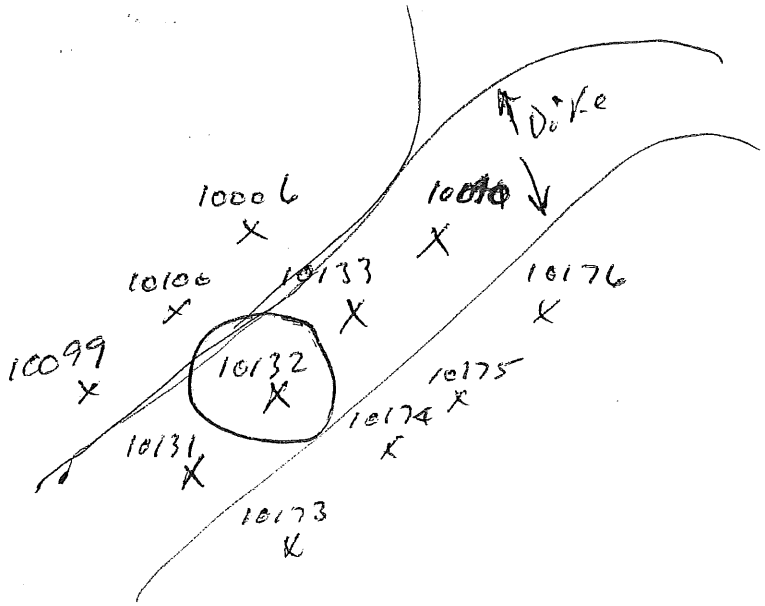
ERPIMS Values:

Sacode:

Lot Control#:

Comments: Began sampling at 1' bgs which was original ground surface beneath the clay liner comprising the dike. Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* [illegible] 2-9-2010

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10133**
Sample Number: **PR0061**
Sample Name: **PB-PR-10133-SO-PR0061**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split spoon sampler, ziplock baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1053
Start Depth: 4'
End Depth: 14'
Sample Matrix: **SOIL**

QC Partners:
(TB) — (ER) — (FB) —

Sample Team: EW

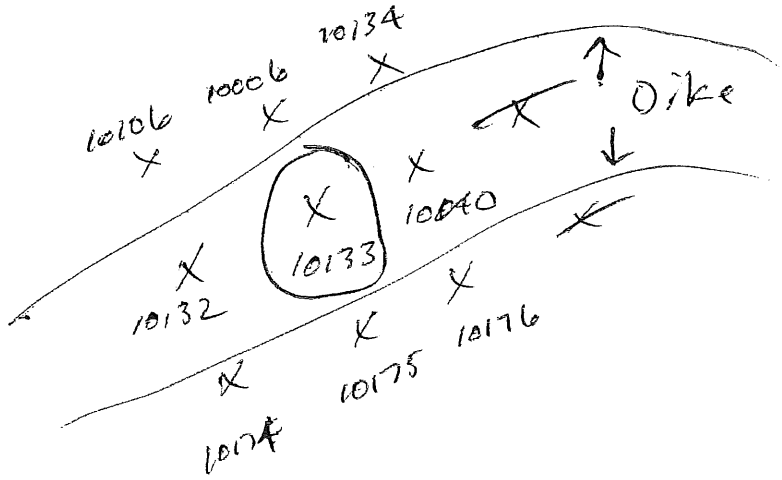
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Began sampling at 4 where brown very fine grain SAND was encountered which lies below the clay liner of the dike. Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* Edward E. Weaver 2-9-10

Shaw E & I, Inc.

Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10040**

Sample Number: **PR0068**

Sample Name: **PB-PR-10040-SO-PR0068**

Sampling Method: **DP**

Sample Type: **SB** *Sample Purpose:* **REG**

Sampling Equip: Spoon Sampler, ziploc baggies, disposable gloves

QC Partners:

(TB) — (ER) — (FB) —

Task: **PR-AUG09**

Collection Date: 8-19-09

Collection Time: 1128

Start Depth: 2'

End Depth: 12'

Sample Matrix: **SOIL**

Sample Team: EW

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

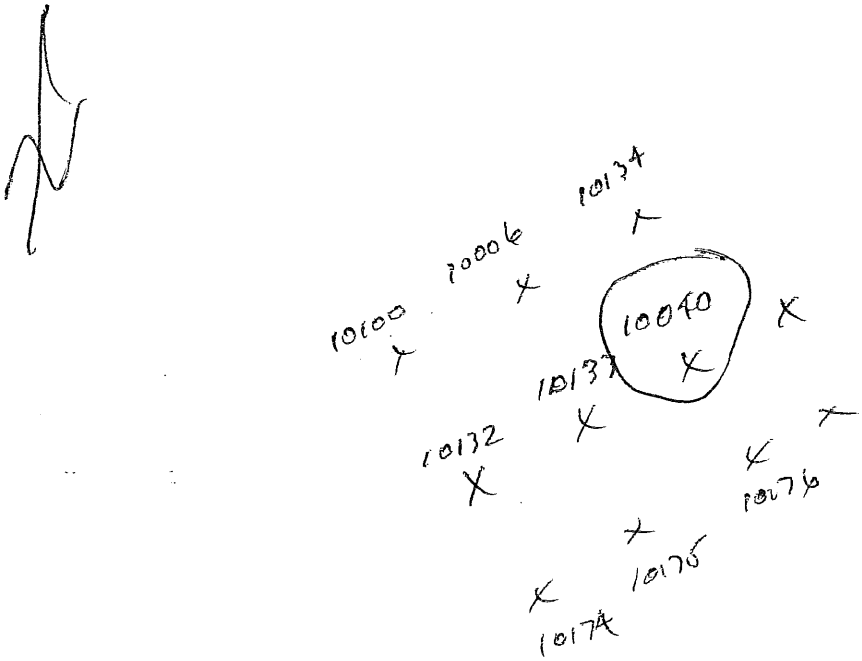
ERPIMS Values:

Sacode:

Lot Control#:

Comments: Began sampling at 2' bgs to be below the clay liner composition the dike. Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* Edward E. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10134**
Task: **PR-AUG09**
Sample Number: **PR0062**
Collection Date: 8-19-09
Sample Name: **PB-PR-10134-SO-PR0062**
Collection Time: ~~1428~~ EW 1304
Sampling Method: **DP**
Start Depth: ~~2'~~ EW 0'
Sample Type: **SB** *Sample Purpose:* **REG**
End Depth: ~~12'~~ EW 10'
Sampling Equip: Spoon Sampler, ziplock baggie, disposable gloves
Sample Matrix: **SOIL**

QC Partners:
(TB) — (ER) — (FB) —
Sample Team: EW

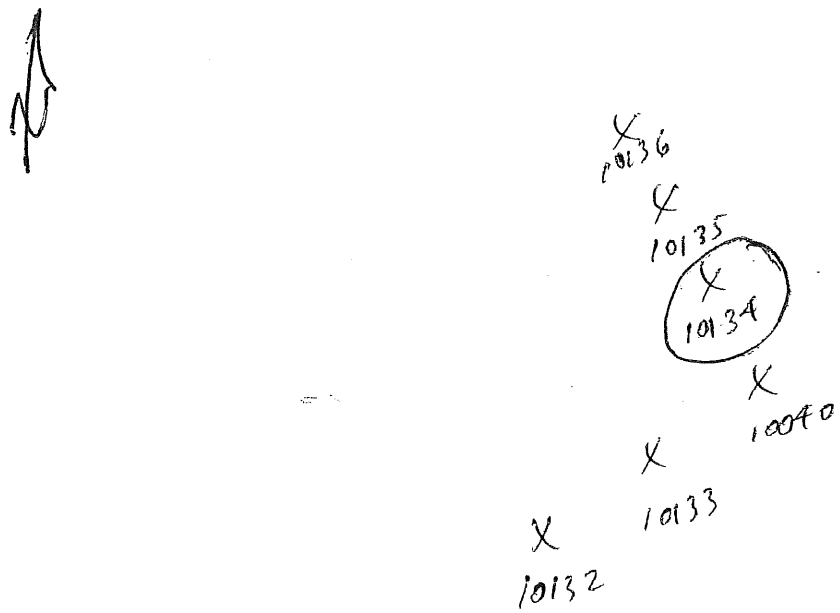
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: ~~Began sampling at 2' bgs to start below clay layer of dike.~~
Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: 8-19-09 *Reviewed BY / Date:* 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10135**
Sample Number: **PR0063**
Sample Name: **PB-PR-10135-SO-PR0063**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split Spoon Sampler, ziplock baggie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1328
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

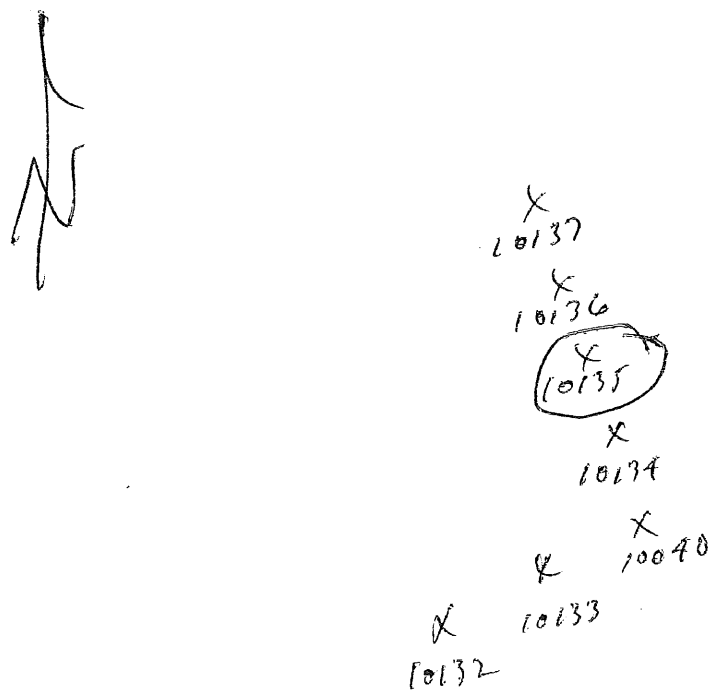
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* Edward W. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: AR-10136
Sample Number: PR-0072
Sample Name: PB-PR-10136-SO-PR0072
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Split spoon sampler, ziplock baggies, disposable gloves

Task: **SO DELINEATION**
Collection Date: 8-19-09
Collection Time: 1359
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

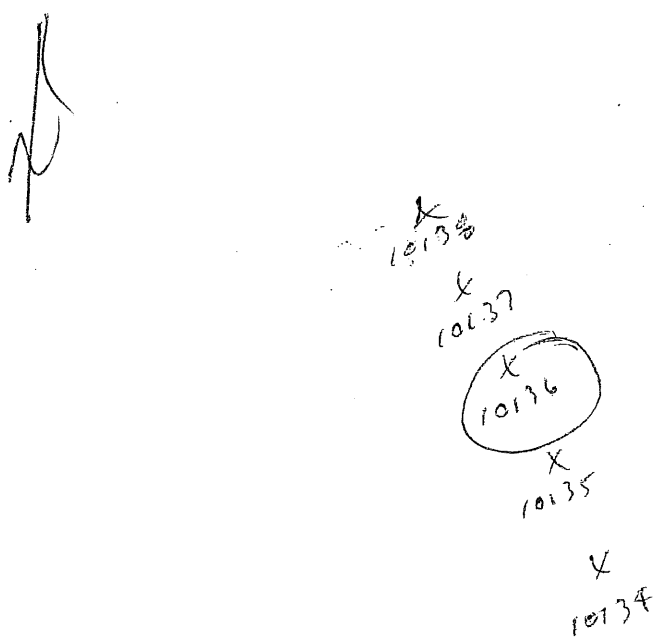
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* Edward A. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009ACCT

Location Code: **PR-10183**
Sample Number: **PR0065**
Sample Name: **PB-PR-10183-SO-PR0065**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Spl7spoon Samples, 2: plastic baggie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1427
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

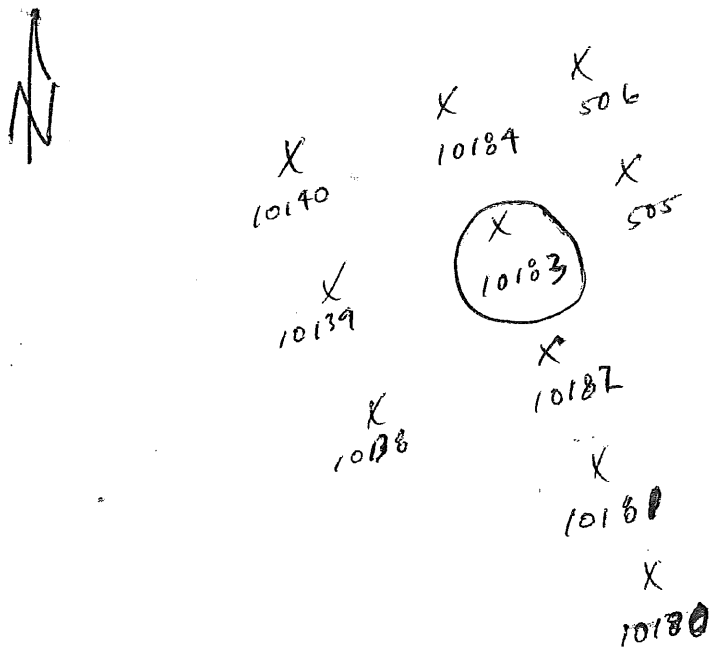
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs - Also collected FD + FS at this location -

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* Edward E. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-10183**
Sample Number: **PR0066**
Sample Name: **PB-PR-10183-SO-PR0066**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **FD**
Sampling Equip: Splitspoon Sampler, ziplock baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1427
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

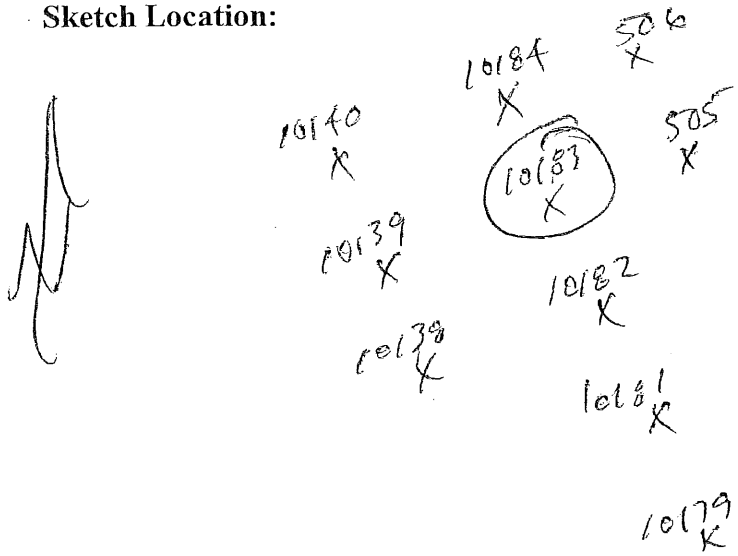
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs. Also collected regular FS samples at this location

Sketch Location:



Logged BY / Date: EW Clayton 8-19-09 *Reviewed BY / Date:* Edward E Nawar 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ~~ACT~~ TA EW

Location Code: **PR-10183**

Sample Number: **PR0067**

Sample Name: **PB-PR-10183-SO-PR0067**

Sampling Method: **DP**

Sample Type: **SB** *Sample Purpose:* **FS**

Sampling Equip: Spl 5 spoon sampler, 2 ziplock baggie, disposable gloves

QC Partners:

(TB) — (ER) — (FB) —

Task: **PR-AUG09**

Collection Date: 8-19-09

Collection Time: 1427

Start Depth: 0'

End Depth: 10

Sample Matrix: **SOIL**

Sample Team: EW

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

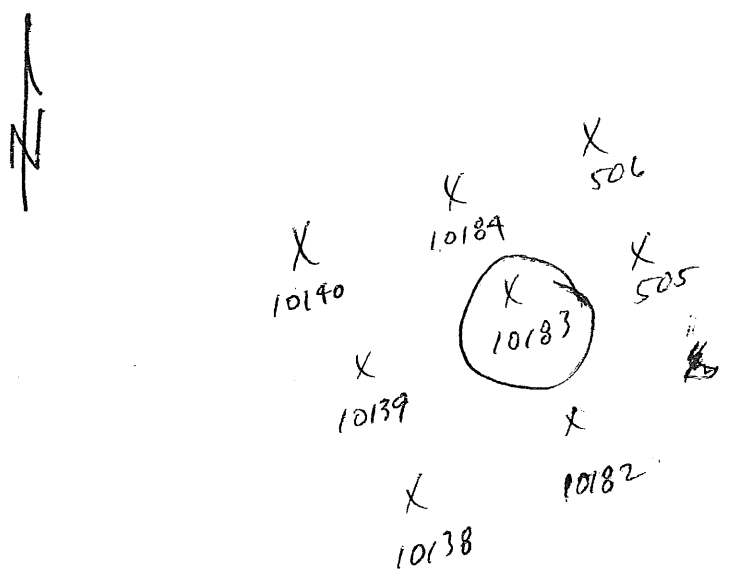
ERPIMS Values:

Sacode:

Lot Control#:

Comments: Direct push sample to 10' bgs. Also collected regular + FD samples at this location.

Sketch Location:



Logged BY / Date: [signature] 8-19-09

Reviewed BY / Date: [signature] 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-10181**
Sample Number: **PR0064**
Sample Name: **PB-PR-10181-SO-PR0064**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Split spoon Sample, ziplock baggies, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1451
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

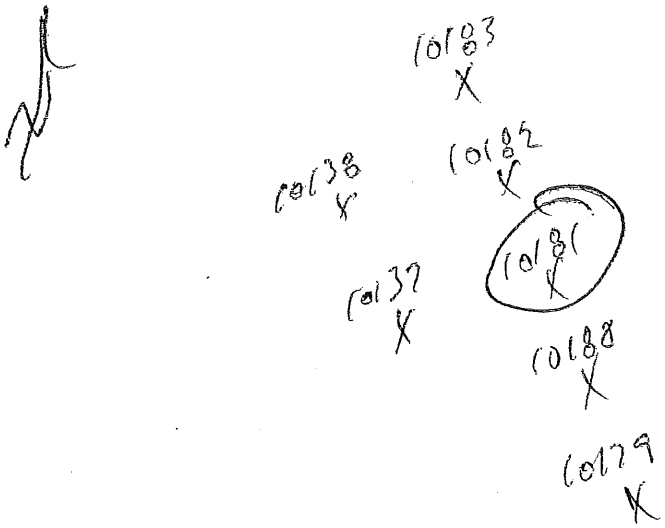
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: E. W. Weaver 8-19-09 *Reviewed BY / Date:* Edward W. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-10180**
Sample Number: **PR0071**
Sample Name: **PB-PR-10180-SO-PR0071**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Spoon sampler, ziplock bags, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1522
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

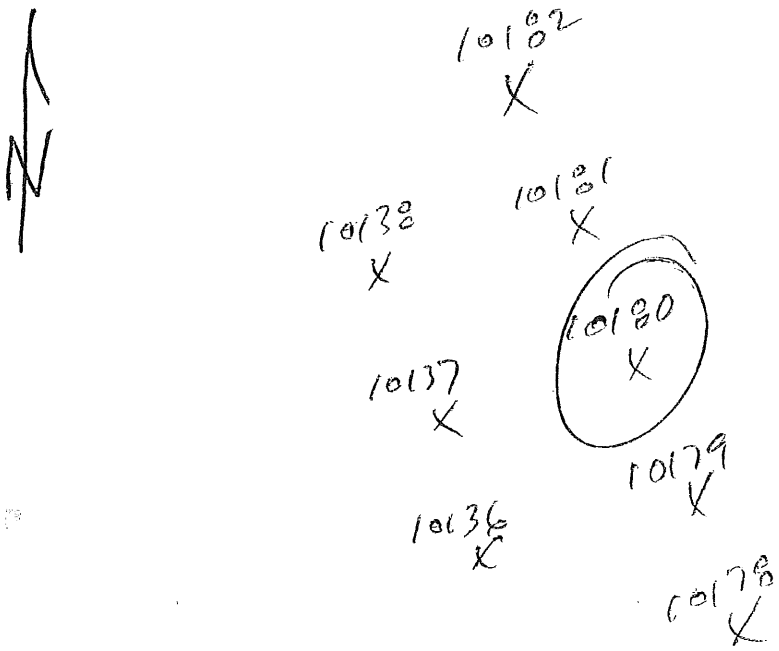
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs

Sketch Location:



Logged BY / Date: Eric W. Weaver 8-19-09 *Reviewed BY / Date:* Edward J. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: **PR-10179**
Sample Number: **PR0070**
Sample Name: **PB-PR-10179-SO-PR0070**
Sampling Method: **DP**
Sample Type: **SB** *Sample Purpose:* **REG**
Sampling Equip: Splitspoon Sampler, ziplock baggie, disposable gloves

Task: **PR-AUG09**
Collection Date: 8-19-09
Collection Time: 1553
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

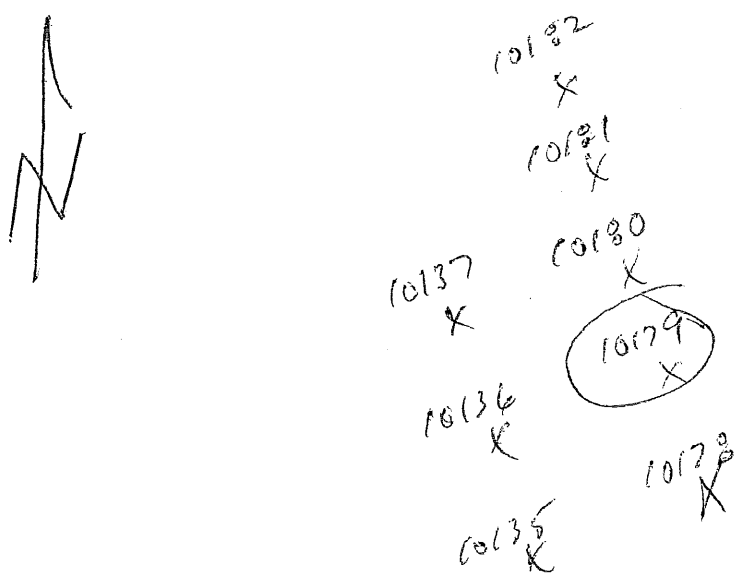
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: Eric W. Weaver 8-19-09 *Reviewed BY / Date:* Edward C. Weaver 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB082009 ACCT

Location Code: PR-10178A
Sample Number: PR-0073
Sample Name: PB-PR-10178-SO-PR0073
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Spl, 7 spoon, Sampler, Ziplock bagging, disposable gloves

Task: **SO DELINEATION**
Collection Date: 8-19-09
Collection Time: 1628
Start Depth: 0'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW

QC Partners:
(TB) — (ER) — (FB) —

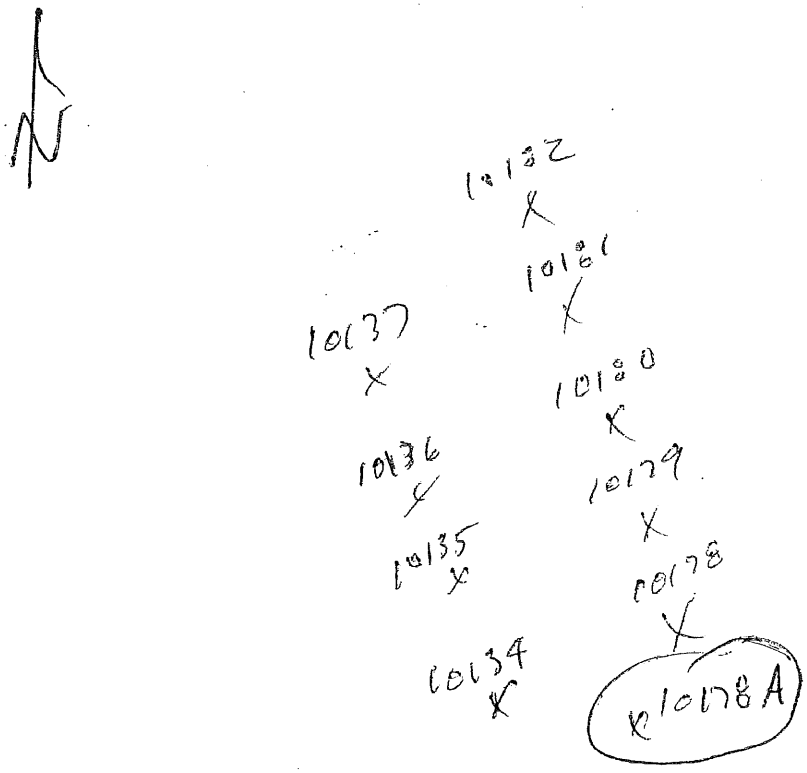
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Direct push sample to 10' bgs.

Sketch Location:



Logged BY / Date: [signature] 8-19-09 *Reviewed BY / Date:* [signature] 2-9-10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB102309ACCT

Location Code: PR00507
Sample Number: PR00507
Sample Name: PB-PR-00507-SO-PR00507
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: 6620 DT Geoprobe

Task: SO DELINEATION
Collection Date: 10-21-09
Collection Time: 1045
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW / BT

QC Partners:
(TB) —
(ER) —
(FB) —

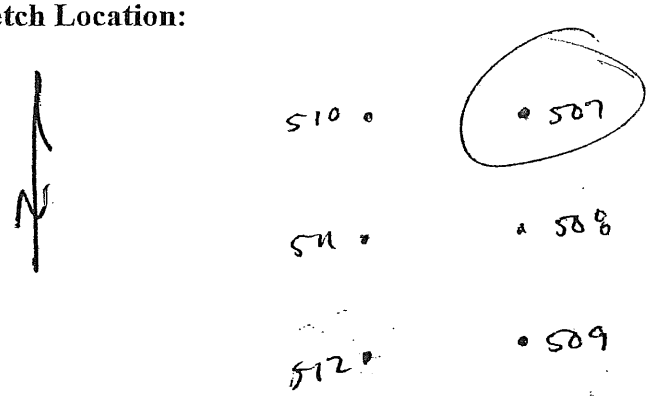
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample collected from 0'-10'

Sketch Location:



Logged BY / Date: E. Wilson 10-21-09 *Reviewed BY / Date:* [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB102309ACCT

Location Code: PR00508
Sample Number: PR 00508
Sample Name: PB-PR 00508-SO-PR00508
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: Geoprobe 6620 DT

Task: SO DELINEATION
Collection Date: 10-21-09
Collection Time: 1059
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT

QC Partners:
(TB) — (ER) — (FB) —

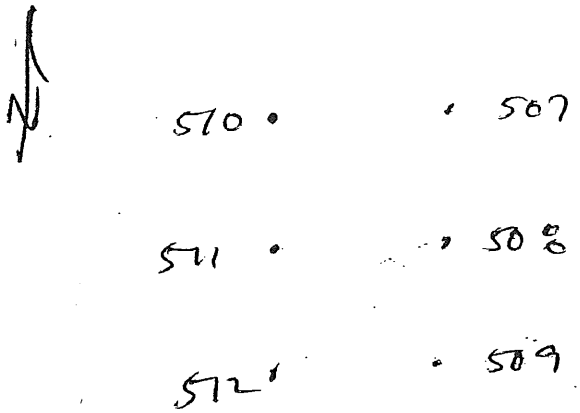
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample Collected from 0 to 10'

Sketch Location:



Logged BY / Date: [signature]
Reviewed BY / Date: [signature] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB102309ACCT

Location Code: PR-00509
Sample Number: PR00509
Sample Name: PB-PR-00509-SO-PR00509
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: 6620 DT Geoprobe

Task: SO DELINEATION
Collection Date: 10-21-09
Collection Time: 1114
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/BT

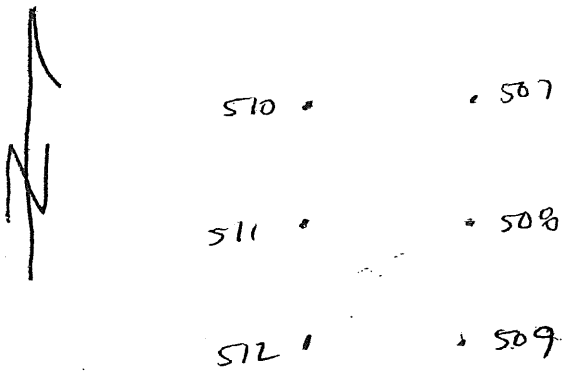
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample collected from 0-10'.

Sketch Location:



Logged BY / Date: EW Wenzel 10-21-09 *Reviewed BY / Date:* [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB102309ACCT

Location Code: PR-00512
Sample Number: PR00512
Sample Name: PB-PR-00512-SO-PR00512
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: 6620 DT Geoprobe

Task: SO DELINEATION
Collection Date: 10-21-09
Collection Time: 1153
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT

QC Partners:
(TB) (ER) (FB)

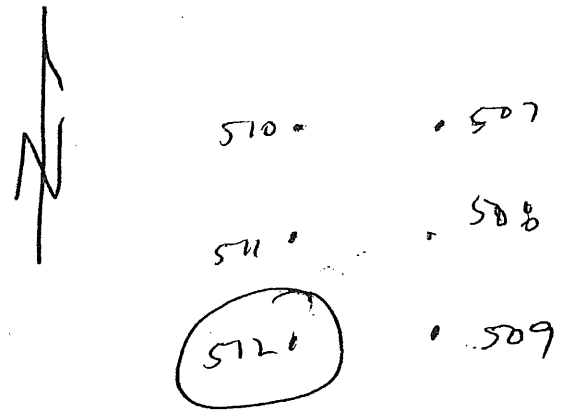
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample Collected from 0 to 10'

Sketch Location:



Logged BY / Date: EWeaver 10-21-09 *Reviewed BY / Date:* [illegible] 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB102309ACCT

Location Code: PR-00511
Sample Number: PR00511
Sample Name: PB-PR-00511-SO-PR00511
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: 6620 DT Geoprobe
QC Partners:
(TB) (ER) (FB)

Task: SO DELINEATION
Collection Date: 10-21-09
Collection Time: 1358
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT

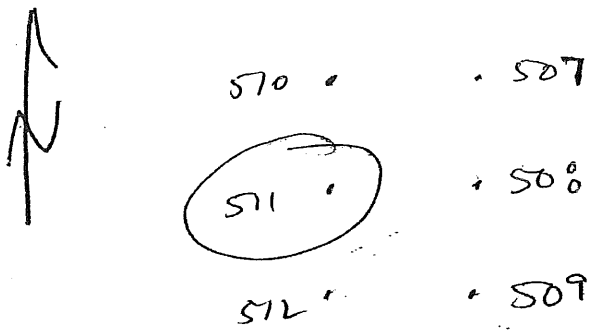
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample Collected from 0-10'

Sketch Location:



Logged BY / Date: EW 10-21-09 *Reviewed BY / Date:* MJ 3/10/16

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB102309ACCT

Location Code: PR-00510
Sample Number: PR-00510
Sample Name: PB-PR-00510-SO-PR00510
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: 6620 DT Geoprobe

Task: SO DELINEATION
Collection Date: 10-21-09
Collection Time: 1415
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT

QC Partners:
(TB) (ER) (FB)

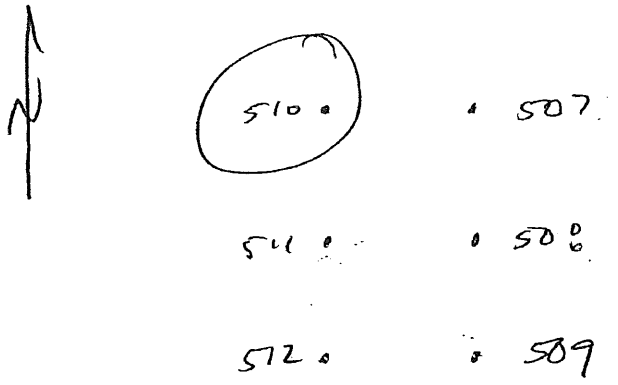
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample Collected from 0-10'.

Sketch Location:



Logged BY / Date: EW Weaver 10-21-09 *Reviewed BY / Date:* MGS 3/10/10

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PBH2009 ACCT

Location Code: PRRWP
Sample Number: PR-00513
Sample Name: PB-PR-0513-SO-PR00513
Sampling Method: GRAB
Sample Type: SO
Sample Purpose: REG
Sampling Equip: Bucket auger, ziplock baggie

Task: SO DELINEATION
Collection Date: 11-19-09
Collection Time: 0915
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT/JB

QC Partners:
(TB) —— (ER) —— (FB) ——

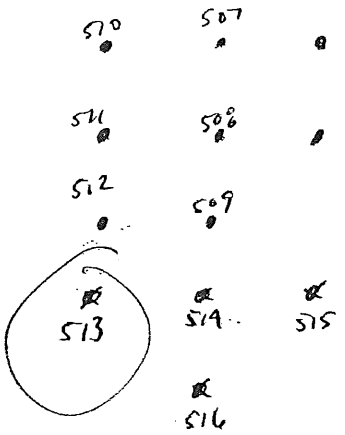
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Hand augered from ground surface to 10' bgs - homogenized soil in ziplock baggie, then collected sample

Sketch Location:



Logged BY / Date: [signature] 11/19/09 *Reviewed BY / Date:* [signature] 3/10/18

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 112009 Acct

Location Code: PRRWP
Sample Number: PR-00514
Sample Name: PB-PR-00514-SO-PR00514
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: Bucket auger, 2 ziplock baggie

Task: SO DELINEATION
Collection Date: 11-19-09
Collection Time: 1040
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT/JB

QC Partners:
(TB) — (ER) — (FB) —

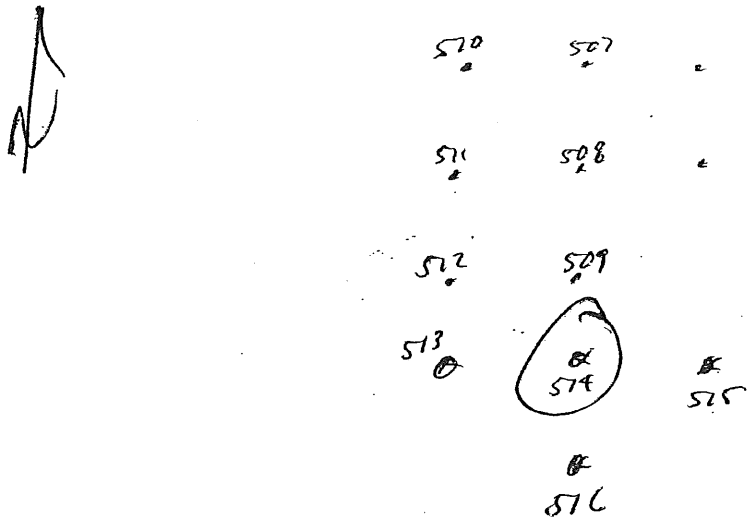
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Hand augered from ground surface to 10' bgs. Composited soil in 2 ziplock baggie, then collected sample

Sketch Location:



Logged BY / Date: [signature] 11/19/09 *Reviewed BY / Date:* [signature] 3/10/16

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB112009 Acct

Location Code: PRRWP
Sample Number: PR-00515
Sample Name: PB-PR-00515-SO-PR00515
Sampling Method: GRAB
Sample Type: SO *Sample Purpose:* REG
Sampling Equip: Bucket auger, ziplock baggie.
QC Partners:
(TB) — (ER) — (FB) —

Task: SO DELINEATION
Collection Date: 11-19-09
Collection Time: 1120
Start Depth: 0'
End Depth: 10'
Sample Matrix: SOIL
Sample Team: EW/BT/JB

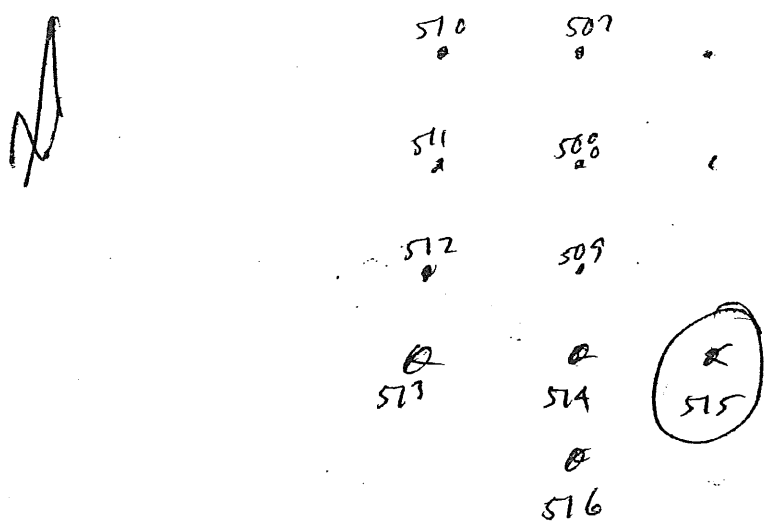
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Hand augured from ground surface to 10' bgs, Composited soil in ziplock baggie, then collected sample

Sketch Location:



Logged BY / Date: EWilliams 11-19-09 *Reviewed BY / Date:* 3/10/16

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Sample Collection Log

132458 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB112009 Acct

Location Code: PRRWP

Task: **SO DELINEATION**

Sample Number: PR-00516

Sample Name: PB-PR-00516-SO-PR00516

Collection Date: 11-20-09

Collection Time: 1215

Sampling Method: **GRAB**

Start Depth: 0'

Sample Type: **SO** *Sample Purpose:* **REG**

End Depth: 10'

Sampling Equip: Bucket auger, ziplock baggie.

Sample Matrix: **SOIL**

QC Partners:

(TB) — (ER) — (FB) —

Sample Team: EW/BT/JB

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

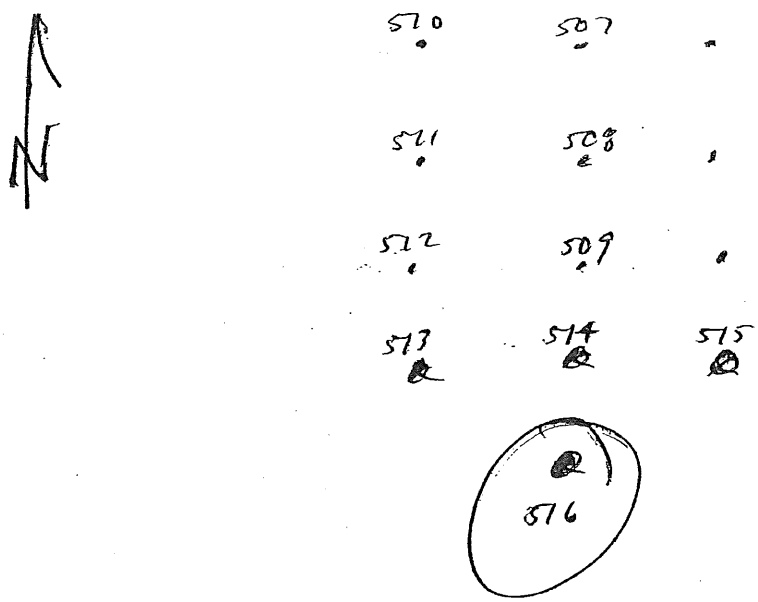
ERPIMS Values:

Sacode:

Lot Control#:

Comments: Hand augered from ground surface to 10' bgs, composited soil in a ziplock baggie then collected sample

Sketch Location:



Logged BY / Date: EW Newell 11-19-09 *Reviewed BY / Date:* [illegible] 3/10/10

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 ACCT

Location Code: **PRWP-SO020**
Sample Number: **PR0200**
Sample Name: **PRWP-SO020-SO-PR0200-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-8-10
Collection Time: 1320
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW / KB

QC Partners:
(TB) (ER) (FB)

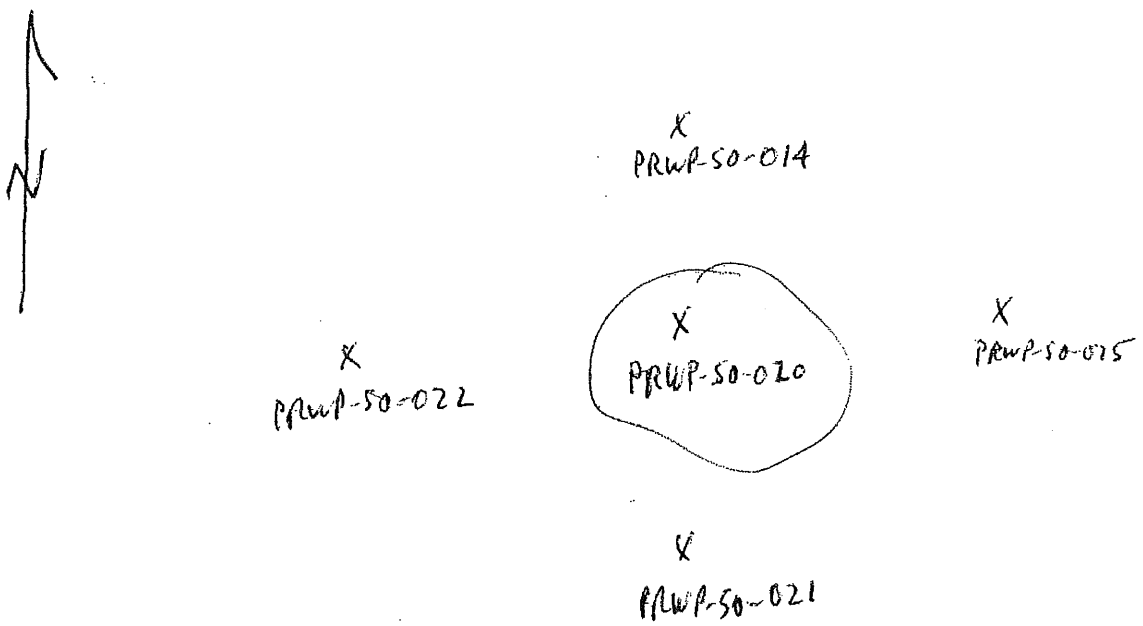
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-8-10 *Reviewed BY / Date:* Edward Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 11/6/10 ACCT

Location Code: **PRWP-SO022**
Sample Number: **PR0201**
Sample Name: **PRWP-SO022-SO-PR0201-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-8-10
Collection Time: 1410
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

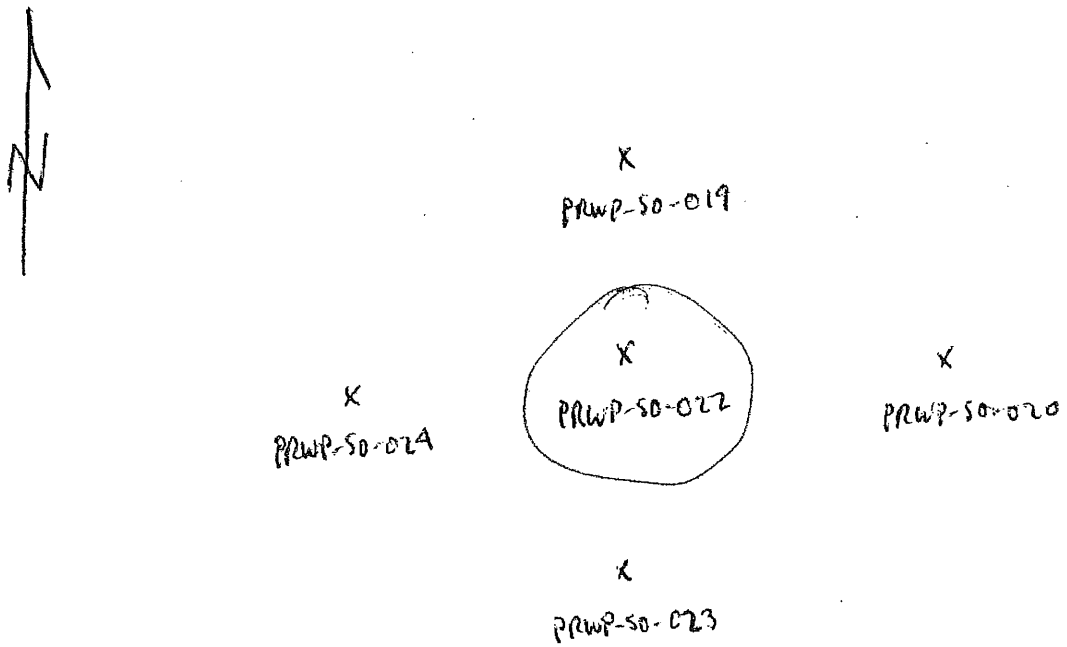
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'

Sketch Location:



Logged BY / Date: Eric W. Werner 11-8-10 *Reviewed BY / Date:* Edward [illegible] 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO024**
Sample Number: **PR0202**
Sample Name: **PRWP-SO024-SO-PR0202-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-8-10
Collection Time: 1445
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW / KB

QC Partners:
(TB) (ER) (FB)

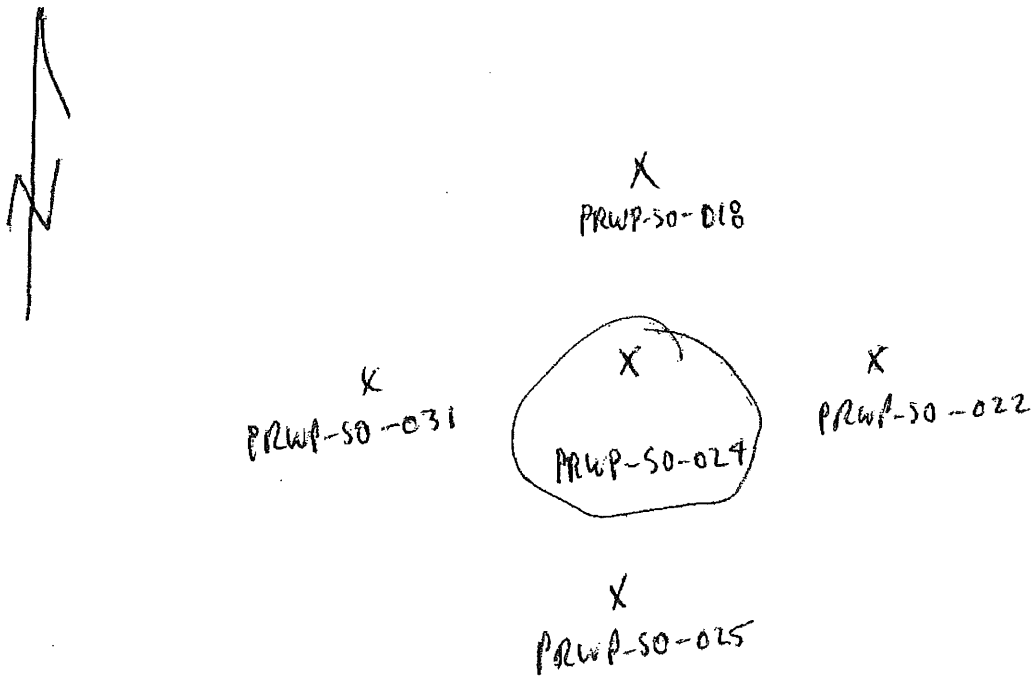
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-8-10 *Reviewed BY / Date:* Edward Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 Acct

Location Code: **PRWP-SO026**
Sample Number: **PR0203**
Sample Name: **PRWP-SO026-SO-PR0203-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1410
Start Depth: 1'
End Depth: 10
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

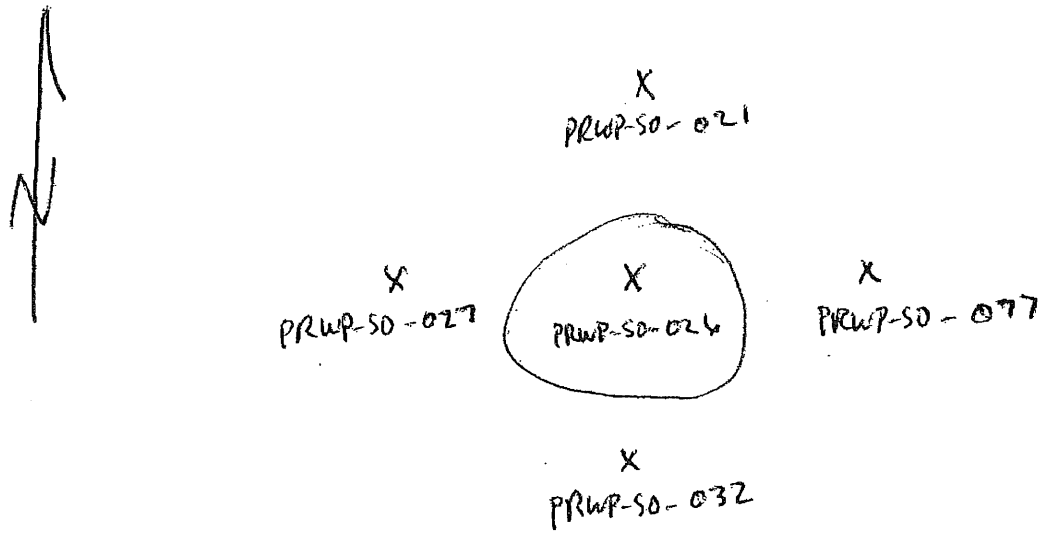
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'. MS and MSD (PR0203MS & PR0203MSD) also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-9-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Act

Location Code: **PRWP-SO026**
Sample Number: **PR0203MS**
Sample Name: **PRWP-SO026-SO-PR0203-MS**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **MS**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1410
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

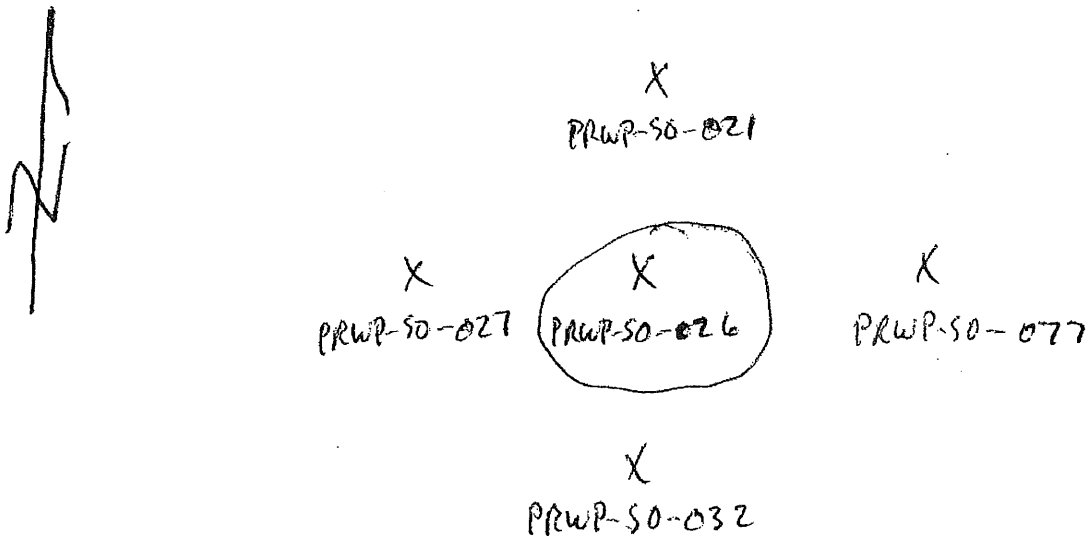
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'. Regular sample (PR0203) and MSD (PR0203MSD) were also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-9-10 *Reviewed BY / Date:* Edward K. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111W0 Acct

Location Code: **PRWP-SO026**
Sample Number: **PR0203MSD**
Sample Name: **PRWP-SO026-SO-PR0203-MSD**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **MSD**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1410
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

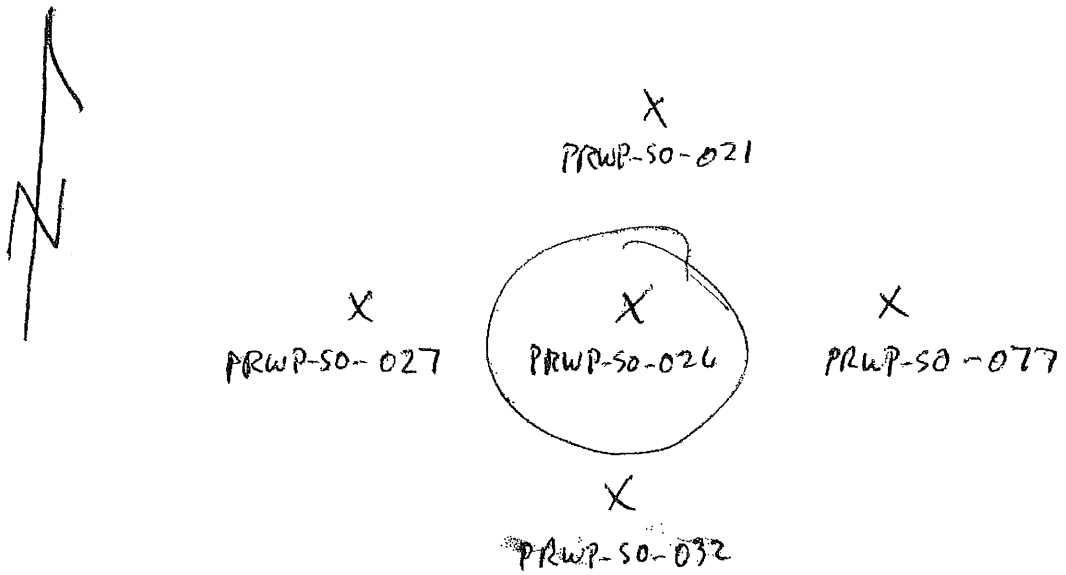
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0203) and MS (PR0203MS) also collected at this location.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-9-10 *Reviewed BY / Date:* Edward K. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO027**
Sample Number: **PR0204**
Sample Name: **PRWP-SO027-SO-PR0204-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1425
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

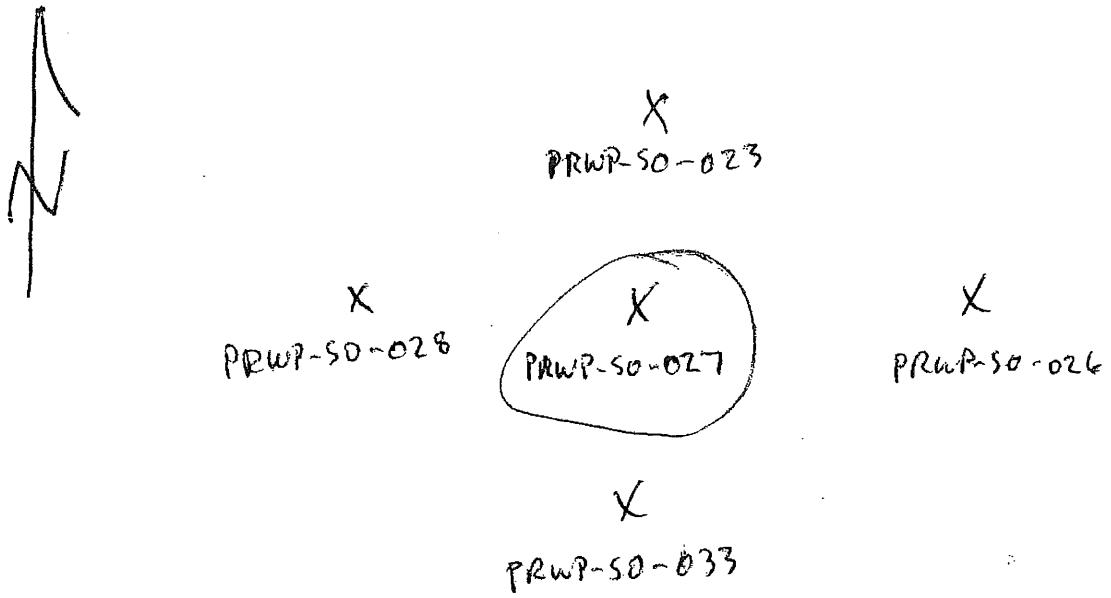
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-9-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 Acct

Location Code: **PRWP-SO028**
Sample Number: **PR0205**
Sample Name: **PRWP-SO028-SO-PR0205-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1440
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

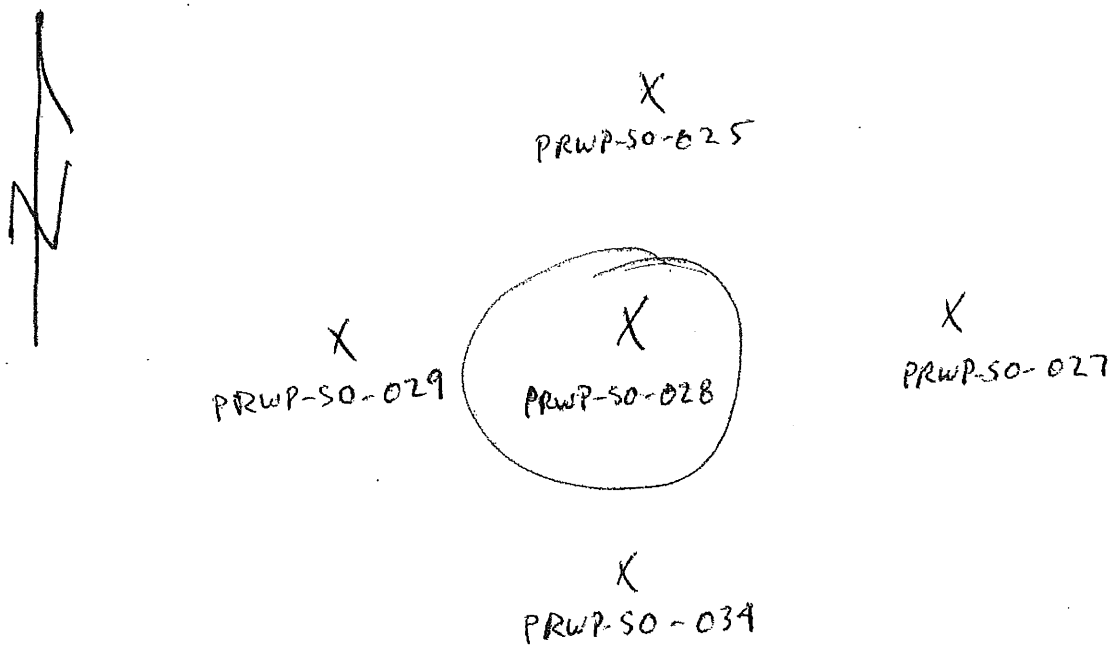
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E W Weaver 11-9-10 *Reviewed BY / Date:* Edward Weaver 4-27-11

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Sample Collection Log

132457 · PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO029**
Sample Number: **PR0206**
Sample Name: **PRWP-SO029-SO-PR0206-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1450
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

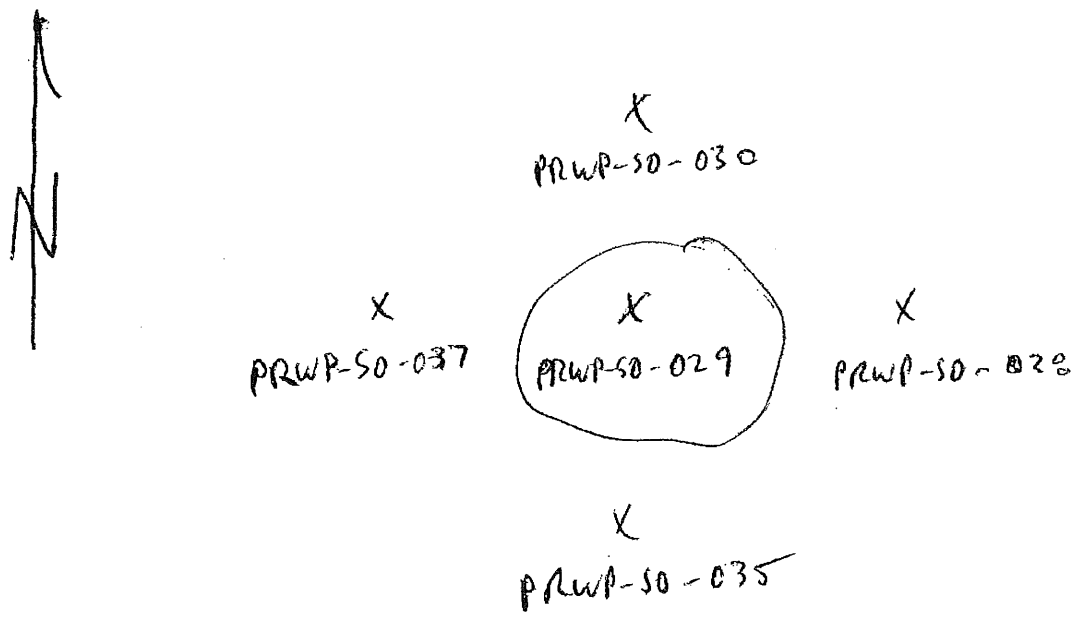
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-9-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 · PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO030**
Sample Number: **PR0207**
Sample Name: **PRWP-SO030-SO-PR0207-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1510
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

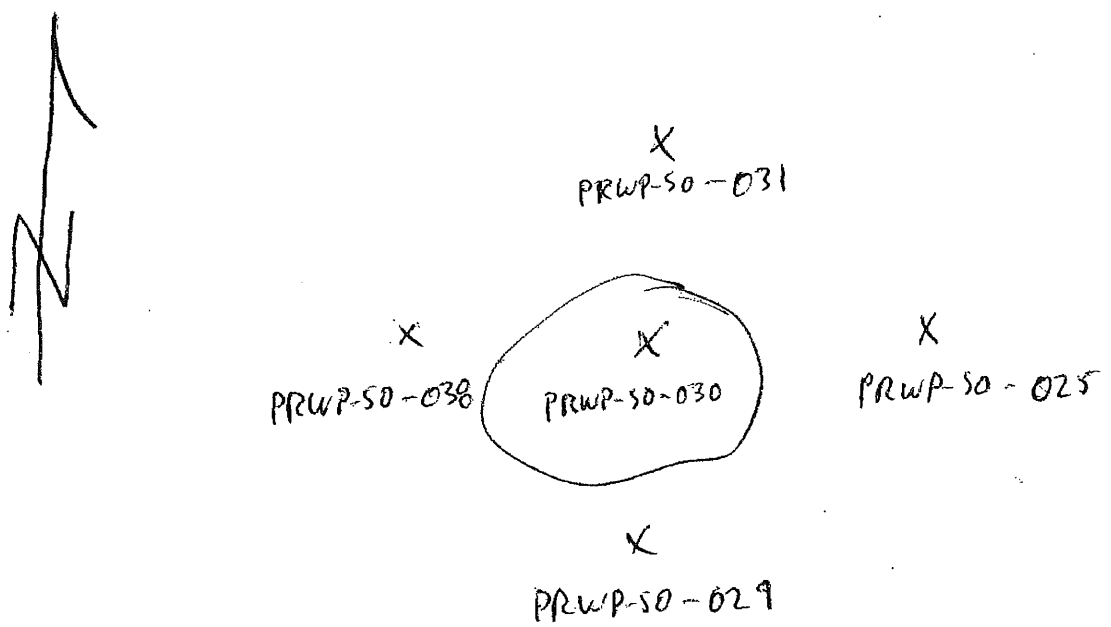
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-9-10 *Reviewed BY / Date:* Edward Schlemer 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO031**
Sample Number: **PR0208**
Sample Name: **PRWP-SO031-SO-PR0208-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geo probe

Task: **PR-NOV10**
Collection Date: 11-9-10
Collection Time: 1525
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

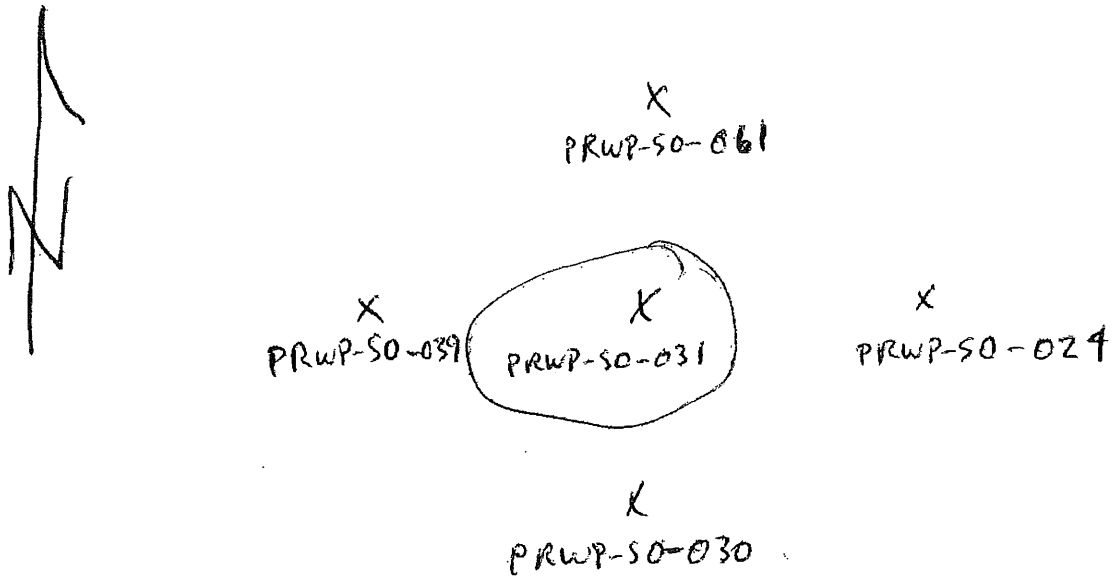
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-9-10 *Reviewed BY / Date:* Edward S. Kerr 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB M1610 Acct

Location Code: **PRWP-SO035**
Sample Number: **PR0209**
Sample Name: **PRWP-SO035-SO-PR0209-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 0920
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

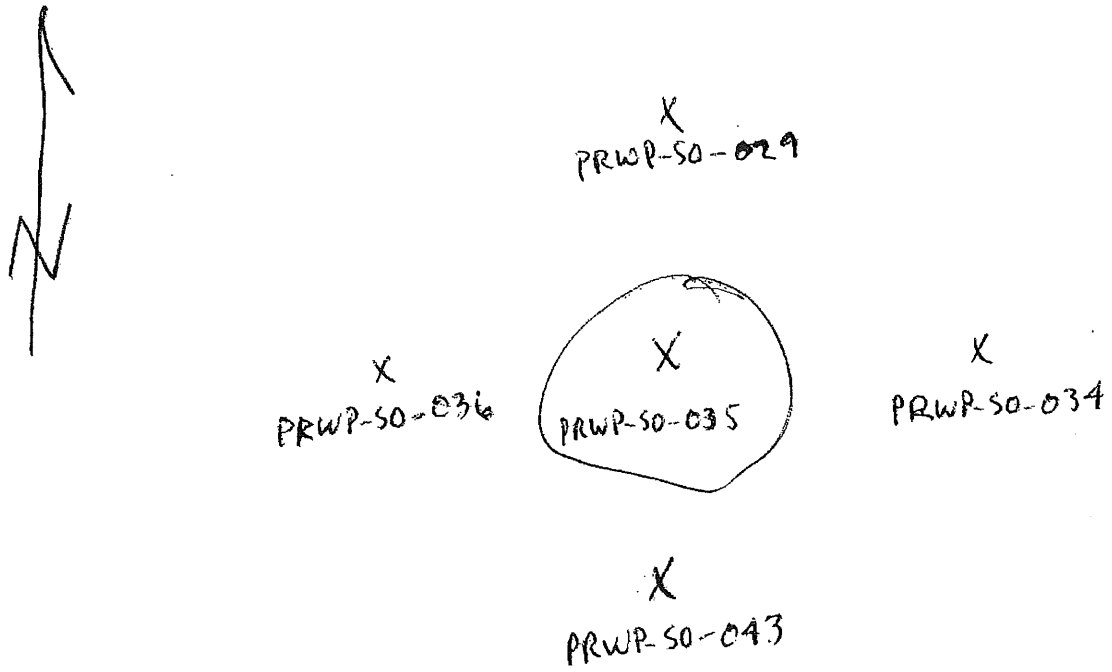
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. FD (PR0210) + FS (PR0211) also collected at this Location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-10-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 AccT

Location Code: **PRWP-SO035**
Sample Number: **PR0210**
Sample Name: **PRWP-SO035-SO-PR0210-FD**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **FD**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 0920
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

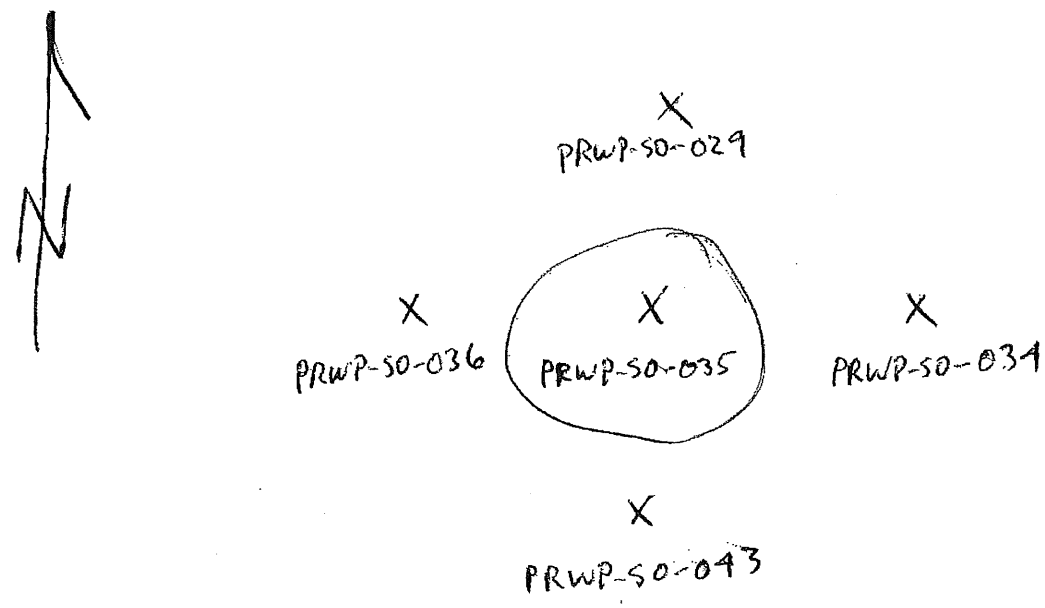
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0209) + FS (PR0211) also collected at this location.

Sketch Location:



Logged BY / Date: E W Weaver 11-10-10 *Reviewed BY / Date:* Edward W Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610TA

Location Code: **PRWP-SO035**
Sample Number: **PR0211**
Sample Name: **PRWP-SO035-SO-PR0211-FS**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **FS**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 0920
Start Depth: 1'
End Depth: 10
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

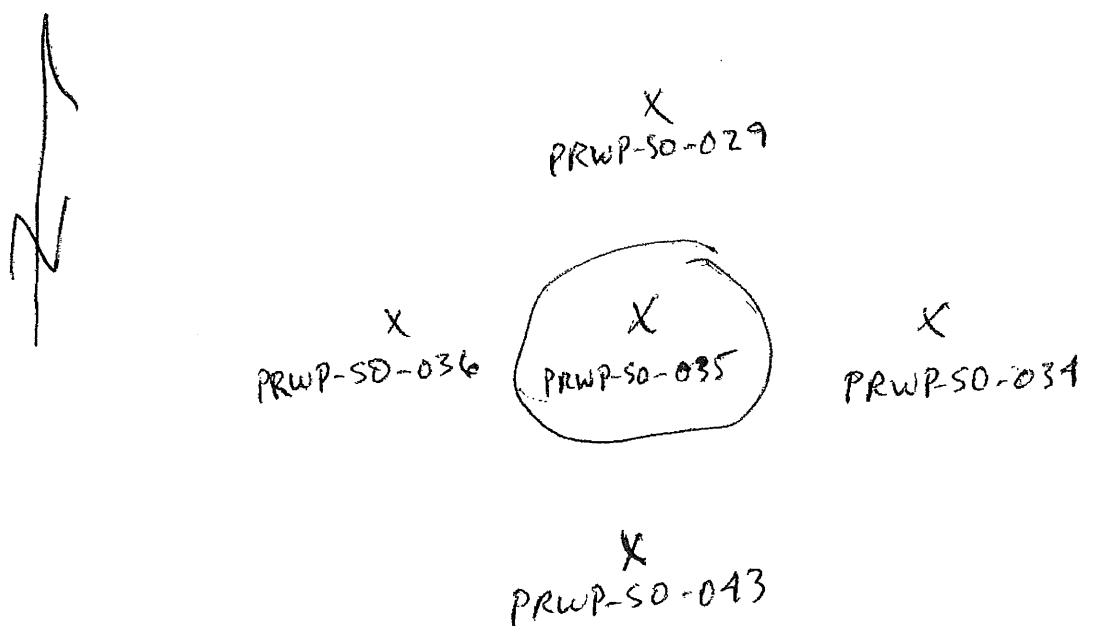
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0209) + FD (PR0210) also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Werner 11-10-10 *Reviewed BY / Date:* Edward E. Werner 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO040**
Sample Number: **PR0212**
Sample Name: **PRWP-SO040-SO-PR0212-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 1345
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) _____ (ER) _____ (FB) _____

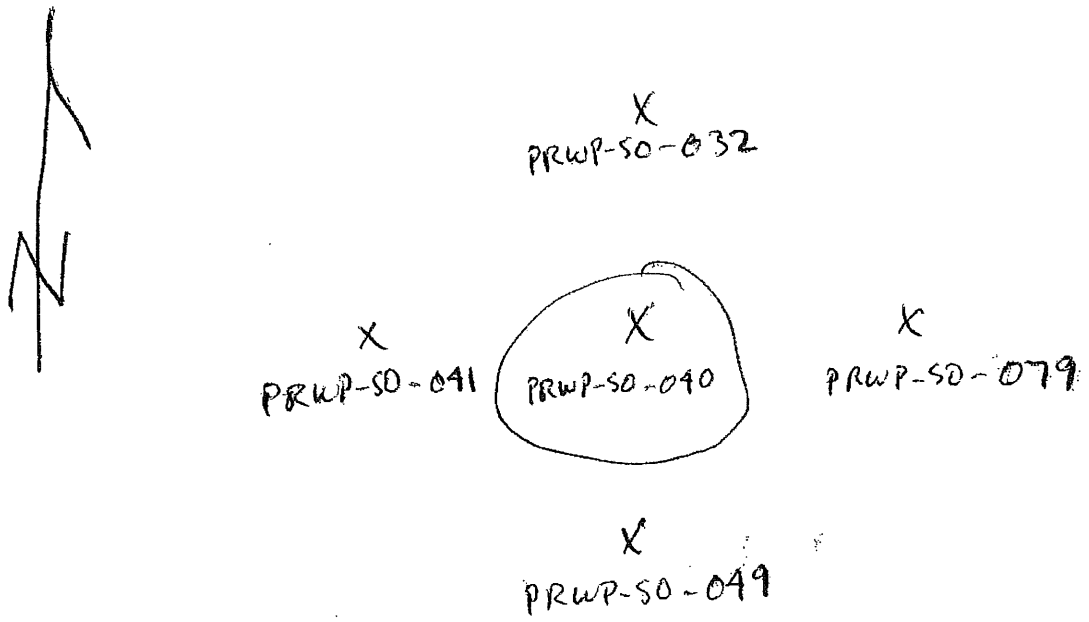
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-10-10 *Reviewed BY / Date:* Edward Wilson 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO041**
Sample Number: **PR0213**
Sample Name: **PRWP-SO041-SO-PR0213-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 1400
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

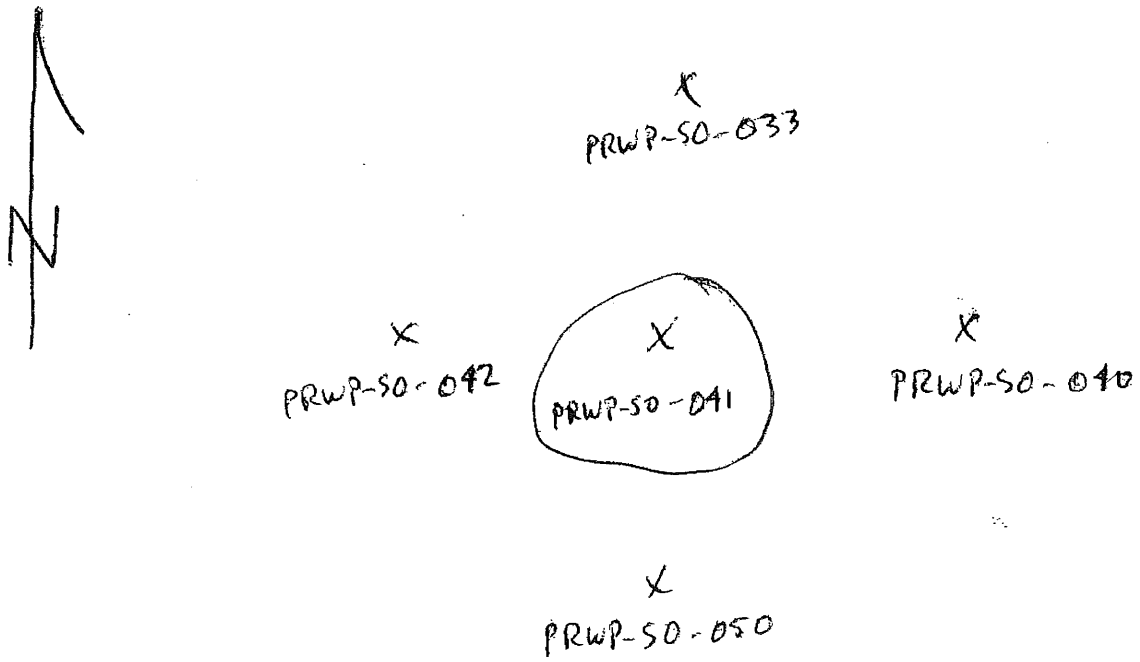
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-10-10 *Reviewed BY / Date:* Edward [illegible] 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO042**
Sample Number: **PR0214**
Sample Name: **PRWP-SO042-SO-PR0214-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 1415
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

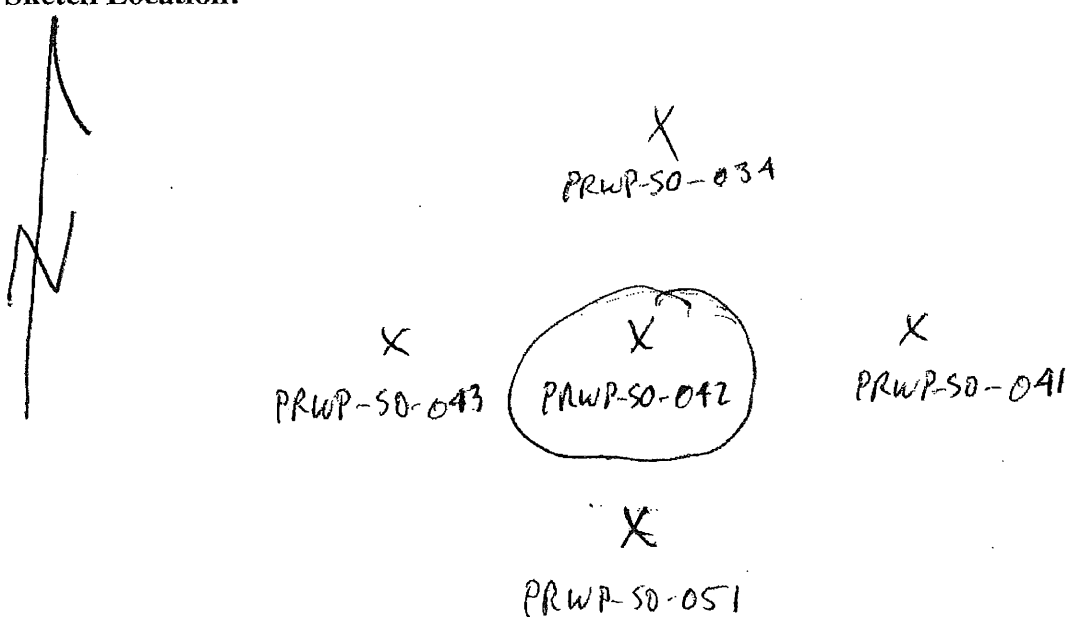
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'

Sketch Location:



Logged BY / Date: EW Weaver 11-10-10 *Reviewed BY / Date:* Edward S. Weaver 4-27-11

Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO043**
Sample Number: **PR0215**
Sample Name: **PRWP-SO043-SO-PR0215-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 1430
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW / KB

QC Partners:
(TB) (ER) (FB)

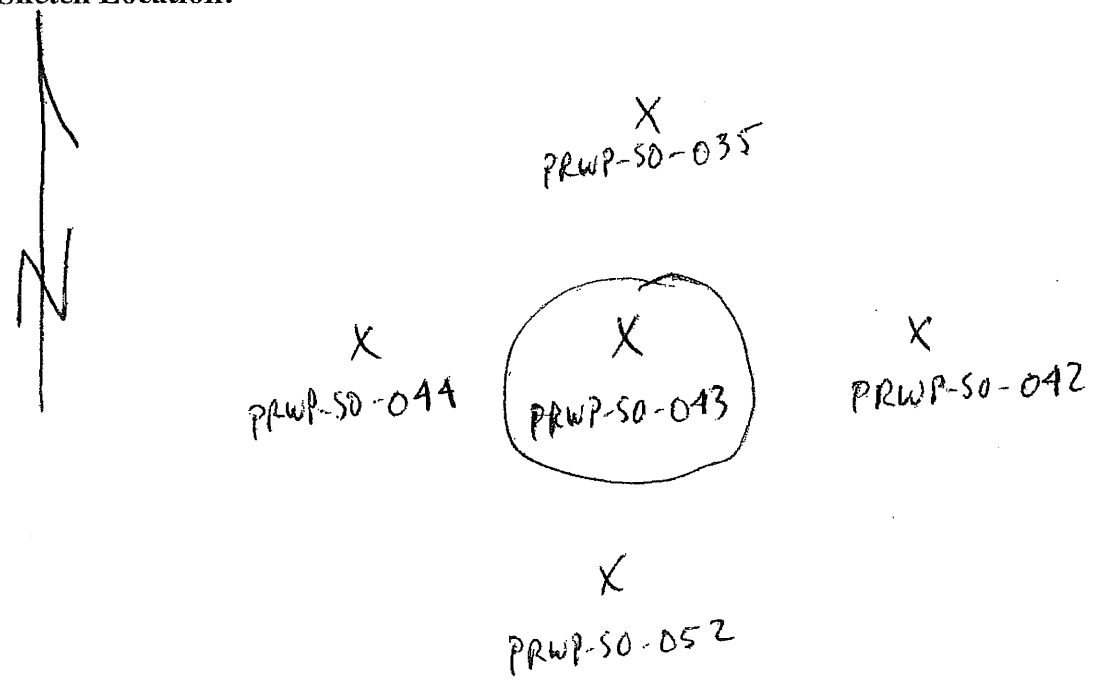
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-10-10 *Reviewed BY / Date:* Edward W. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 Acct

Location Code: **PRWP-SO044**
Sample Number: **PR0216**
Sample Name: **PRWP-SO044-SO-PR0216-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 1440
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

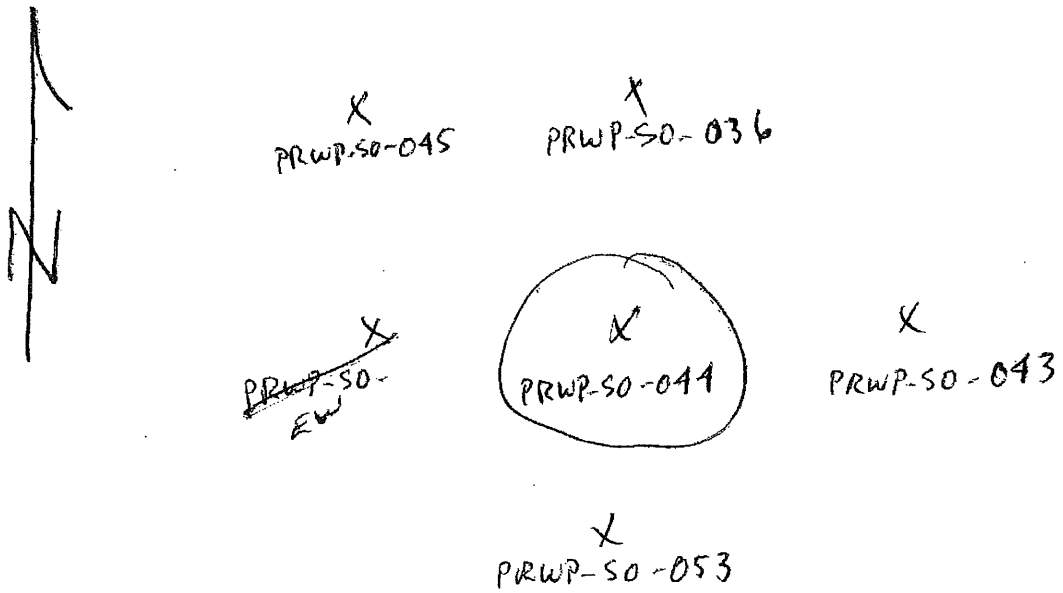
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-10-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO045**
Sample Number: **PR0217**
Sample Name: **PRWP-SO045-SO-PR0217-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-10-10
Collection Time: 1450
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

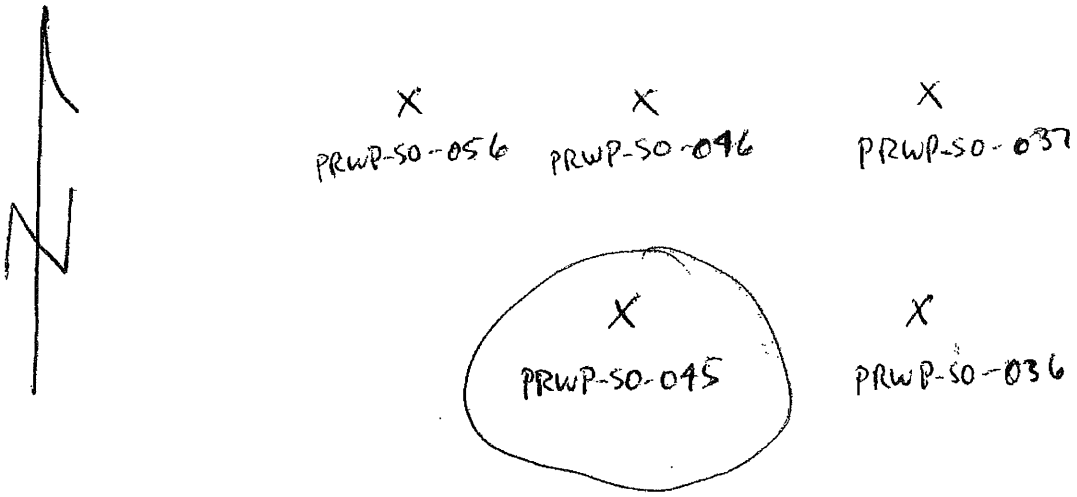
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'

Sketch Location:



Logged BY / Date: E. W. Weaver 11-10-10 *Reviewed BY / Date:* Edward Mann 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO053**
Sample Number: **PR0218**
Sample Name: **PRWP-SO053-SO-PR0218-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 0945
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

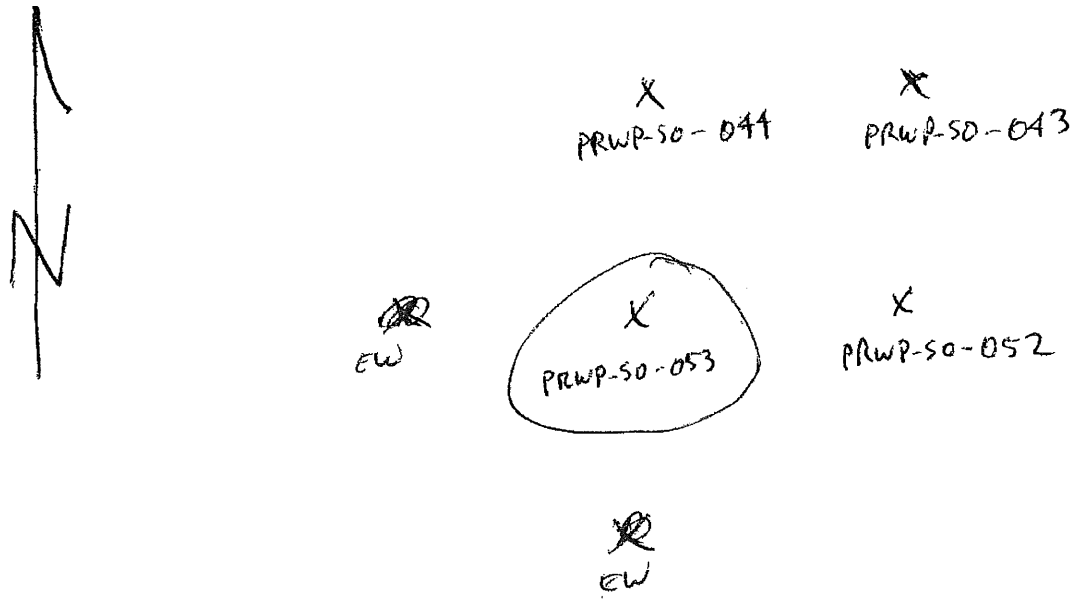
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-11-10 *Reviewed BY / Date:* Edward S. McCann 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO055**
Sample Number: **PR0219**
Sample Name: **PRWP-SO055-SO-PR0219-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1035
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

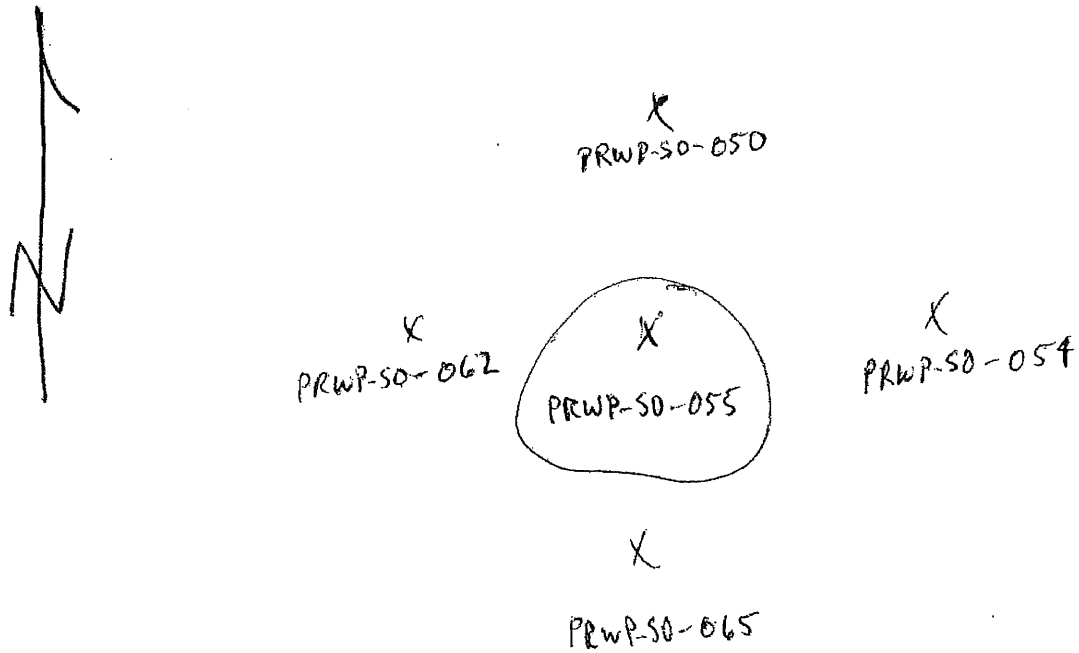
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. FD (PR0220) and FS (PR0221) also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-11-10

Reviewed BY / Date: Edward K. Weaver 4-27-11

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Sample Collection Log

132457 · PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO055**
Sample Number: **PR0220**
Sample Name: **PRWP-SO055-SO-PR0220-FD**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **FD**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1035
Start Depth: 1
End Depth: 10
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

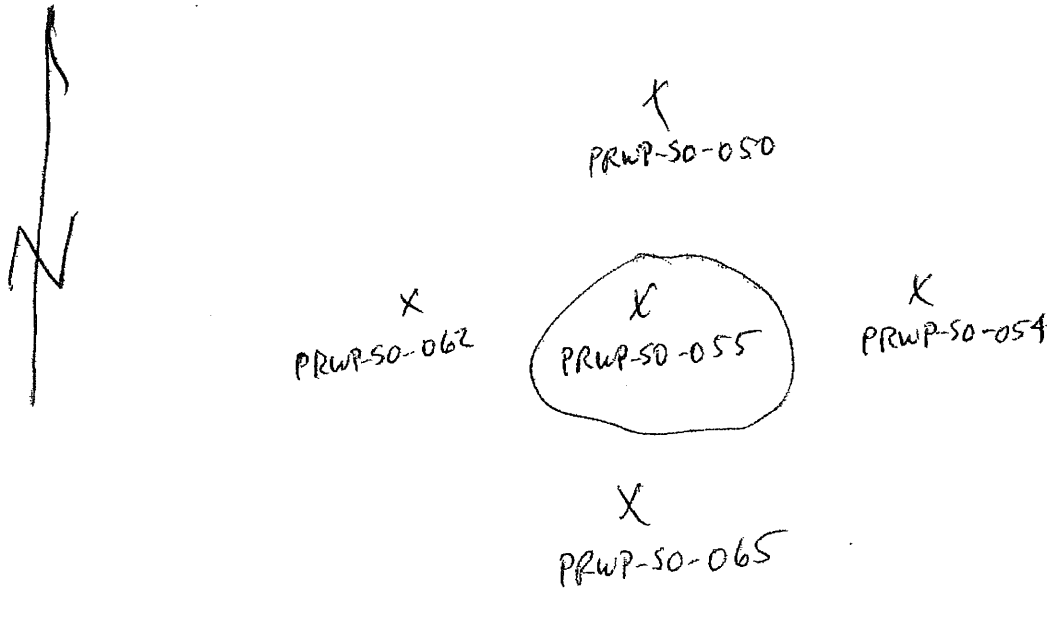
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0219) and QFS (PR0221) also collected at this location.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-11-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 TA

Location Code: **PRWP-SO055**
Sample Number: **PR0221**
Sample Name: **PRWP-SO055-SO-PR0221-FS**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **FS**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1035
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW / KB

QC Partners:
(TB) (ER) (FB)

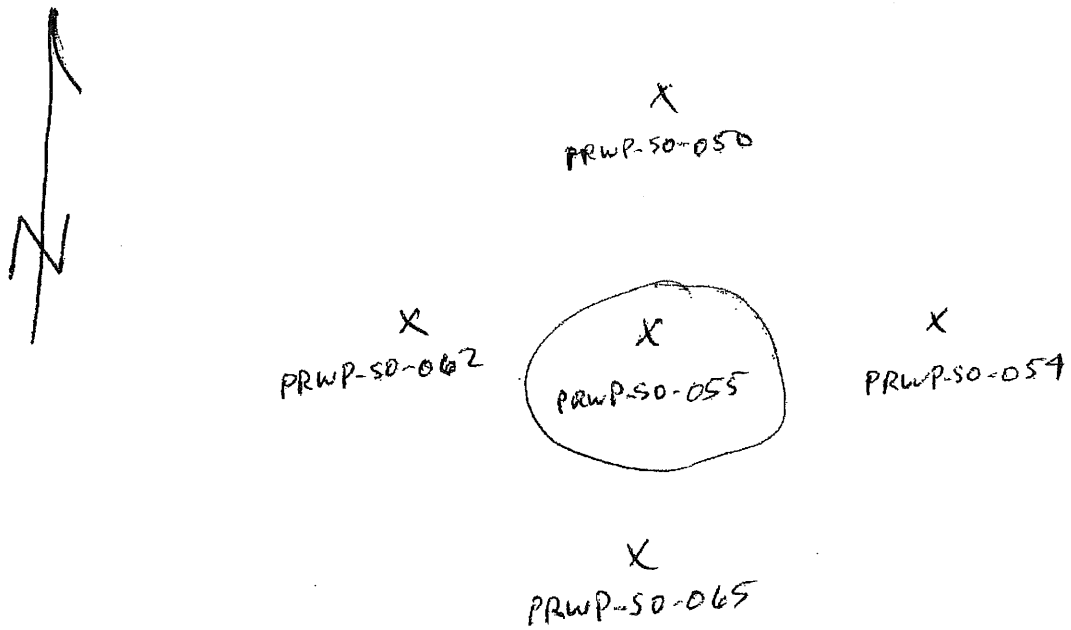
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0219) + FD (PR0220) also collected at this location.

Sketch Location:



Logged BY / Date: Erin W. Weaver 11-11-10 *Reviewed BY / Date:* Edward S. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO056**
Sample Number: **PR0222**
Sample Name: **PRWP-SO056-SO-PR0222-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1105
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

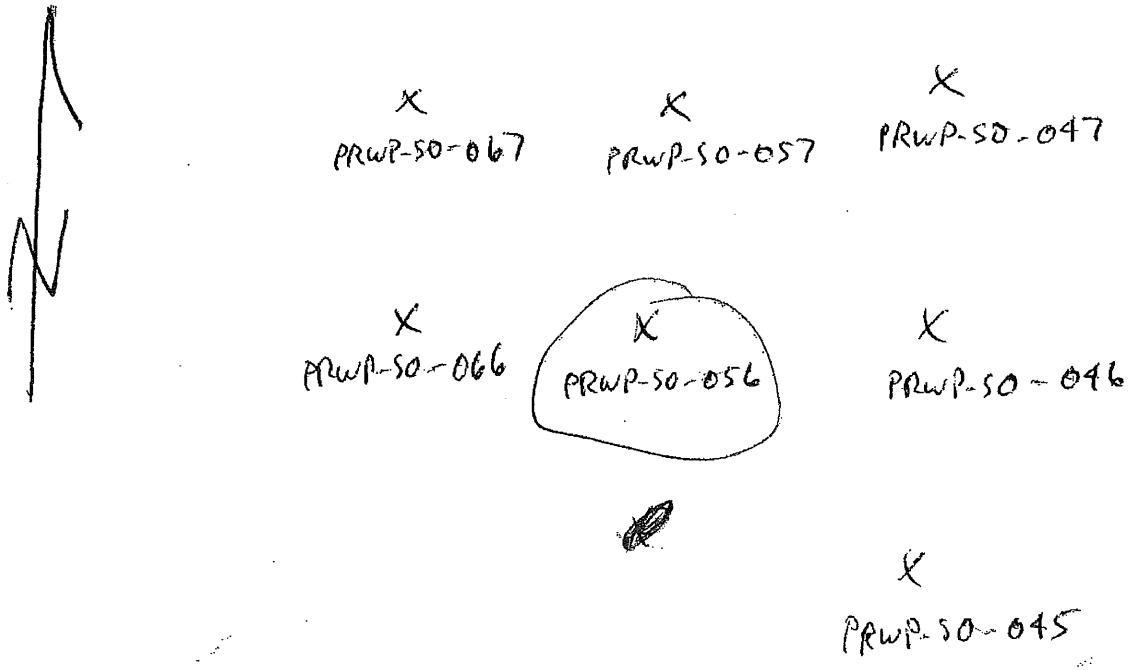
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite Sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-11-10 *Reviewed BY / Date:* Edward S. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO057**
Sample Number: **PR0223**
Sample Name: **PRWP-SO057-SO-PR0223-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe
QC Partners:
(TB) (ER) (FB)

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1125
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

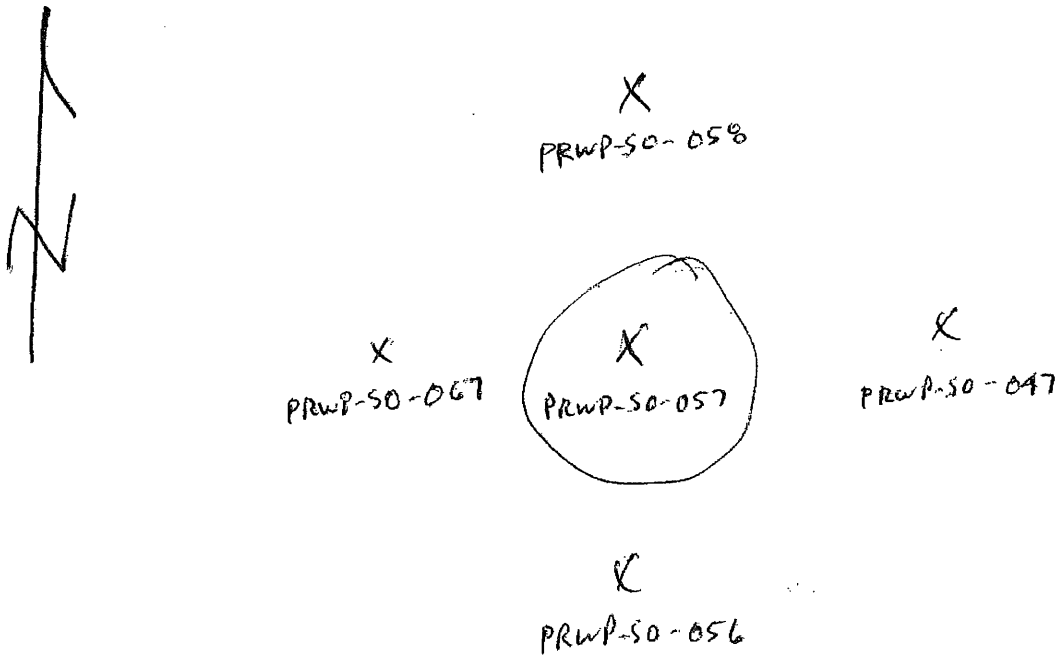
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-11-10 *Reviewed BY / Date:* Edward S. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO058**
Sample Number: **PR0224**
Sample Name: **PRWP-SO058-SO-PR0224-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1140
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

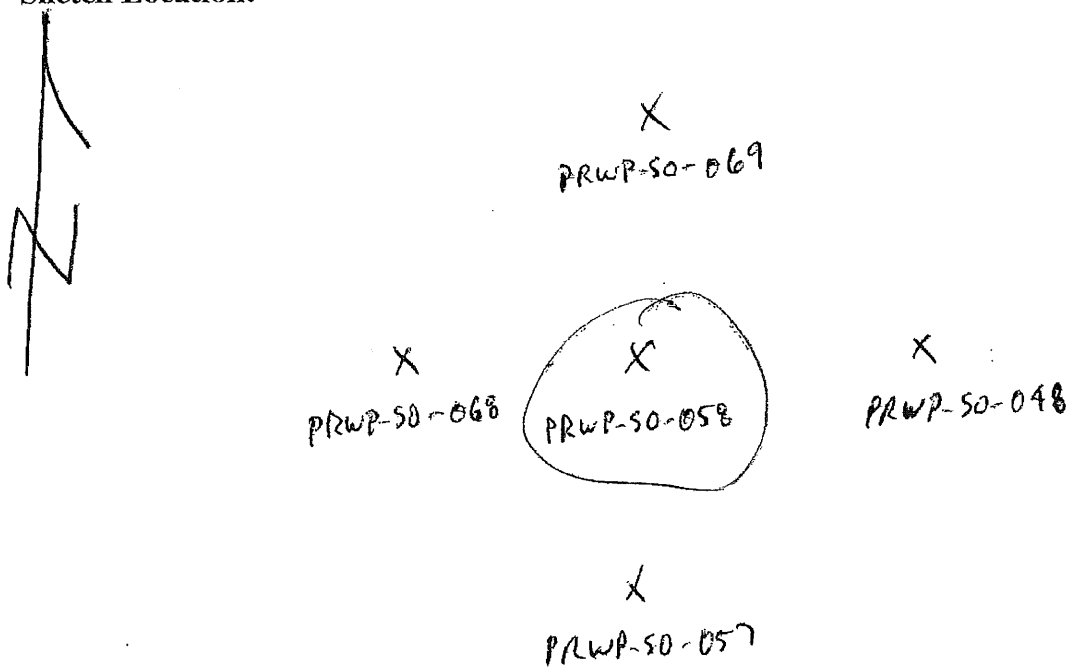
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* Edward O. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO061**
Sample Number: **PR0225**
Sample Name: **PRWP-SO061-SO-PR0225-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1350
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

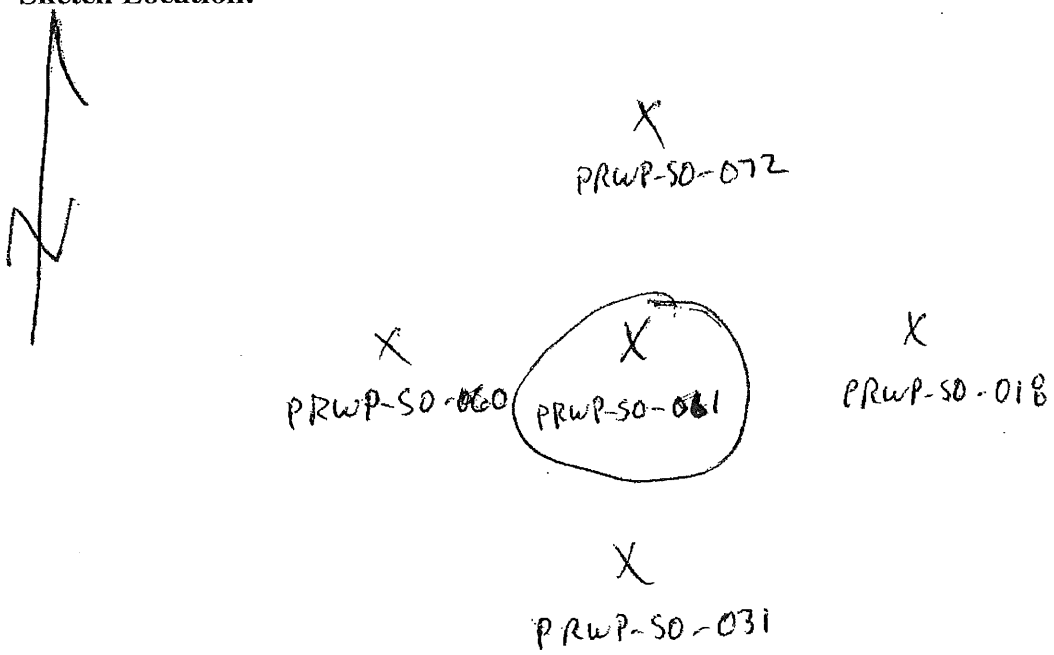
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-11-10 *Reviewed BY / Date:* Edward A. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO062**
Sample Number: **PR0226**
Sample Name: **PRWP-SO062-SO-PR0226-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1430
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

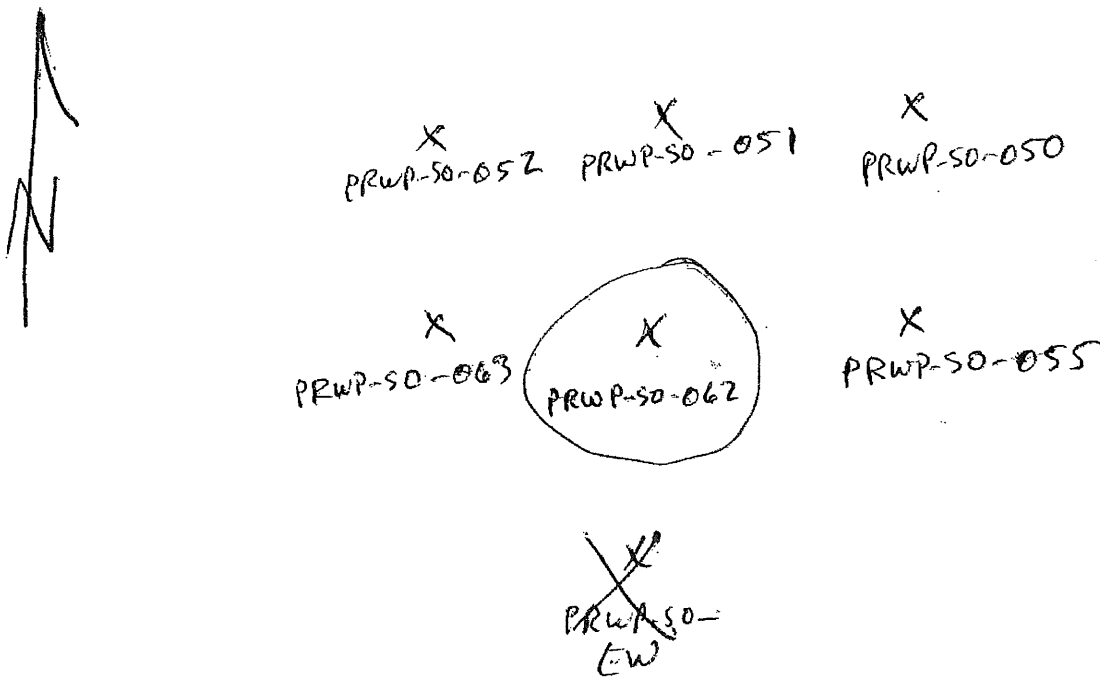
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-11-10 *Reviewed BY / Date:* Edward S. Meaner 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 AccT

Location Code: **PRWP-SO063**
Sample Number: **PR0227**
Sample Name: **PRWP-SO063-SO-PR0227-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1445
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

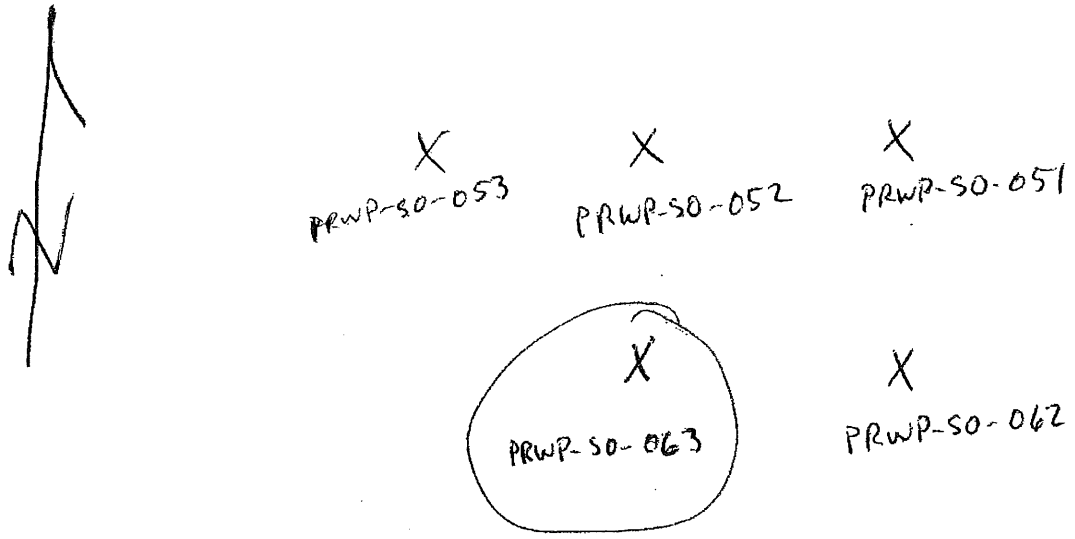
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-11-10 *Reviewed BY / Date:* Edward S. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO064**
Sample Number: **PR0228**
Sample Name: **PRWP-SO064-SO-PR0228-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1555
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

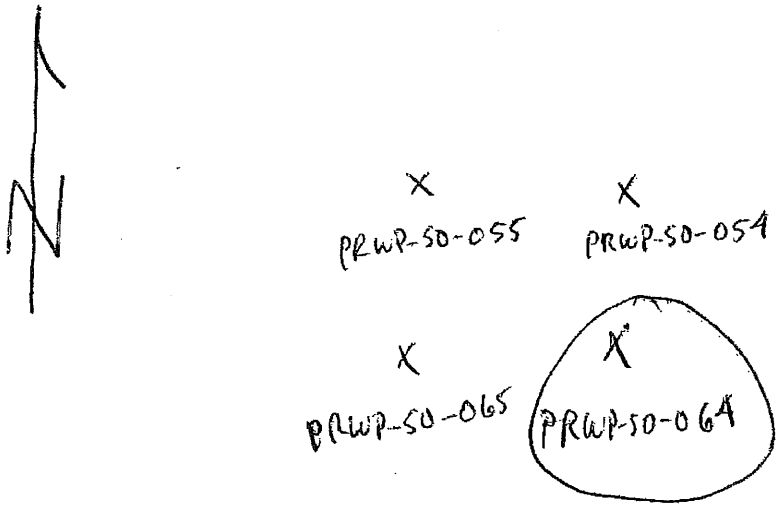
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-11-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO065**
Sample Number: **PR0229**
Sample Name: **PRWP-SO065-SO-PR0229-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1610
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

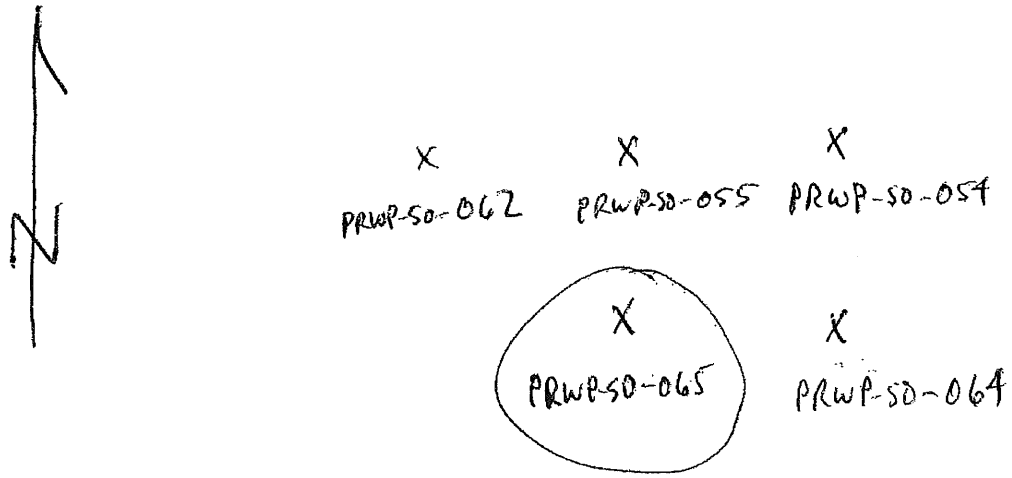
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-11-10 *Reviewed BY / Date:* Edward Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO066**
Sample Number: **PR0230**
Sample Name: **PRWP-SO066-SO-PR0230-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1645
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

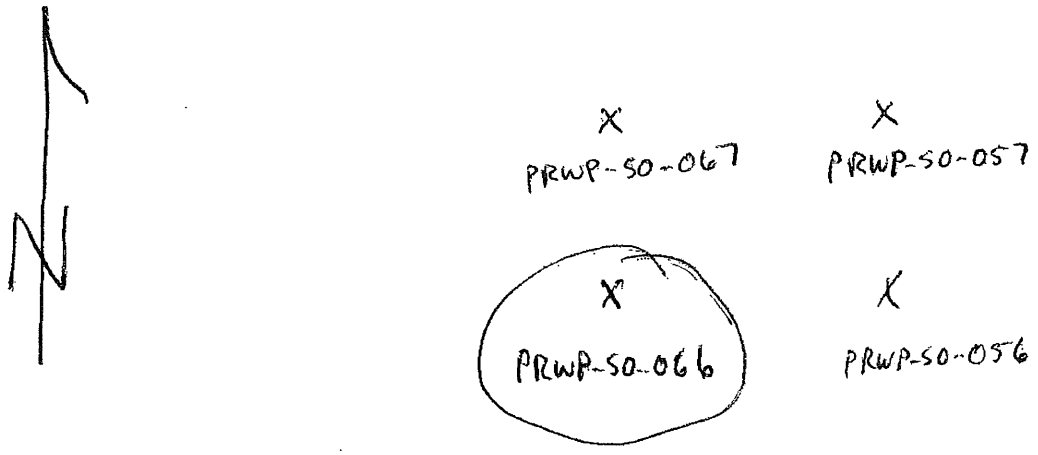
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-11-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO067**
Sample Number: **PR0231**
Sample Name: **PRWP-SO067-SO-PR0231-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-11-10
Collection Time: 1700
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

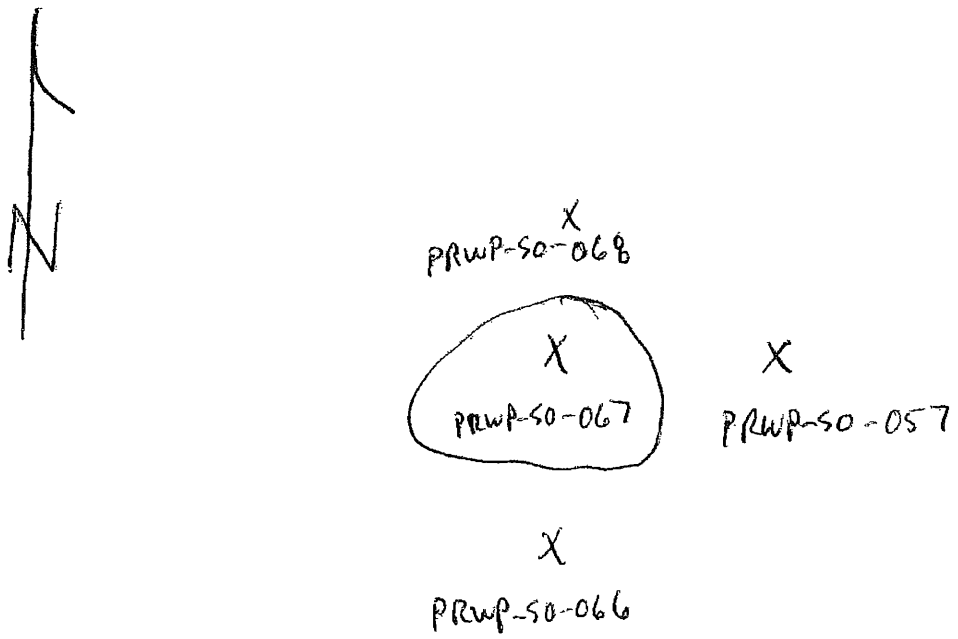
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-11-10 *Reviewed BY / Date:* Edward K. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO068**
Sample Number: **PR0232**
Sample Name: **PRWP-SO068-SO-PR0232-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 0935
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

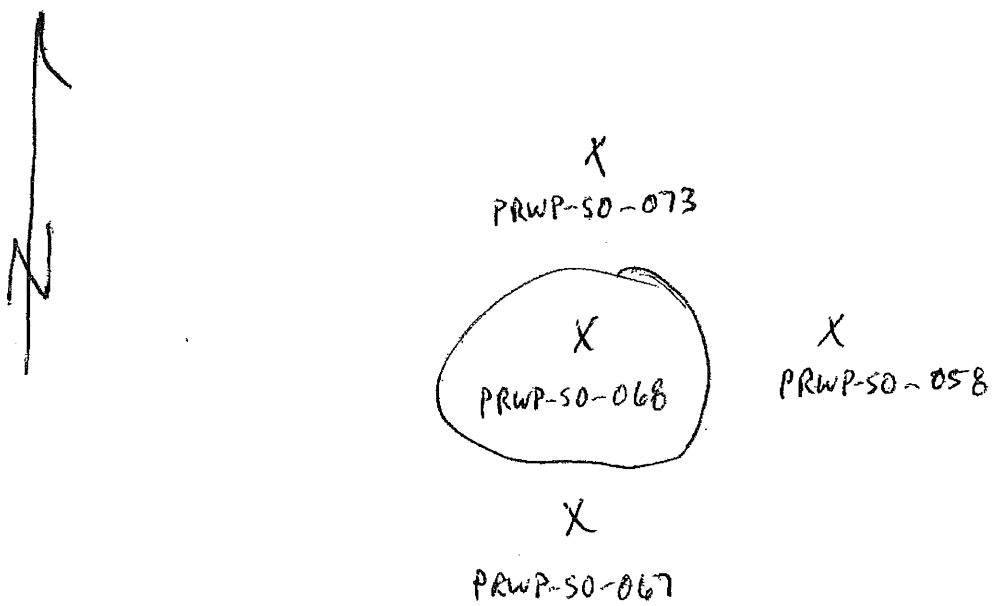
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-12-10 *Reviewed BY / Date:* Edward L. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO070**
Sample Number: **PR0233**
Sample Name: **PRWP-SO070-SO-PR0233-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1010
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW / KB

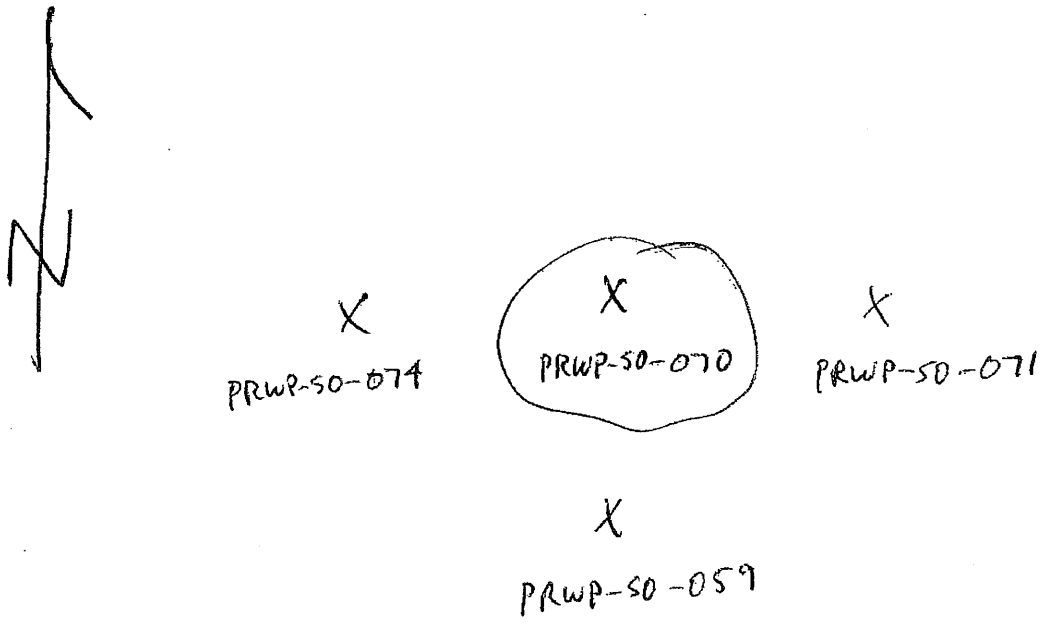
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W Weaver

Reviewed BY / Date: Edward B Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 ACCT

Location Code: **PRWP-SO071**
Sample Number: **PR0234**
Sample Name: **PRWP-SO071-SO-PR0234-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1020
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

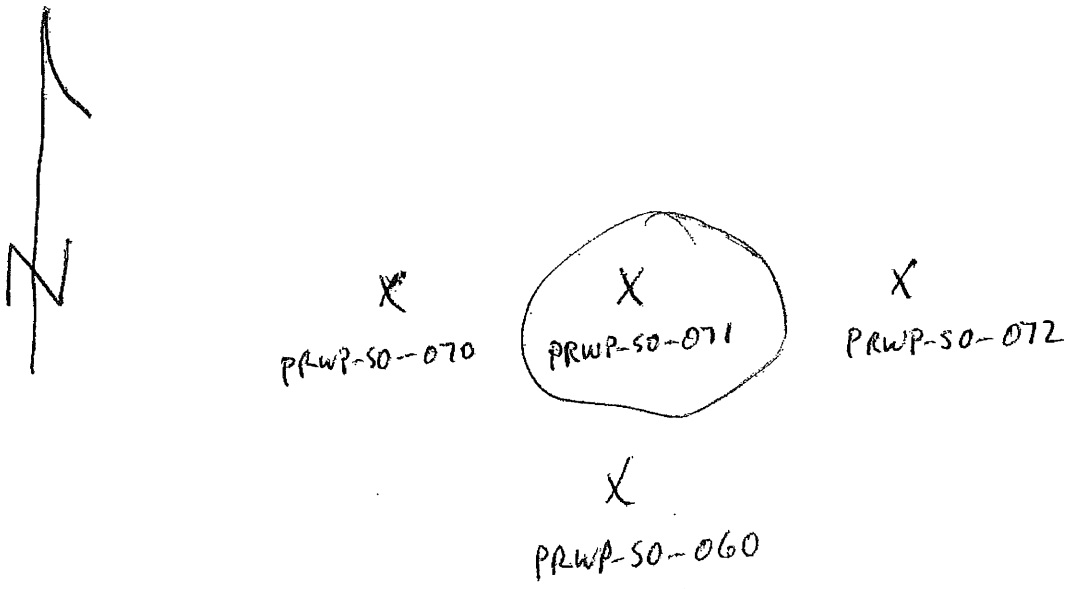
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-12-10 *Reviewed BY / Date:* Edward Graham 4-27-11

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Sample Collection Log

132457 · PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 AccT

Location Code: **PRWP-SO072**
Sample Number: **PR0235**
Sample Name: **PRWP-SO072-SO-PR0235-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1030
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

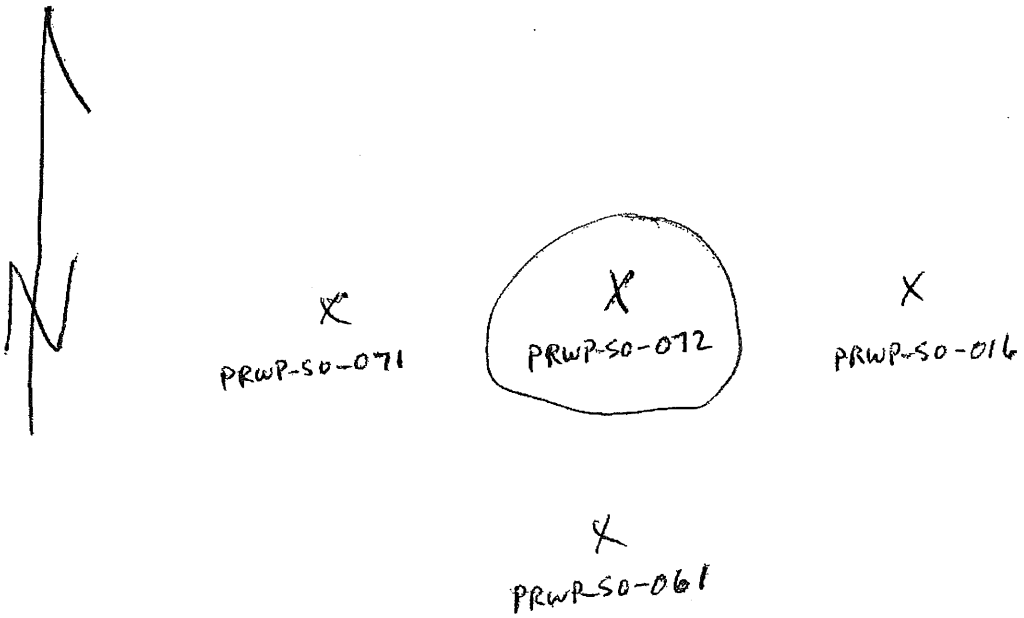
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. MS (PR0235MS) and MSD (PR0235MSD) also collected at this location.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-12-10 *Reviewed BY / Date:* Edward [illegible] 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 Acct

Location Code: **PRWP-SO072**
Sample Number: **PR0235MS**
Sample Name: **PRWP-SO072-SO-PR0235-MS**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **MS**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1030
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

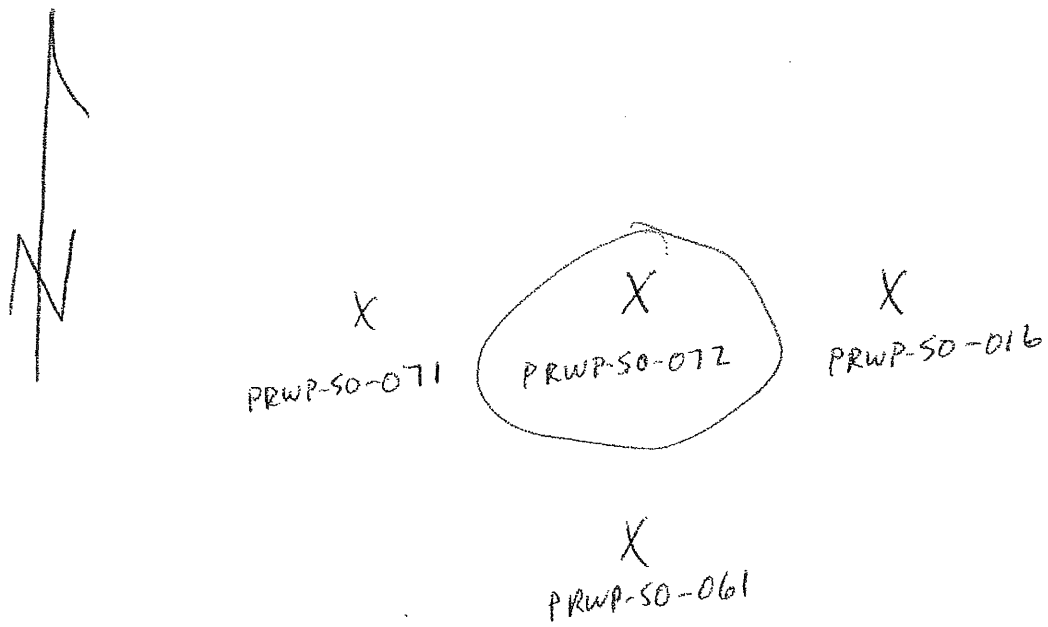
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0235) + MSD (PR0235MSD) also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-12-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610ACCT

Location Code: **PRWP-SO072**
Sample Number: **PR0235MSD**
Sample Name: **PRWP-SO072-SO-PR0235-MSD**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **MSD**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1030
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

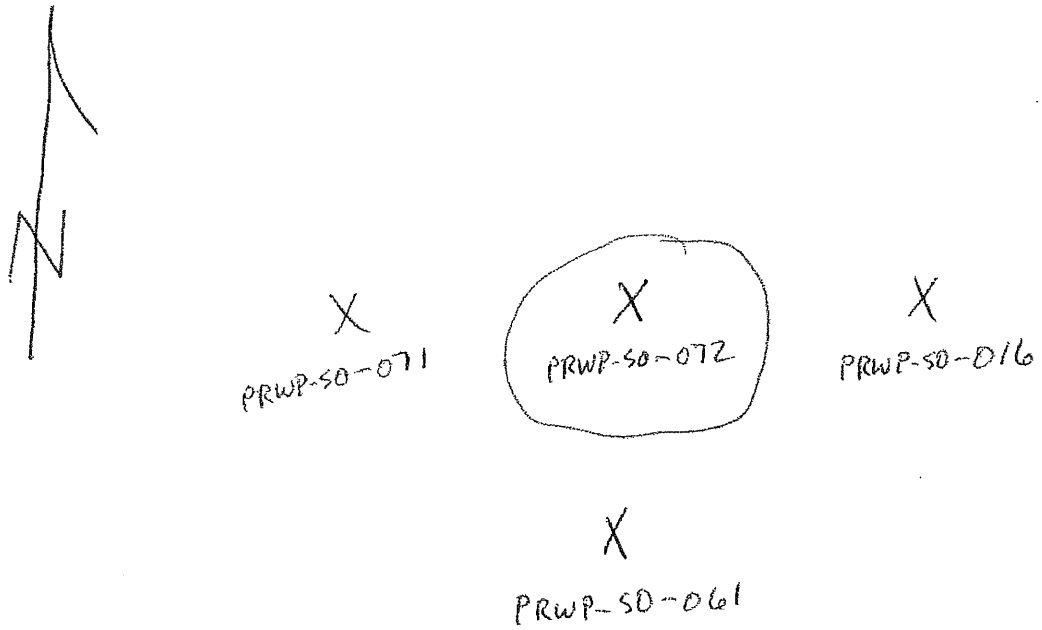
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0235) and MS (PR0235MS) collected at this location

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-12-10 *Reviewed BY / Date:* Edward L. Moore 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 AccT

Location Code: **PRWP-SO073**
Sample Number: **PR0236**
Sample Name: **PRWP-SO073-SO-PR0236-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1140
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

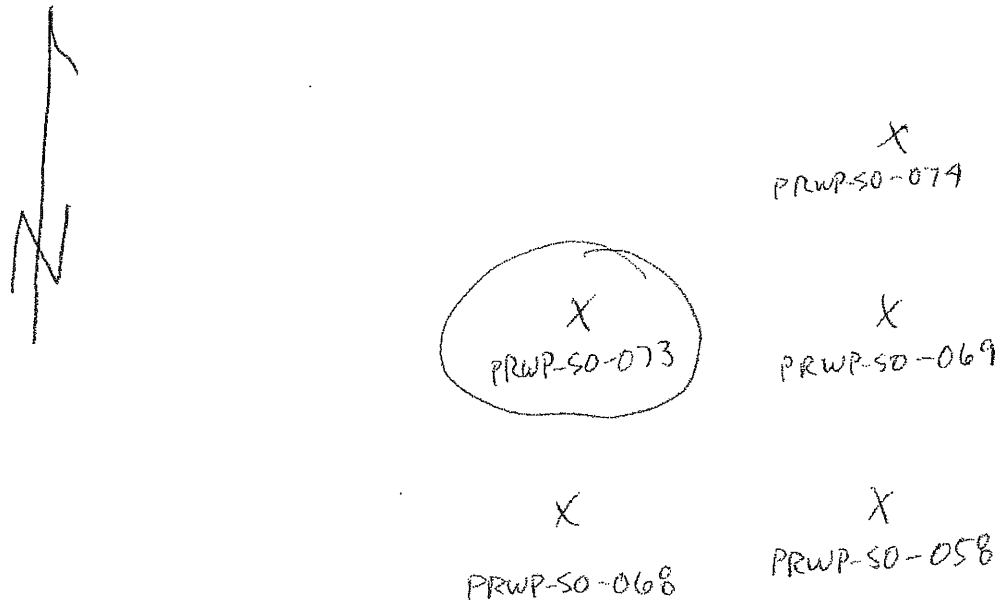
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. FD(PR0237) + FS(PR0238) also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-12-10 *Reviewed BY / Date:* Edward S. Weaver 4-27-11

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Sample Collection Log

132457 · PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 ACCT

Location Code: **PRWP-SO073**
Sample Number: **PR0237**
Sample Name: **PRWP-SO073-SO-PR0237-FD**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **FD**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1140
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

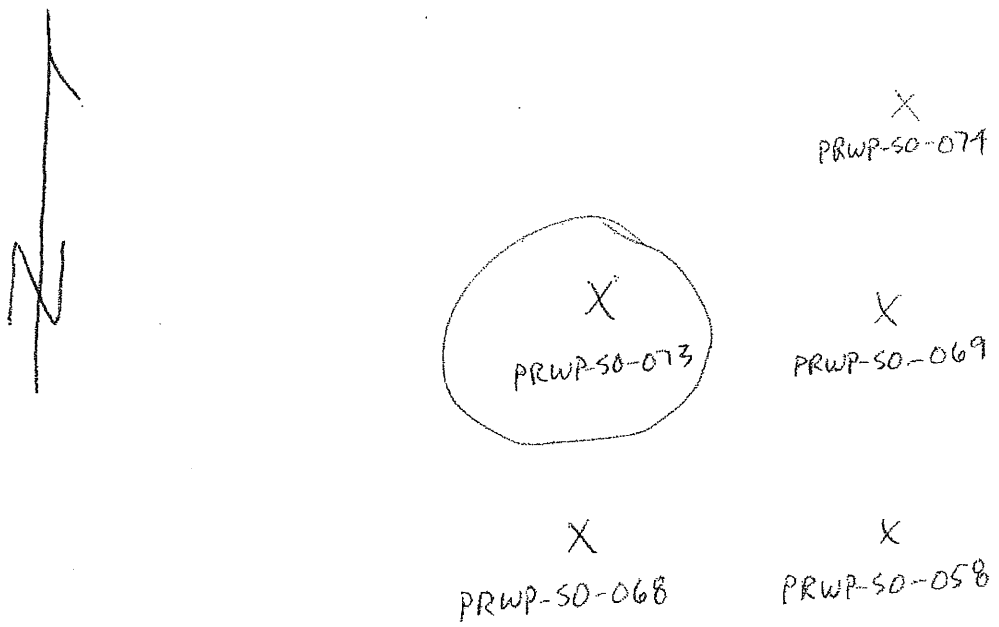
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0236) and FS (PR0238) also collected at this location.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-12-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB111610 TA

Location Code: **PRWP-SO073**
Sample Number: **PR0238**
Sample Name: **PRWP-SO073-SO-PR0238-FS**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **FS**
Sampling Equip: Geoprobe

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1140
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

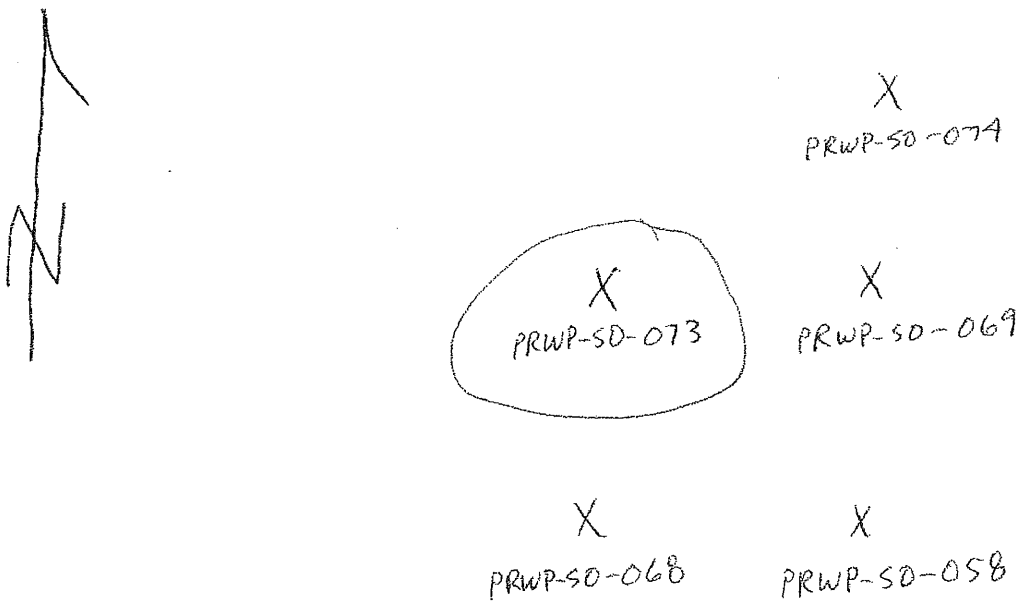
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'. Regular sample (PR0236) and FD (PR0237) also collected at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 11-12-10 *Reviewed BY / Date:* Edward K. Weaver 4-27-11

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB 111610 ACCT

Location Code: **PRWP-SO074**
Sample Number: **PR0239**
Sample Name: **PRWP-SO074-SO-PR0239-REG**
Sampling Method: **GRAB**
Sample Type: **SO** *Sample Purpose:* **REG**
Sampling Equip: Geoprobe
QC Partners:
(TB) (ER) (FB)

Task: **PR-NOV10**
Collection Date: 11-12-10
Collection Time: 1150
Start Depth: 1'
End Depth: 10'
Sample Matrix: **SOIL**
Sample Team: EW/KB

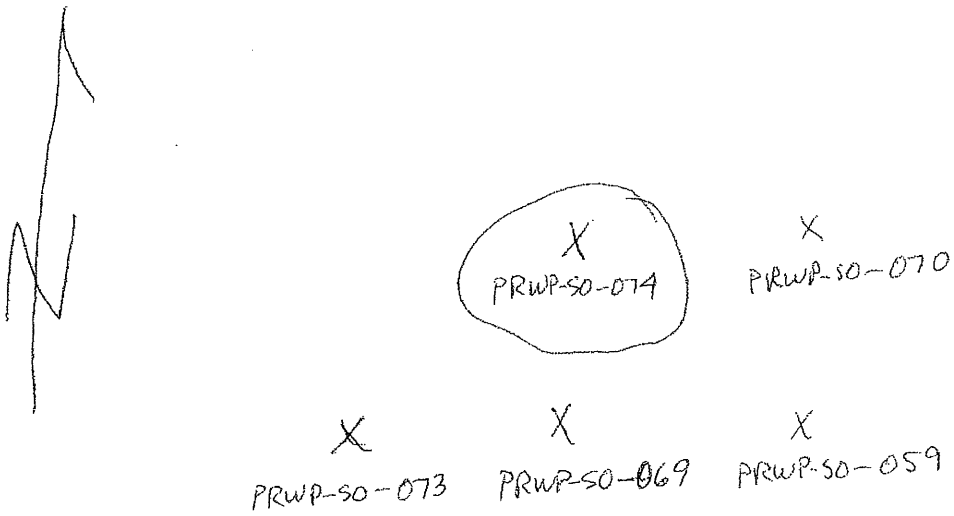
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Composite sample from 1' to 10'.

Sketch Location:



Logged BY / Date: Eric W. Weaver 11-12-10 *Reviewed BY / Date:* Edward E. Weaver 4-27-11

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Sample Collection Log

Project:

Project Number: **Delivery Order:**
Project Manager:

Location Code: PRWP-SO-075 **RFA/COC Number:** PB111610 Acct

Sample Number: PR0240 **Collection Date:** 11-12-10

Sample Name: PRWP-SO075-SO-PR0240-REG **Collection Time:** 1435

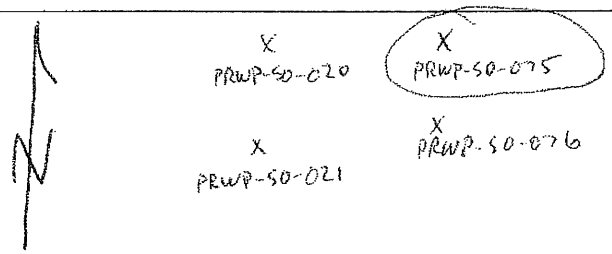
Sampling Method: Grab **Sample Purpose:** REG. **Start Depth:** 1'

Sample Type: SO **End Depth:** 10'

Sampling Equip: Geoprobe **Sample Matrix:** Soil

Analytical Suite	Filter	Quantity	Size	Units	Bottle Type
Explosives	N	1	4	oz.	CWM

Comments: Composite sample from 1' to 10'.



Logged BY / Date: Eric W. Weaver 11-12-10 *Reviewed BY /Date:* Edward L. Weaver 4-27-11

Shaw™
Shaw E & I, Inc.

Sample Collection Log

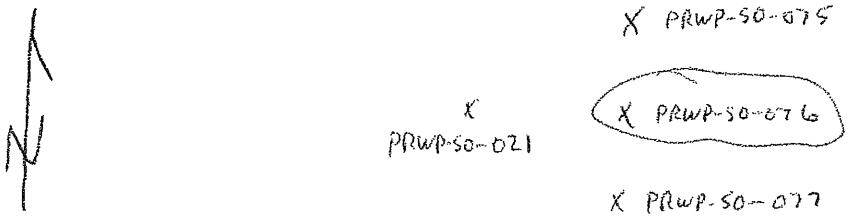
Project:

Project Number: **Delivery Order:**
Project Manager:

Location Code: PRWP-SO-076
RFA/COC Number: PB111610ACCT
Sample Number: PR0241
Collection Date: 11-12-10
Sample Name: PRWP-S0076-SO-PR0241-REG.
Collection Time: 1440
Sampling Method: Grab
Sample Purpose: REG.
Start Depth: 1'
Sample Type: SO
End Depth: 10'
Sampling Equip: Geoprobe
Sample Matrix: Soil

Analytical Suite	Filter	Quantity	Size	Units	Bottle Type
Explosives	N	1	4	oz.	CWM

Comments: Composite sample from 1' to 10'



Logged BY / Date: Eric W. Weaver 11-12-10
Reviewed BY /Date: Edward S. Weaver 4-27-11

Shaw™
Shaw E & I, Inc.

Sample Collection Log

Project:

Project Number: **Delivery Order:**
Project Manager:

Location Code: PRWP-SO-077
RFA/COC Number: PB111610Acct
Sample Number: PR0242
Collection Date: 11-12-10
Sample Name: PRWP-S0077-SO-PR0242-REG
Collection Time: 1445
Sampling Method: Grab
Sample Purpose: REG.
Start Depth: 1'
Sample Type: SO
End Depth: 10'
Sampling Equip: Geoprobe
Sample Matrix: Soil

Analytical Suite	Filter	Quantity	Size	Units	Bottle Type
Explosives	N	1	4	oz.	CWM

Comments: Composite sample from 1' to 10'.

X PRWP-SO-076

X PRWP-SO-026

X PRWP-SO-077

X PRWP-SO-078

Logged BY / Date: E. W. Weaver 11-12-10

Reviewed BY /Date: Edward E. Weaver 4-27-11

Shaw
Shaw E & I, Inc.

Sample Collection Log

Project:

Project Number: **Delivery Order:**
Project Manager:

Location Code: PRWP-SO-078
RFA/COC Number: PB111610 AccT
Sample Number: PR0243
Collection Date: 11-12-10
Sample Name: PRWP-SO078-SO-PR0243-REG
Collection Time: 1450
Sampling Method: Grab
Sample Purpose: REG.
Start Depth: 1'
Sample Type: SO
End Depth: 10'
Sampling Equip: Geoprobe
Sample Matrix: Soil

Analytical Suite	Filter	Quantity	Size	Units	Bottle Type
Explosives	N	1	4	oz.	CWM

Comments: Composite Sample from 1' to 10'.

X PRWP-SO-077

X PRWP-SO-032 X PRWP-SO-078

X PRWP-SO-079

Logged BY / Date: E. W. Weaver 11-12-10 *Reviewed BY /Date:* Edward W. Weaver 4-27-11

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB 111610 ACCT

PAGE 1 OF 5

Bill To: Accounting
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

Project Name/No: PBOW
Sample Team Member: E. Weaver
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 139798.09000000
Required Report Date: 21 Days

Sample Shipment Date: 11-16-10
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8731-0942-9008

Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
PR0200	Soil	11-8-10/1320	~~4oz.~~ CWM	4 oz.	4°C cool	Nitroaromatics SW846-8330		
PR0201	Soil	11-8-10/1410	CWM	4 oz.	4°C cool	Nitroaromatics SW846-8330		
PR0202	Soil	11-8-10/1445	CWM	4 oz.	4°C cool	Nitroaromatics SW846-8330		
PR0203	Soil	11-9-10/1410	CWM	4 oz.	4°C	Nitroaromatics SW846-8330		
PR0203MS	Soil	11-9-10/1410	CWM	4 oz.	4°C	Nitroaromatics SW846-8330		
PR0203MSD	Soil	11-9-10/1410	CWM	4 oz.	4°C	Nitroaromatics SW846-8330		
PR0204	Soil	11-9-10/1425	CWM	4 oz.	4°C	Nitroaromatics SW846-8330		
PR0205	Soil	11-9-10/1440	CWM	4 oz.	4°C	Nitroaromatics SW846-8330		
PR0206	Soil	11-9-10/1450	CWM	4 oz.	4°C	Nitroaromatics SW846-8330		

Special Instructions:

Possible Hazard Identification:
Non-haz: ____ Flammable: ____ Poison B: ____ Unknown: X

Sample Disposal:
Return to Client: ____ Disposal by Lab: X Archive: ____

Turnaround Time:
Normal: X Rush:

Level of QC Required:
Definitive: X Project Specific: ____

1. Relinquished by: E. W. Weaver	Date: 11-16-10 Time: 1550	1. Received by:	Date: Time:
2. Relinquished by:	Date: Time:	2. Received by:	Date: Time:
3. Relinquished by:	Date: Time:	2. Received by:	Date: Time:

Comments:

APPENDIX B

LAND SURVEY DATA

FINAL REPORT
of
SURVEYING SERVICES PERFORMED
by
SACKS SURVEYING & MAPPING, P.C. / KUSMER & ASSOCIATES J.V.
at the
PLUMBROOK ORDNANCE WORKS, SANDUSKY, OH
for
SHAW E & I (PURCHASE ORDER #542512 OP)
OCTOBER, 2009

SUMMARY OF WORK PERFORMED

Sacks Surveying & Mapping, PC, in joint venture with Kusmer & Associates, Inc., located a) 19 test pits, 4 soil bore locations, and 2 monitoring wells along the TNT "B" Sewerline Area; b) 6 surface water & sediment sample locations in the TNT "A" Sewerline Area; and c) 51 test pits in the Pentolite Road Red Water Ponds Area, all sites located within the Plumbrook Ordnance Works facility. Work was performed on-site between 27 October, 2009 and 30 October, 2009 in accordance with Shaw E & I surveying specifications under purchase order #542512 OP.

KEY PERSONNEL

W. Robert Kusmer – Ohio Land Surveyor S-6754
Stanley Robert Sacks – North Carolina Surveyor L-2913
Michael A. McKibbin – North Carolina Surveyor L-4519, Hazmat Project Manager
Jeff Bucholtz – On-site Party Chief *
Steven Chris Shelton – Survey Technician *
* all on-site personnel for this project are OSHA 29 CFR 1910.120 40-hour trained and medically monitored in accordance with Shaw E & I requirements.

FIELD PROCEDURES

All monitoring well and sampling locations reported below were surveyed with a Topcon GTS-235W Total Station using conventional angle and distance measurements to determine the horizontal and vertical position thereof. The survey control points used in this operation were established at each site by direct static differential GPS observation using three Ashtech Promark III GPS receivers. GPS vectors were adjusted holding fixed station "SKY D" using Ashtech post-processing software, producing a least squares adjustment of the WGS 84 positions. A loop using the unadjusted vectors passing the fixed and derived control positions yields a loop precision exceeding 1 part in 100,000. Horizontal and vertical values of Sacks Surveying & Mapping control station "PB 06" were derived by GPS survey in 1996 from NGS Monuments "SKY D" and "J-318" (a first order benchmark). The horizontal datum is NAD 83. The vertical datum is NGVD 29. Values were scaled to the Ohio State Plane Coordinate System (North Zone) using a combined scale and ellipsoid factor of 0.9999270034. Values for National Geodetic Survey (NGS) Monument "SKY D" are:

SKY D:
Northing (y) 196,085.494 m
Easting (x) 586,761.658 m
Orthometric Elevation 175.30 m +/-
(elevation converted from NAVD 88 to NGVD 29 using Corpscon 6.0.1 software)

J-318:
Northing (y) 196,170 m +/-
Easting (x) 583,400 m +/-
Orthometric Elevation 182.801 m
(First Order Class II NGVD 29 Benchmark)

SAMPLE LOCATIONS

TNT "B" Sewerline

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
200	619,220.392	1,917,831.759	660.292	GPS-TNTB-200
202	619,219.039	1,918,044.059	659.855	GPS-TNTB-202
265	621,591.778	1,918,993.624	646.171	GPS-TNTB-265
269	621,195.704	1,919,110.307	649.096	GPS-TNTB-269
231	624,080.988	1,920,565.292	633.568	SS&M Pt. #231
232	624,001.003	1,920,460.503	633.424	SS&M Pt. #232
247	623,473.54	1,919,549.17	644.99 Riser	MW-01
			645.14 Casing	
			642.43 Conc. Pad/Ground	
256	622,790.82	1,919,271.37	643.90 Riser	MW-02
			644.08 Casing	
			641.46 Conc. Pad/Ground	
205	619,168.29	1,917,918.74	660.91	TP-01
206	619,279.08	1,917,961.69	659.84	TP-02
207	619,390.15	1,918,007.77	660.13	TP-03
208	619,670.72	1,918,097.80	659.88	TP-04
273	621,040.94	1,918,619.80	646.28	TP-05
272	621,280.10	1,918,725.04	646.15	TP-06
271	621,390.07	1,918,751.95	647.76	TP-07
268	621,765.64	1,918,889.57	644.95	TP-08
267	621,874.97	1,918,949.20	642.79	TP-09
264	621,992.22	1,918,991.90	641.65	TP-10
263	622,100.00	1,919,010.94	641.33	TP-11
262	622,294.08	1,919,075.88	640.02	TP-12
261	622,385.95	1,919,129.29	639.74	TP-13
260	622,476.39	1,919,165.37	639.22	TP-14
257	622,679.02	1,919,237.45	640.64	TP-15
252	622,783.27	1,919,268.01	641.23	TP-16
251	622,887.68	1,919,306.05	641.16	TP-17
TP-18 WAS NOT SAMPLED ACCORDING TO ON-SITE SHAW E&I REP.				
241	623,784.26	1,919,669.52	640.62	TP-19
242	623,866.51	1,919,685.02	639.49	TP-20
239	623,782.04	1,919,652.97	639.97	DP-11
240	623,771.29	1,919,671.47	640.19	DP-12
204	619,168.64	1,917,905.86	661.05	DP-13
203	619,160.74	1,917,927.78	661.18	DP-14

TNT "A" Sewerline

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
231	624,080.988	1,920,565.292	633.568	SS&M Pt. #231
232	624,001.003	1,920,460.503	633.424	SS&M Pt. #232
233	623,933.12	1,920,587.08	624.88	SDSW-01
234	623,976.14	1,920,607.84	625.40	SDSW-02
235	624,139.29	1,920,562.24	622.40	SDSW-03
236	624,459.36	1,920,757.43	620.46	SDSW-04
237	624,651.40	1,920,901.20	619.73	SDSW-05
238	624,762.44	1,920,983.50	619.60	SDSW-06

Pentolite Road Red Water Pond

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
100	625,014.851	1,919,443.066	634.440	GPS-PRH20-155
155	625,138.563	1,919,385.239	631.853	GPS-PRH20-100
115	625,229.83	1,919,226.67	630.46	464
114	625,231.52	1,919,251.94	631.03	465
113	625,233.10	1,919,274.62	631.03	466
112	625,230.09	1,919,303.09	631.32	467
111	625,229.64	1,919,328.36	631.15	468
110	625,230.02	1,919,354.71	631.16	469
109	625,230.10	1,919,376.76	630.66	470
108	625,229.97	1,919,400.65	630.48	471
107	625,229.40	1,919,425.18	630.88	472
105	625,230.66	1,919,451.27	630.34	473
116	625,230.95	1,919,193.20	631.18	474
143	625,261.94	1,919,245.00	631.47	475
125	625,299.81	1,919,236.06	631.26	476
138	625,257.65	1,919,366.44	630.87	477
133	625,293.45	1,919,367.70	631.09	478
106	625,230.06	1,919,472.47	630.14	479
136	625,256.61	1,919,423.10	630.35	480
137	625,259.08	1,919,399.88	630.33	481
139	625,261.94	1,919,350.01	631.17	482
140	625,258.71	1,919,323.85	630.75	483
141	625,257.63	1,919,299.13	630.76	484
142	625,258.78	1,919,273.41	630.89	485
128	625,296.24	1,919,268.04	631.19	486
126	625,326.91	1,919,238.87	631.47	487

Pentolite Road Red Water Pond <cont.>

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
124	625,298.85	1,919,206.08	631.07	488
122	625,267.74	1,919,212.31	631.55	489
121	625,265.35	1,919,188.32	631.45	490
117	625,233.43	1,919,160.17	631.53	491
132	625,291.06	1,919,347.51	630.90	492
130	625,290.21	1,919,319.80	630.78	493
129	625,293.21	1,919,291.88	630.97	494
144	625,327.07	1,919,265.27	630.57	495
123	625,292.98	1,919,181.91	631.69	496
120	625,262.63	1,919,156.20	631.34	497
118	625,234.94	1,919,132.77	631.47	498
119	625,193.38	1,919,158.92	631.71	499
135	625,292.00	1,919,429.33	631.33	500
134	625,290.01	1,919,397.16	631.03	501
145	625,190.65	1,919,129.10	631.33	502
148	625,162.04	1,919,163.29	631.58	503
154	625,070.08	1,919,170.87	631.63	504
103	625,061.49	1,919,489.96	632.18	505
104	625,088.45	1,919,471.72	632.47	506
147	625,159.22	1,919,133.55	631.88	507
149	625,132.32	1,919,137.04	631.58	508
150	625,101.76	1,919,143.77	631.30	509
146	625,159.07	1,919,103.69	632.14	510
152	625,128.22	1,919,103.61	632.01	511
151	625,098.85	1,919,102.17	631.68	512
102	624,963.00	1,919,541.82	632.02	10178A
153	625,072.40	1,919,201.00	632.34	10195A

CERTIFICATION

I, Warren Robert Kusmer, Ohio Professional Surveyor #S-6754, hereby certify that the information in this survey report is true to the best of my knowledge and belief.

Warren Robert Kusmer,
Ohio Professional Surveyor #S-6754

Date

FINAL REPORT
of
SURVEYING SERVICES PERFORMED
by
SACKS SURVEYING & MAPPING, P.C. / KUSMER & ASSOCIATES J.V.
at the
PLUMBROOK ORDNANCE WORKS, SANDUSKY, OH
for
SHAW E & I (PURCHASE ORDER #634727 OP)
DECEMBER, 2010

SUMMARY OF WORK PERFORMED

Sacks Surveying & Mapping, PC, in joint venture with Kusmer & Associates, Inc., surveyed 78 locations at the following sites within the Plumbrook Ordnance Works facility:

1) 7 soil sample locations at TNT Sewer Line Line A site #45
2) 7 soil sample locations at TNT Sewer Line Line A site #53
3) 4 soil sample locations at the Wastewater Treatment Plant #1 site; and
4) 60 soil sample locations at the Pentolite Road Red Water Ponds site;

Work was performed on-site on 14 December, 2010 in accordance with Shaw E & I surveying specifications under purchase order #634727 OP.

KEY PERSONNEL

W. Robert Kusmer – Ohio Land Surveyor S-6754
Stanley Robert Sacks – North Carolina Surveyor L-2913
Michael A. McKibbin – North Carolina Surveyor L-4519, Hazmat Project Manager
Jeff Bucholtz – On-site Party Chief *
Steven Chris Shelton – Survey Technician *
* all on-site personnel for this project are OSHA 29 CFR 1910.120 40-hour trained and medically monitored in accordance with Shaw E & I requirements.

FIELD PROCEDURES

All sampling locations reported below were surveyed with a Topcon GTS-603 Total Station using conventional angle and distance measurements to determine the horizontal and vertical position thereof. Survey control used meets or exceeds the standards for a Third Order, Class II horizontal and Third Order vertical survey as defined in the Standards and Specifications for Geodetic Control Networks (1984). The survey control points used in this operation were previously established by this firm (October, 2009) by direct static differential GPS observation using three Ashtech Promark II GPS receivers with reference to NGS Monument "Sky D" as a fixed horizontal reference and NGS Monument "J-318" (a first order benchmark) as a fixed vertical reference. The horizontal datum is NAD 83(1995). The vertical datum is NGVD 29. Values were scaled to the Ohio State Plane Coordinate System (North Zone) using a combined scale and ellipsoid factor of 0.9999270034.

SKY D:
Northing (y) 196,085.494 m
Easting (x) 586,761.658 m
Orthometric Elevation 175.30 m +/-
(SKYD not used as vertical control)

J-318:
Northing (y) 196,170 m +/-
Easting (x) 583,400 m +/-
Orthometric Elevation 182.801 m
(First Order Class II NGVD 29 Benchmark)

SAMPLE LOCATIONS

TNT Sewer Line A

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
300	624,276.602	1,923,666.124	635.715	GPS-TNTA-300
301	624,559.814	1,9234,94.186	---	NAIL-TNTA-301
302	624,600.605	1,923,493.619	631.963	GPS-TNTA-302
1200	624,498.74	1,923,396.31	631.03	45ANL-1
1201	624,492.38	1,923,362.17	630.51	45ANL-5
1204	624,486.88	1,923,393.65	630.94	45ACL-1
1205	624,483.43	1,923,376.14	630.57	45ACL-2
1206	624,481.86	1,923,368.89	630.58	45ACL-3
1203	624,479.65	1,923,400.88	631.26	45ASL-1
1202	624,471.47	1,923,366.77	630.94	45ASL-5
1207	624,343.49	1,922,562.41	631.00	53BNL-1
1208	624,333.14	1,922,524.63	630.96	53BNL-5
1211	624,329.19	1,922,559.67	630.90	53BCL-1
1212	624,326.58	1,922,542.31	630.32	53BCL-2
1213	624,322.71	1,922,525.36	630.71	53BCL-3
1210	624,319.04	1,922,568.26	630.98	53BSL-1
1209	624,309.50	1,922,531.87	630.93	53BSL-5

Wastewater Treatment Plant #1

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
200	623,831.119	1,920,178.168	635.762	GPS-WWTP1-200
201	624,053.771	1,920,180.353	634.731	GPS-WWTP1-201
1214	623,982.44	1,919,736.77	637.29	SSW108-S
1215	623,990.54	1,919,742.10	637.41	SSW108-NE
1216	623,991.06	1,919,732.69	637.51	SSW108-NW
1217	623,988.70	1,919,737.60	637.39	SSW108-R

Pentolite Road Red Water Pond

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
100	625,014.851	1,919,443.066	634.440	GPS-PRH20-155
155	625,138.563	1,919,385.239	631.853	GPS-PRH20-100
1231	625,021.62	1,919,069.91	632.28	TRWOSO-020
1230	625,002.18	1,919,058.60	632.02	TRWOSO-021
1232	625,029.05	1,919,043.02	632.28	TRWOSO-022
1233	625,002.19	1,919,030.97	632.28	TRWOSO-023
1246	625,037.56	1,919,015.94	632.41	TRWOSO-024
1245	625,013.21	1,919,004.02	632.25	TRWOSO-025
1229	624,970.28	1,919,039.23	631.82	TRWOSO-026
1234	624,976.81	1,919,015.64	631.96	TRWOSO-027
1244	624,986.03	1,918,990.83	632.18	TRWOSO-028
1266	624,992.81	1,918,962.06	643.06	TRWOSO-029
1265	625,021.49	1,918,973.68	642.83	TRWOSO-030
1251	625,046.90	1,918,988.15	632.77	TRWOSO-031
1228	624,942.48	1,919,029.09	631.91	TRWOSO-032
1235	624,948.81	1,919,001.91	632.19	TRWOSO-033
1243	624,957.95	1,918,976.33	632.40	TRWOSO-034
1275	624,965.86	1,918,945.84	643.16	TRWOSO-035
1272	624,978.23	1,918,917.91	643.15	TRWOSO-036
1267	625,001.67	1,918,934.14	642.80	TRWOSO-037
1264	625,030.97	1,918,946.94	643.38	TRWOSO-038
1252	625,055.88	1,918,960.14	643.32	TRWOSO-039
1227	624,913.78	1,919,021.07	632.03	TRWOSO-040
1236	624,920.54	1,918,993.21	632.34	TRWOSO-041
1242	624,935.52	1,918,957.64	632.91	TRWOSO-042
1276	624,944.53	1,918,932.69	642.81	TRWOSO-043
1273	624,954.51	1,918,899.33	643.64	TRWOSO-044
1271	624,990.70	1,918,888.40	643.89	TRWOSO-045
1268	625,012.72	1,918,906.66	643.71	TRWOSO-046
1263	625,034.58	1,918,918.91	643.72	TRWOSO-047
1253	625,064.59	1,918,931.27	643.75	TRWOSO-048
1226	624,888.15	1,919,005.48	632.04	TRWOSO-049
1237	624,896.68	1,918,974.42	632.90	TRWOSO-050
1241	624,906.32	1,918,949.88	633.24	TRWOSO-051
1277	624,917.39	1,918,923.11	643.43	TRWOSO-052
1274	624,931.07	1,918,879.42	643.39	TRWOSO-053
1225	624,860.81	1,918,991.82	632.40	TRWOSO-054
1238	624,872.37	1,918,959.92	632.60	TRWOSO-055
1269	625,022.88	1,918,879.09	643.56	TRWOSO-056
1262	625,043.40	1,918,891.34	644.04	TRWOSO-057
1256	625,072.26	1,918,902.26	643.84	TRWOSO-058

Pentolite Road Red Water Pond <cont.>

SS&M ID#	Northing (y)	Easting (x)	Elevation	Shaw Designation
1254	625,087.10	1,918,948.82	643.72	TRWOSO-059
1250	625,080.01	1,918,978.93	633.07	TRWOSO-060
1247	625,070.84	1,919,001.71	633.25	TRWOSO-061
1240	624,879.63	1,918,934.86	632.19	TRWOSO-062
1278	624,891.83	1,918,907.24	643.90	TRWOSO-063
1224	624,833.77	1,918,979.84	632.65	TRWOSO-064
1239	624,845.03	1,918,942.15	632.84	TRWOSO-065
1270	625,027.47	1,918,846.66	643.62	TRWOSO-066
1261	625,051.82	1,918,862.35	643.70	TRWOSO-067
1260	625,080.04	1,918,875.07	643.16	TRWOSO-068
1257	625,100.60	1,918,910.51	644.30	TRWOSO-069
1255	625,114.87	1,918,960.08	644.00	TRWOSO-070
1249	625,107.21	1,918,990.76	633.09	TRWOSO-071
1248	625,095.94	1,919,019.17	632.96	TRWOSO-072
1259	625,113.26	1,918,883.44	643.94	TRWOSO-073
1258	625,129.07	1,918,919.79	644.53	TRWOSO-074
1219	625,016.86	1,919,100.60	631.51	TRWOSO-075
1220	624,999.99	1,919,088.11	631.59	TRWOSO-076
1221	624,965.24	1,919,068.93	631.79	TRWOSO-077
1222	624,937.37	1,919,059.20	631.89	TRWOSO-078
1223	624,909.99	1,919,049.63	632.05	TRWOSO-079

CERTIFICATION

I, Warren Robert Kusmer, Ohio Professional Surveyor #S-6754, hereby certify that the information in this survey report is true to the best of my knowledge and belief.

FOR REVIEW PURPOSES ONLY UNLESS SIGNED, SEALED & DATED

_____

Warren Robert Kusmer,
Ohio Professional Surveyor #S-6754

_____

APPENDIX C

RISK-BASED EVALUATION FOR SOIL CONTAMINATION DELINEATION

A risk-based approach was employed as part of the Pentolite Road Red Water Pond (PRRWP) Area soil contamination delineation effort. This delineation was performed in response to the finding of unexpected results obtained at the end of the non-time-critical removal action (NTCRA) performed for 2,4,6-trinitrotoluene (TNT) removal at the PRRWP Area (McTech Corp, 2009). Once the NTCRA goal for TNT effort was attained, the excavation perimeter samples were noticed to exhibit higher than expected concentrations of non-TNT nitroaromatics. A comparison of the individual sample results to U.S. Environmental Protection Agency (EPA) Region 9 preliminary remediation goals (EPA, 2004) indicated that noncancer hazards associated with the NTCRA excavation perimeter wall samples generally exceeded a hazard index (HI) value of 1. Therefore, the U.S. Army Corps of Engineers decided that further delineation sampling was required in the PRRWP Area before this site could be closed out in a decision document.

The risk-based approach described in this appendix was used for two different, though related, purposes. First, it was used iteratively to determine where additional test pits or soil borings should be placed for delineation sampling; second, it was used to help determine when the extent of PRRWP Area contamination was adequately delineated. This type of approach is not a formal risk assessment used to estimate the risk of a potential receptor; instead, this approach is intended as a tool to help support remedial alternatives that are developed in the feasibility study (FS) addendum. Estimates of areas and soil volumes that may require remediation are determined in the FS addendum.

Risk-Based Approach. This risk-based evaluation involves a comparison of the analytical results collected from each composite soil sample to EPA regional screening levels (RSL) for residential soil, which were used as risk-based delineation levels (EPA, 2012). Residential use is assumed because land use in areas immediately adjacent to the Plum Brook Ordnance Works (PBOW) boundary includes residential properties, and the assumption of residential use is consistent with the criteria used to remediate other PBOW sites. The RSLs reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a hazard quotient of 1. For a chemical such as TNT, which has both cancer-based and non-cancer-based toxicity values, both cancer-based and non-cancer-based values were used.

The results of this evaluation were used to determine whether the residual human health risk values associated with a given soil sample are within or below the risk management levels, including both noncancer hazards and cancer risks. EPA (1990) describes concentrations that

result in ILCR values within the 1E-6 to 1E-4 range as acceptable, with the lower end of this range being the point of departure. At PBOW, a risk management goal for cancer risks has been defined as a combined ILCR that does not exceed 1E-5, and the risk management goal for noncancer hazard is defined as a combined HI that does not exceed a value of 1 (Ohio Environmental Protection Agency, 2004). These goals have been used for other PBOW sites such as TNT Areas A, B, and C. These goals are also recognized in Ohio Environmental Protection Agency (2009) guidance.

These soil sample-specific ILCR and HI values include the contributions of all detected site-related nitroaromatic contaminants. Where the risk or hazard is found to exceed the respective risk management goal at a given location, the excavation of additional test pits, or in some cases installation of soil borings, is generally performed farther from the original NTCRA excavation in this direction. Once a soil sample or set of soil samples is identified as meeting the risk management goals, no further soil sampling is required for the represented area.

For cancer risks, the ILCR value of a given test pit or soil boring composite sample is derived as follows:

$$ILCR_n = ILCR_{n\text{-}a} + ILCR_{n\text{-}b} + \ldots + ILCR_{n\text{-}z} \qquad \text{Eq. C-1}$$

Where:

$ILCR_n$ = combined ILCR value in sample "n"
$ILCR_{n\text{-}a}$ = ILCR value of nitroaromatic "a" in sample "n."

The ILCR values of the individual chemicals in a sample are calculated as follows:

$$ILCR_{n\text{-}a} = (C_{n\text{-}a} \div RSL_{a(canc)}) \times ILCR_{RSL} \qquad \text{Eq. C-2}$$

Where:

$ILCR_{n\text{-}a}$ = ILCR value of nitroaromatic "a" in sample "n"
$C_{n\text{-}a}$ = detected concentration of nitroaromatic "a" in sample "n"
$RSL_{a(canc)}$ = cancer RSL of nitroaromatic "a"
$ILCR_{RSL}$ = ILCR of the RSL (=1E-6).

For noncancer hazard, the HI value of a given test pit or soil boring composite sample is derived as follows:

$$HI_n = HQ_{n\text{-}a} + HQ_{n\text{-}b} + \ldots + HQ_{n\text{-}z} \qquad \text{Eq. C-3}$$

Where:

HI_n = combined HI value in sample "n"
$HQ_{n\text{-}a}$ = hazard quotient value of nitroaromatic "a" in sample "n."

The hazard quotients of the individual chemicals in a sample are calculated as follows:

$$HQ_{n\text{-}a} = C_{n\text{-}a} \div (RSL_{a(nc)} \times HQ_{RSL}) \qquad \text{Eq. C-4}$$

Where:

$HQ_{n\text{-}a}$ = hazard quotient value of nitroaromatic "a" in sample "n"
$C_{n\text{-}a}$ = detected concentration of nitroaromatic "a" in sample "n"
$RSL_{a(canc)}$ = noncancer RL of nitroaromatic "a"
HQ_{RSL} = hazard quotient of the noncancer-based RSL (= 1).

Only definitive laboratory data were used in the risk-based evaluation. These definitive data are adequate for comparative analysis to the RSLs and the ultimate purposes of this evaluation in determining the extent of contamination for the FS addendum.

Note that this risk-based approach is used only as a tool to assist in the delineation of contamination. Therefore, the exceedance of either an HI of 1 and/or an ILCR of 1E-5 by the sample-specific analytical results at a given location is not necessarily interpreted as meaning that the location has not been adequately delineated. The risk-based results of other adjacent samples and potentially other site-specific information is likewise considered (e.g., presence of a berm or tile drain contamination) in evaluating whether additional delineation is necessary at a given location. As mentioned, estimates of soil volumes and areas that may require remediation are determined in the FS addendum.

Results. Sample-by-sample ILCR and HI values are shown on site delineation report Figures 5-2 and 5-3, respectively. The ILCR and HI calculations are shown in Tables C-1 (June and November 2010 sample ILCR and HI values), C-2 (July through November 2009 sample ILCR and HI values), C-3 (May and June 2009 sample ILCR values), and C-4 (May and June sample HI values).

As described in Section 5.2 of the site delineation report, samples were collected initially from test pits that were stepped out approximately 30 to 60 feet all around the original NTCRA excavation perimeter. This set of samples appears to have bounded the contamination west of the NTCRA excavation, but ILCR values were as high as 3.5E-2 north of the NTCRA excavation and as high as 2.4E-3 southeast of the NTCRA excavation (Figure 5-2 of the site delineation report). Similarly, the HI values of the initial step-out samples were as high as 1,690 east of the NTCRA excavation and as high as 118 southeast of the excavation (Figure 5-3 of the site delineation report). After an additional 30-foot step-out was made, test pits were again sampled. This additional step-out, shown as the second concentric band outside of the NTCRA excavation boundary on Figures 5-2 and 5-3 of the site delineation report, appears to have delineated the contamination along the south and east of the NTCRA excavation. Further contamination is indicated north of the NTCRA excavation from near samples 401 and 402, northward to samples 477, 480, and 481, and also westward to sample location 416. However, east-west and north-south tile drain lines containing water with detections of dinitrotoluenes were discovered while digging the test pit for sample 420. Therefore, some of the contamination in this northern area is likely to be associated with the tile drain lines rather than the PRRWP Area. Note that the contamination at the drain lines is being investigated separately from the PRRWP Area residual contamination.

Residual contamination with ILCR values exceeding the 1E-5 criterion was found in several samples. Contamination was also found northwest of the NTCRA excavation, on the other side of the berm (Figure 5-2 of the site delineation report). This area extends from sample PRWP-SO028 north-northeastward to sample 499. Tile drains were also found in this area. Because this area is on the opposite side of the berm from the PRRWP Area and contains tile drains, it is likely that the contamination in this area is associated with the tile drains rather than the PRRWP Area.

References

McTech Corp, 2009, ***Non-Time Critical Removal Action Report, Soil Excavation, Composting, and Disposal***, ***Plum Brook Ordnance Works, Pentolite Road Red Water Ponds, Sandusky, Ohio,*** April.

Ohio Environmental Protection Agency, 2009***, Human Health Cumulative Carcinogenic Risk and Non-carcinogenic Hazard Goals for the DERR Remedial Response Program***, Technical Decision Compendium, Division of Emergency and Remedial Response, August 21.

Ohio Environmental Protection Agency, 2004, Email Correspondence from L. Moore, OEPA Risk Assessor, to L. Long, USACE Risk Assessor, December 15.

U.S. Environmental Protection Agency (EPA), 2012, ***Regional Screening Level Table***, November, on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

U.S. Environmental Protection Agency (EPA), 2004, ***Region 9 Preliminary Remediation Goals (PRG) Table***, San Francisco, California, October.

U.S. Environmental Protection Agency (EPA), 1990, ***National Oil and Hazardous Substances Pollution Contingency Plan***, 40 CFR Part 300.430.

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO010				PRWP-SO011				PRWP-SO012				PRWP-SO013				PRWP-SO014			
			Sample No.:	PR0075				PR0076				PR0077				PR0078				PR0079			
			Sample Date:	16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10			
			Sample Depth:	1 - 10 Ft				0 - 3 Ft				0 - 3 Ft				0 - 3 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.343		0.00		-	-			0.889		0.01		-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.291		0.05		4.68		0.77		0.72		0.12		3.95		0.65	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			1.38		0.01	1.9E-06	8.24		0.07	1.1E-05	5.77		0.05	8.0E-06	21.2		0.18	2.9E-05
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	-	-			0.214		0.0001		3.55		0.002		0.435		0.0002		15.8		0.007	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			6.37		0.18	3.4E-07
Summed Sample HI/ILCR:						0.00	0.0E+00			0.06	1.9E-06			0.84	1.1E-05			0.17	8.0E-06			1.01	3.0E-05 CANC!

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO015				PRWP-SO016				PRWP-SO017				PRWP-SO018				PRWP-SO019			
			Sample No.:	PR0080				PR0081				PR0082				PR0083				PR0084			
			Sample Date:	16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10				16-Jun-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.104	J	0.00		0.182		0.00		-	-			0.768		0.01		-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.448		0.07		0.175		0.03		1.3		0.21		5.57		0.91	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.803		0.01	1.1E-06	1.28		0.01	1.8E-06	2.9		0.02	4.0E-06	3.36		0.03	4.7E-06	18		0.15	2.5E-05
Dinitrotoluene, 2,6-	mg/kg	61	0.72	0.16	J	0.00	2.2E-07	-	-			0.551		0.01	7.7E-07	-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.66		0.0008		1.61		0.0007		3.29		0.001		3.53		0.002		18.7		0.01	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.01	1.3E-06			0.09	1.8E-06			0.06	4.8E-06			0.25	4.7E-06			1.07	2.5E-05 CANC!

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO019				PRWP-SO020				PRWP-SO022				PRWP-SO024				PRWP-SO026			
			Sample No.:	PR0085				PR0200				PR0201				PR0202				PR0203			
			Sample Date:	16-Jun-10				8-Nov-10				8-Nov-10				8-Nov-10				9-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	FD				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	3.57		0.59		21.7		3.56		8.25		1.35		0.175	J	0.03		12.6		2.07	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	12.3		0.10	1.7E-05	50.1		0.42	7.0E-05	16.4		0.14	2.3E-05	-	-			36.3		0.30	5.0E-05
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			21.3	J		4.8E-06	8.37	J		1.9E-06	0.21	J		4.8E-08	9.81	J		2.2E-06
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	13.1		0.01		74		0.03		28.9		0.01		1.72		0.001		43.4	J	0.02	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			9.74	J	0.27	5.1E-07	-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.69	1.7E-05 CANC!			4.28 NC!	7.5E-05 CANC!			1.50 NC!	2.5E-05 CANC!			0.03	4.8E-08			2.39 NC!	5.3E-05 CANC!

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO027				PRWP-SO028				PRWP-SO029				PRWP-SO030				PRWP-SO031			
			Sample No.:	PR0204				PR0205				PR0206				PR0207				PR0208			
			Sample Date:	9-Nov-10				9-Nov-10				9-Nov-10				9-Nov-10				9-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	3.61		0.59		1.62		0.27		1.61		0.26		1.13		0.19		0.497		0.08	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	9.28		0.08	1.3E-05	2.37		0.02	3.3E-06	3.58		0.03	5.0E-06	2.05		0.02	2.8E-06	0.492		0.00	6.8E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	1.52	J		3.5E-07	0.714	J		1.6E-07	1.21	J		2.8E-07	1.57	J		3.6E-07	0.47	J		1.1E-07
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	11.4		0.005		6.29		0.003		7.27		0.003		5.67		0.003		2.55		0.001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.67	1.3E-05			0.29	3.5E-06			0.30	5.2E-06			0.20	3.2E-06			0.09	7.9E-07

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO035				PRWP-SO035				PRWP-SO035				PRWP-SO040				PRWP-SO041			
			Sample No.:	PR0209				PR0210				PR0211				PR0212				PR0213			
			Sample Date:	10-Nov-10				10-Nov-10				10-Nov-10				10-Nov-10				10-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				FD				FS				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.152	J	0.00		-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.131	J	0.02		0.658	J	0.11		-	-			3.08		0.50		1.46		0.24	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	5.08	J	0.04	7.1E-06	1.02	J	0.01	1.4E-06	0.31	J	0.00	4.3E-07	5.51		0.05	7.7E-06	1.69		0.01	2.3E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	0.801	J		1.8E-07	0.351	J		8.0E-08	-	-			2.35	J		5.3E-07	0.321	J		7.3E-08
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	5.31	J	0.002		2.27	J	0.001		1.6	J	0.0007		10.5		0.005		3.52		0.002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			0.76	J	0.02	4.0E-08	-	-			-	-		
Summed Sample HI/ILCR:						0.07	7.2E-06			0.12	1.5E-06			0.02	4.7E-07			0.56	8.2E-06			0.26	2.4E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO042				PRWP-SO043				PRWP-SO044				PRWP-SO045				PRWP-SO053			
			Sample No.:	PR0214				PR0215				PR0216				PR0217				PR0218			
			Sample Date:	10-Nov-10				10-Nov-10				10-Nov-10				10-Nov-10				11-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.118	J	0.00		-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.558		0.09		0.431		0.07		0.204		0.03		-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.518		0.00	7.2E-07	2.52		0.02	3.5E-06	0.725		0.01	1.0E-06	-	-			-	-		
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	0.449	J		1.0E-07	0.7	J		1.6E-07	0.308	J		7.0E-08	0.11	J		2.5E-08	0.118	J		2.7E-08
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	4		0.002		6.01		0.003		1.34		0.0006		0.437		0.0002		0.407		0.0002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.10	8.2E-07			0.10	3.7E-06			0.04	1.1E-06			0.0002	2.5E-08			0.0002	2.7E-08

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO055				PRWP-SO055				PRWP-SO055				PRWP-SO056				PRWP-SO057			
			Sample No.:	PR0219				PR0220				PR0221				PR0222				PR0223			
			Sample Date:	11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				#NAME?				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				FD				FS				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			-	-			0.602		0.10		1.15		0.19	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.72	J	0.01	1.0E-06	0.402	J	0.00	5.6E-07	0.81		0.01	1.1E-06	0.777		0.01	1.1E-06	3.58		0.03	5.0E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			0.115	J	0.00	1.6E-07	-	-		
RDX	mg/kg	NA	4.4	-	-			0.298	J		6.8E-08	-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	2.13		0.001		1.42		0.0006		2.4		0.001		2.69		0.001		3.35		0.002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.01	1.0E-06			0.00	6.3E-07			0.01	1.1E-06			0.11	1.2E-06			0.22	5.0E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO058				PRWP-SO061				PRWP-SO062				PRWP-SO063				PRWP-SO064			
			Sample No.:	PR0224				PR0225				PR0226				PR0227				PR0228			
			Sample Date:	11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10				11-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			0.186		0.00		-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.557		0.09		1.43		0.23		0.279		0.05		-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	1.66		0.01	2.3E-06	1.81		0.02	2.5E-06	-	-			0.101	J	0.00	1.4E-07	1.19		0.01	1.7E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.91		0.001		3.62		0.002		0.843		0.0004		1.11		0.0005		3.19		0.001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.11	2.3E-06			0.25	2.5E-06			0.05	0.0E+00			0.00	1.4E-07			0.01	1.7E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO065				PRWP-SO066				PRWP-SO067				PRWP-SO068				PRWP-SO070			
			Sample No.:	PR0229				PR0230				PR0231				PR0232				PR0233			
			Sample Date:	11-Nov-10				11-Nov-10				11-Nov-10				12-Nov-10				12-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	0.259		0.00		-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.185		0.03		0.624	J	0.10		0.388		0.06		1.05		0.17	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.789		0.01	1.1E-06	2.26		0.02	3.1E-06	5.35		0.04	7.4E-06	0.629	J	0.01	8.7E-07	2.41		0.02	3.3E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	3.02		0.001		2.17		0.0010		6.26		0.003		1.74		0.001		4.2		0.002	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.01	1.1E-06			0.05	3.1E-06			0.15	7.4E-06			0.07	8.7E-07			0.19	3.3E-06

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO071				PRWP-SO072				PRWP-SO073				PRWP-SO073				PRWP-SO073			
			Sample No.:	PR0234				PR0235				PR0236				PR0237				PR0238			
			Sample Date:	12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1-10 ft			
			Sample Purpose:	REG				REG				REG				FD				FS			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	1.25		0.20		0.258		0.04		-	-			-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	7.3		0.06	1.0E-05	0.638		0.01	8.9E-07	-	-			-	-			-	-		
Dinitrotoluene, 2,6-	mg/kg	61	0.72	1.44		0.02	2.0E-06	-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	8.27		0.004		1.1		0.0005		0.231		0.0001		0.334		0.0002		-	-		
Trinitrotoluene, 2,4,6-	mg/kg	36	19	0.317		0.01	1.7E-08	-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.3	1.2E-05			0.05	8.9E-07			0.0001	0.0E+00			0.0002	0.0E+00			0.0000	0.0E+00

Table C-1

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PRWP-SO074				PRWP-SO075				PRWP-SO076				PRWP-SO077				PRWP-SO078			
			Sample No.:	PR0239				PR0240				PR0241				PR0242				PR0243			
			Sample Date:	12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10				12-Nov-10			
			Sample Depth:	1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft				1 - 10 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-Based RSL	Cancer-Based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			1.78	J	0.01		-	-			-	-			1.03	J	0.01	
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			4.83		0.79		5.37		0.88		3.87		0.63		1.79		0.29	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			10.5		0.09	1.5E-05	11.1		0.09	1.5E-05	4.33		0.04	6.0E-06	3.88		0.03	5.4E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1.1		0.02	1.5E-06	1.25		0.02	1.7E-06	0.511	J	0.01	7.1E-07	-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.54		0.0007		22.1		0.0100		27.2		0.0124		12.3		0.0056		7.58		0.0034	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Summed Sample HI/ILCR:						0.0007	0.0E+00			0.92	1.6E-05 CANC!			1.01	1.7E-05 CANC!			0.68	6.7E-06			0.34	5.4E-06

RSL = U.S. EPA November 2012 Regional Screening Level; VQ = validation qualifier; HQ = hazard quotient; ILCR = incremental lifetime cancer risk; mg/kg = milligrams per kilogram; NA = not applicable; J = estimated concentration; HI =hazard index.

Notes:

1. Sample purpose "REG" is the regular sample, "FD" is the field duplicate, and "FS" is the field split. For REG and FD, the sample with the higher concentrations is shown. The FS samples are shown independently.
2. "-" indicates that the analyte was not detected in this sample.
3. RDX is shown as detected in several samples at concentrations less than the reporting limits. Because RDX has no association with Plum Brook Ordnance Works and is a common false positive in samples from collected from non-PBOW sites, the contribution of RDX is not included in the ILCR value for this sample.
4. A Sample HI Value with associated "NC!" below exceeds a value of 1 (rounded to one significant figure); HI value is shaded.
5. A Sample ILCR Value with associated "CANC!" below exceeds a value of 1E-5 (rounded to one significant figure); ILCR value is shaded.

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-00502				PR-00503				PR-00504				PR-00505				PR-00506			
			Sample Number:	PR0050				PR0051				PR0052				PR0054				PR0056			
			Sample Date:	18-Aug-09				18-Aug-09				18-Aug-09				18-Aug-09				18-Aug-09			
			Sample Depth:	0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 10 Ft			
			Sample Purpose:	REG				REG				REG				FD				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			0.102	J	0.00	
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	0.167	J	0.00		-	-			-	-			0.413		0.00		0.102	J	0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.0959	J	0.02		7.36		1.21		5.97		0.98		0.995	J	0.16		0.0904	J	0.01	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	2.06		0.02	2.9E-06	12.9		0.11	1.8E-05	13.1		0.11	1.8E-05	6.75	J	0.06	9.4E-06	0.827		0.01	1.1E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			1.12	J	0.02	1.6E-06	-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.75		0.0003		23.5		0.0107		32		0.0145		1.53	J	0.0007		0.16	J	0.0001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	0.0602	J	0.002	3.2E-09	-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.04	2.9E-06			1.32	1.8E-05			1.1024	1.8E-05			0.24117	1.1E-05			0.0231	1.1E-06
											CANC!				**CANC!**								

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-00507				PR-00508				PR-00509				PR-00510				PR-00511			
			Sample Number:	PR-00507				PR-00508				PR-00509				PR-00510				PR-00511			
			Sample Date:	21-Oct-09				21-Oct-09				21-Oct-09				21-Oct-09				21-Oct-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			1.4		0.01		-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	1.09		0.18		6.09		1.00		5.32		0.87		2.78		0.46		1.25		0.20	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	4.09	J	0.03	5.7E-06	15.2		0.13	2.1E-05	11.6		0.10	1.6E-05	4.4		0.04	6.1E-06	4.41		0.04	6.1E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	0.24		0.00	3.3E-07	0.973		0.02	1.4E-06	-	-			0.308		0.01	4.3E-07	0.562		0.01	7.8E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	2.54		0.0012		18.1		0.0082		16.9		0.0077		4.12		0.0019		3.67		0.0017	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			0.3		0.008	1.6E-08	-	-			-	-			0.0613	J	0.002	3.2E-09
Sample HI and ILCR						0.2179	6.0E-06			1.15754	2.2E-05			0.98581	1.6E-05			0.49933	6.5E-06			0.25425	6.9E-06
											CANC!				**CANC!**								

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-00512				PR-00513				PR-00514				PR-00515				PR-00516			
			Sample Number:	PR-00512				PR-00513				PR-00514				PR-00515				PR-00516			
			Sample Date:	21-Oct-09				19-Nov-09				19-Nov-09				19-Nov-09				19-Nov-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.572		0.09		9.62	J	1.58		6.86	J	1.12		6.62	J	1.09		0.919		0.15	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.538		0.00	7.5E-07	22.5	J	0.19	3.1E-05	13.5	J	0.11	1.9E-05	16.5	J	0.14	2.3E-05	2.33		0.02	3.2E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			8.1	J		1.8E-06	-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.717		0.0003		40.4	J	0.0184		31.2	J	0.0142		30.2	J	0.0137		3.29		0.0015	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.09858	7.5E-07			1.78291	3.1E-05			1.25127	1.9E-05			1.23647	2.3E-05			0.17157	3.2E-06
										NC!	**CANC!**				**CANC!**				**CANC!**				

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10035				PR-10036				PR-10037				PR-10040				PR-10060			
			Sample Number:	PR0025				PR0028				PR0030				PR0068				PR0017			
			Sample Date:	24-Jul-09				24-Jul-09				24-Jul-09				19-Aug-09				24-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				2 - 12 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			0.385		0.00		0.0577	J	0.0004		-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			0.33		0.00		-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.362		0.06		-	-			-	-			-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.298		0.00	4.1E-07	-	-			0.364		0.00	5.1E-07	-	-			0.121	J	0.00	1.7E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	1.47		0.0007		1.66		0.0008		0.628		0.0003		-	-			0.235		0.0001	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			1.99		0.055	1.0E-07	0.167		0.005	8.8E-09	-	-		
Sample HI and ILCR						0.0625	4.1E-07			0.00075	0.0E+00			0.06336	6.1E-07			0.00502	8.8E-09			0.00112	1.7E-07

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10125				PR-10126				PR-10127				PR-10132				PR-10133			
			Sample Number:	PR0026				PR0027				PR0029				PR0060				PR0060			
			Sample Date:	24-Jul-09				23-Jul-09				24-Jul-09				19-Aug-09				19-Aug-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				1 - 11 Ft				1 - 11 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			0.0503	J	0.0003		-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			-	-			-	-			-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	0.363		0.00	5.0E-07	0.159	J	0.00	2.2E-07	0.0675	J	0.0006	9.4E-08	-	-			-	-		
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.236		0.0001		-	-			0.19		0.0001		-	-			-	-		
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			0.888		0.025	4.7E-08	0.185		0.005	9.7E-09
Sample HI and ILCR						0.00313	5.0E-07			0.00133	2.2E-07			0.00098	9.4E-08			0.02467	4.7E-08			0.00514	9.7E-09

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10136				PR-10138				PR-10139				PR-10140				PR-10149			
			Sample Number:	PR0072				PR0057				PR0058				PR0059				PR0016			
			Sample Date:	19-Aug-09				19-Aug-09				19-Aug-09				19-Aug-09				22-Jul-09			
			Sample Depth:	0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 10 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR		VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.112	J	0.00075		-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.35		0.0023		-	-			-	-			0.0923	J	0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			1.93		0.32		4.07		0.67		-	-			0.813		0.13	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			5.44		0.05	7.6E-06	9.65		0.08	1.3E-05	3.89		0.03	5.4E-06	2.02		0.02	2.8E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.0508	J	0.00002		3.58		0.0016		9.16		0.0042		3.58		0.0016		1.47		0.0007	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.00077	0.0E+00			0.36569	7.6E-06			0.75179	1.3E-05			0.03404	5.4E-06			0.1514	2.8E-06

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10158				PR-10161				PR-10163				PR-10164				PR-10176			
			Sample Number:	PR0034				PR0021				PR0023				PR0024				PR0006			
			Sample Date:	24-Jul-09				24-Jul-09				24-Jul-09				24-Jul-09				23-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	FD				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			0.116	J	0.00		0.322		0.00		0.197		0.00	
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			0.214		0.00		0.345		0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			-	-			0.241		0.04		-	-		
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			-	-			0.0737	J	0.00	1.0E-07	0.802		0.01	1.1E-06	0.218		0.00	3.0E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.0583	J	0.0000		0.138	J	0.0001		0.345		0.0002		0.468		0.0002		0.0457	J	0.0000	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			0.0459	J	0.001	2.4E-09	1.75		0.049	9.2E-08
Sample HI and ILCR						2.65E-05	0.0E+00			6.27E-05	0.0E+00			0.00154	1.0E-07			0.05125	1.1E-06			0.05406	3.9E-07

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-10178A				PR-10183				PR-10184				PR-477				PR-478			
			Sample Number:	PR0073				PR0066				PR0007				PR0011				PR0010			
			Sample Date:	19-Aug-09				19-Aug-09				23-Jul-09				22-Jul-09				22-Jul-09			
			Sample Depth:	0 - 10 Ft				0 - 10 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				FD				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	0.0569	J	0.00		-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.182		0.00		0.229		0.00		9.04	J	0.06		-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			2.54	J	0.42		4.38		0.72		8.45	J	1.39		0.822		0.13	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			10.6	J	0.09	1.5E-05	8.77		0.07	1.2E-05	16.7	J	0.14	2.3E-05	0.677		0.01	9.4E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1.56	J	0.03	2.2E-06	-	-			-	-			0.425		0.01	5.9E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	-	-			4.39	J	0.0020		9.07		0.0041		6.68	J	0.0030		3.62		0.0016	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	0.0692	J	0.002	3.6E-09	-	-			-	-			0.121	J	0.003	6.4E-09	-	-		
Sample HI and ILCR						0.0023	3.6E-09			0.53351	1.7E-05			0.79677	1.2E-05			1.59108	2.3E-05			0.14901	1.5E-06
											CANC!							**NC!**	**CANC!**				

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-479				PR-480				PR-481				PR-482				PR-486			
			Sample Number:	PR0008				PR0003				PR0009				PR0012				PR0013			
			Sample Date:	22-Jul-09				22-Jul-09				22-Jul-09				22-Jul-09				23-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				FS				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.32	J	0.00		-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.203		0.00		0.411		0.00		0.246		0.00		0.0953	J	0.00	
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	0.0594	J	0.01		4.8		0.79		9.33		1.53		2.07		0.34		5.1		0.84	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			10		0.08	1.4E-05	16.8		0.14	2.3E-05	6.29		0.05	8.7E-06	3.84		0.03	5.3E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1		0.02	1.4E-06	-	-			-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.324		0.0001		14		0.0064		11.4		0.0052		6.64		0.0030		6.72		0.0031	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			0.0608	J	0.002	3.2E-09	-	-			-	-			-	-		
Sample HI and ILCR						0.00988	0.0E+00			0.89815	1.5E-05			1.67743	2.3E-05			0.39642	8.7E-06			0.87176	5.3E-06
											CANC!			**NC!**	**CANC!**								

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-487				PR-488				PR-492				PR-493				PR-494			
			Sample Number:	PR0014				PR0015				PR0036				PR0037				PR0040			
			Sample Date:	23-Jul-09				23-Jul-09				24-Jul-09				24-Jul-09				27-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																							
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.0677	J	0.00		-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			0.0981	J	0.00		-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			0.0836	J	0.01		1.6		0.26		0.324		0.05		0.981		0.16	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			0.348		0.00	4.8E-07	2.15		0.02	3.0E-06	1.39		0.01	1.9E-06	1.43		0.01	2.0E-06
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			-	-			0.89		0.01	1.2E-06	0.453		0.01	6.3E-07	0.496		0.01	6.9E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.212		0.0001		0.844		0.0004		3.76		0.0017		1.19		0.0005		1.58		0.0007	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-			-	-		
Sample HI and ILCR						9.6E-05	0.0E+00			0.01744	4.8E-07			0.29717	4.2E-06			0.07267	2.6E-06			0.18159	2.7E-06

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-495				PR-496				PR-497				PR-498			
			Sample Number:	PR0041				PR0042				PR0043				PR0044			
			Sample Date:	27-Jul-09				27-Jul-09				27-Jul-09				27-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				REG				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																			
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			-	-			-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			-	-			-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	-	-			-	-			0.225		0.04		0.102	J	0.02	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	-	-			0.262		0.00	3.6E-07	0.31		0.00	4.3E-07	0.151	J	0.00	2.1E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			0.0599	J	0.00	8.3E-08	-	-			-	-		
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	0.25		0.0001		0.391		0.0002		0.991		0.0005		0.641		0.0003	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.00011	0.0E+00			0.00334	4.5E-07			0.03992	4.3E-07			0.01827	2.1E-07

Table C-2

Sample-by-Sample Cancer Risk and Noncancer Hazard Calculations
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

			Location:	PR-499				PR-499				PR-500				PR-501			
			Sample Number:	PR0045				PR-0047				PR0038				PR0039			
			Sample Date:	27-Jul-09				27-Jul-09				24-Jul-09				24-Jul-09			
			Sample Depth:	0 - 0 Ft				0 - 0 Ft				0 - 0 Ft				0 - 0 Ft			
			Sample Purpose:	REG				FS				REG				REG			
Parameter	Units	Noncancer-based RSL	Cancer-based RSL	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR	Result	VQ	HQ	ILCR
EXPLOSIVES																			
Amino-2,6-dinitrotoluene, 4-	mg/kg	150	NA	-	-			0.24		0.00		-	-			-	-		
Amino-4,6-dinitrotoluene, 2-	mg/kg	150	NA	-	-			0.26	J	0.00		-	-			-	-		
Dinitrobenzene, 1,3-	mg/kg	6.1	NA	4.27		0.70		5.5		0.90		-	-			0.323		0.05	
Dinitrotoluene, 2,4-	mg/kg	120	0.72	11.1		0.09	1.5E-05	17		0.14	2.4E-05	-	-			0.349		0.00	4.8E-07
Dinitrotoluene, 2,6-	mg/kg	61	0.72	-	-			1.3		0.02	1.8E-06	-	-			0.194		0.00	2.7E-07
RDX	mg/kg	NA	4.4	-	-			-	-			-	-			-	-		
Trinitrobenzene, 1,3,5-	mg/kg	2200	NA	14.5		0.0066		18		0.0082		0.858		0.0004		1.28		0.0006	
Trinitrotoluene, 2,4,6-	mg/kg	36	19	-	-			-	-			-	-			-	-		
Sample HI and ILCR						0.79909	1.5E-05			1.07613	2.5E-05			0.00039	0.0E+00			0.05962	7.5E-07
							CANC!				**CANC!**								

RSL = U.S. EPA Regional Screening Level (Novermber 2012); VQ = validation qualifier; HQ = hazard quotient; ILCR = incremental lifetime cancer risk; mg/kg = milligrams per kilogram; NA = not applicable; J = estimated concentration; HI =hazard index.

Notes:

1. Sample purpose "REG" is the regular sample, "FD" is the field duplicate, and "FS" is the field split.
2. "-" indicates that the analyte was not detected in this sample.
3. RDX is shown as detected in Sample PR-00515 at an estimated concentration of 8.1 mg/kg. Because RDX has no association with Plum Brook Ordnance Works and is a common false positive in samples from non-PBOW sites, the contribution of RDX is not included in the ILCR value for this sample.
4. A Sample HI Value with associated "NC!" below exceeds a value of 1 (rounded to one significant figure); HI value is shaded.
5. A Sample ILCR Value with associated "CANC!" below exceeds a value of 1E-5 (rounded to one significant figure); ILCR value is shaded.

Table C-3

Sample-by-Sample Cancer Risk Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE ILCR
May 2009 Sample Identification	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	
Cancer Risk-Based RSL:	**NA**		**NA**		**19**		**0.72**		**0.72**		**NA**		**NA**		
Rows North and South of NTCRA Excavation															
393	1.4		0.51		0	0.00E+00	0.37	5.14E-07	0	0.00E+00	0.084		0		5.1E-07
394	7.0		1.2		0	0.00E+00	5.4	7.50E-06	0.56	7.78E-07	0.38		0		8.3E-06
395	3.6		0.58		0	0.00E+00	2.9	4.03E-06	0.28	3.89E-07	0.36		0		4.4E-06
396	7.8		2.4		0.26	1.37E-08	5.5	7.64E-06	0.6	8.33E-07	0.77		0		8.5E-06
397	5.6		1.6		0.52	2.74E-08	5.8	8.06E-06	0.75	1.04E-06	0.76		0		9.1E-06
398	7.0		0		4.5	2.37E-07	19	2.64E-05	2.4	3.33E-06	0		0		**3.0E-05**
399	3.2		2.2		0	0.00E+00	4.1	5.69E-06	0.58	8.06E-07	0.37		0		6.5E-06
400	0.39		0		0	0.00E+00	2.1	2.92E-06	0.23	3.19E-07	0		0		3.2E-06
401	18		5.4		0	0.00E+00	17	2.36E-05	1.9	2.64E-06	1.6		0		**2.6E-05**
402	9.9		3.4		0	0.00E+00	9.6	1.33E-05	1.2	1.67E-06	0.74		0		**1.5E-05**
403	0.099		0.058		0	0.00E+00	0.8	1.11E-06	0	0.00E+00	0.098		0.11		1.1E-06
404	2.2		1.4		0	0.00E+00	2.6	3.61E-06	0.33	4.58E-07	0.39		0		4.1E-06
405	28		12		0.1	5.26E-09	33	4.58E-05	3.6	5.00E-06	2.0		0		**5.1E-05**
405dup	27		0		0	0.00E+00	30	4.17E-05	0	0.00E+00	0		0		**4.2E-05**
406	18		7.6		0	0.00E+00	18	2.50E-05	1.8	2.50E-06	0.98		0		**2.8E-05**
407	0.39		0.29		0.074	3.89E-09	0.88	1.22E-06	0	0.00E+00	0.21		0		1.2E-06
408	2.3		1.3		0	0.00E+00	2.8	3.89E-06	0.39	5.42E-07	0.38		0		4.4E-06
409	0.92		0.62		0.1	5.26E-09	1.5	2.08E-06	0.19	2.64E-07	0		0		2.4E-06
410	8.3		3.6		0	0.00E+00	8.7	1.21E-05	0.89	1.24E-06	0		0		1.3E-05
411	9.8		3.6		0	0.00E+00	6	8.33E-06	0.8	1.11E-06	0		0		9.4E-06
412	9.1		3.3		0	0.00E+00	5.7	7.92E-06	0.67	9.31E-07	0		0		8.8E-06
413	12		4.9		0	0.00E+00	5.7	7.92E-06	0.95	1.32E-06	1.1		0		9.2E-06
414	1.8		0.46		0	0.00E+00	1.3	1.81E-06	0.23	3.19E-07	0		0		2.1E-06
415	3.2		1.0		0	0.00E+00	4	5.56E-06	0.61	8.47E-07	0		0		6.4E-06
416	19		0		0	0.00E+00	16	2.22E-05	2.6	3.61E-06	0		0		**2.6E-05**
417	7.2		3.0		0	0.00E+00	7.5	1.04E-05	1.1	1.53E-06	0		0		1.2E-05
418	22		7.8		0	0.00E+00	19	2.64E-05	3.1	4.31E-06	2.0		0		**3.1E-05**
419	3.9		2.4		0	0.00E+00	4.6	6.39E-06	0.85	1.18E-06	0		0		7.6E-06
420	10		4.1		0	0.00E+00	10	1.39E-05	1.4	1.94E-06	0		0		**1.6E-05**
421	10		3.7		0	0.00E+00	9.7	1.35E-05	1.2	1.67E-06	0		0		**1.5E-05**
422	14		6		0.054	2.84E-09	16	2.22E-05	2.5	3.47E-06	0		0		**2.6E-05**
423	31		15		0.13	6.84E-09	27	3.75E-05	3.4	4.72E-06	1.9		0		**4.2E-05**
423dil	29		0		0	0.00E+00	26	3.61E-05	0	0.00E+00	0		0		**3.6E-05**
424	1.5		0.77		0.04	2.11E-09	2.9	4.03E-06	0.46	6.39E-07	0		0		4.7E-06
425	2.4		0.44		0	0.00E+00	1.8	2.50E-06	0.36	5.00E-07	0.19		0		3.0E-06
426	0		0.086		0.71	3.74E-08	0.21	2.92E-07	0.036	5.00E-08	0.23		0		3.8E-07
427	0		0.011		0.31	1.63E-08	0.12	1.67E-07	0.031	4.31E-08	0.25		0.22		2.3E-07
428	0.32		0.033		0.16	8.42E-09	0.14	1.94E-07	0.038	5.28E-08	0.25		0.31		2.6E-07
429	0.86		0		0	0.00E+00	0.062	8.61E-08	0	0.00E+00	39		0.088		8.6E-08
430	4.5		2.2		0	0.00E+00	8.9	1.24E-05	1.3	1.81E-06	0		0		1.4E-05
431	1.9		0		0	0.00E+00	4.1	5.69E-06	0.66	9.17E-07	0.49		0		6.6E-06
432	0.067		0		0	0.00E+00	0.16	2.22E-07	0	0.00E+00	0		0		2.2E-07
433	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
434	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
435	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00

Table C-3

Sample-by-Sample Cancer Risk Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE ILCR
May 2009 Sample Identification	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	
Cancer Risk-Based RSL:	**NA**		**NA**		**19**		**0.72**		**0.72**		**NA**		**NA**		
436	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
437	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
438	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
439	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
440	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
441	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
442	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
443	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
444	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
445	0		0		0	0.00E+00	0.052	7.22E-08	0	0.00E+00	0		0		7.2E-08
446	6.7		0		0	0.00E+00	1.3	1.81E-06	0.26	3.61E-07	0.4		0		2.2E-06
447	0.3		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0.063		0.082		0.0E+00
448	0.078		0.019		0.49	2.58E-08	0.067	9.31E-08	0	0.00E+00	0.046		0.46		1.2E-07
449	0		0.036		0	0.00E+00	0.16	2.22E-07	0	0.00E+00	0.038		0		2.2E-07
450	0.071		0		0	0.00E+00	0.11	1.53E-07	0	0.00E+00	0.075		0.12		1.5E-07
451	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
452	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
453	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
454	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
455	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
456	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
457	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
458	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
459	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
460	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0.060		0.0E+00
461	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
462	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
463	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
30-Foot Step-Out						0		0		0.0000					0
10001	1800		50		0	0.00E+00	43	5.97E-05	0	0.00E+00	99		0		**6.0E-05**
10002	1200		77		0	0.00E+00	1400	1.94E-03	280	3.89E-04	260		0		**2.3E-03**
10003	660		0		0	0.00E+00	150	2.08E-04	89	1.24E-04	160		240		**3.3E-04**
10004	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10006	0		31		38	2.00E-06	42	5.83E-05	0	0.00E+00	0		0		**6.0E-05**
10014	20000		5900		560	2.95E-05	22000	3.06E-02	3000	4.17E-03	0		0		**3.5E-02**
10015	16		0		0	0.00E+00	7.8	1.08E-05	0.52	7.22E-07	0		0		1.2E-05
10021	1.3		0.88		0	0.00E+00	2.1	2.92E-06	0.3	4.17E-07	0		0		3.3E-06
10022	17		3.6		0	0.00E+00	8.2	1.14E-05	1.2	1.67E-06	0.56		0		1.3E-05
10023	14		4.5		0.27	1.42E-08	8.5	1.18E-05	1.1	1.53E-06	0		0		1.3E-05
10025	12		3.3		0	0.00E+00	5.7	7.92E-06	0.44	6.11E-07	0		0		8.5E-06
10026	2.5		0.46		0	0.00E+00	1.5	2.08E-06	0	0.00E+00	0		0		2.1E-06
10027	200		0		0	0.00E+00	85	1.18E-04	0	0.00E+00	160		0		**1.2E-04**
10096	560		530		0	0.00E+00	1500	2.08E-03	240	3.33E-04	170		0		**2.4E-03**
10097	600		64		170	8.95E-06	94	1.31E-04	0	0.00E+00	120		240		**1.4E-04**
10098	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10099	0		0		77	4.05E-06	0	0.00E+00	0	0.00E+00	32		0		4.1E-06

Table C-3

Sample-by-Sample Cancer Risk Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE ILCR
May 2009 Sample Identification	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	**(mg/kg)**	**ILCR**	
Cancer Risk-Based RSL:	**NA**		**NA**		**19**		**0.72**		**0.72**		**NA**		**NA**		
10100	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10101	140		0		230	1.21E-05	58	8.06E-05	0	0.00E+00	260		300		**9.3E-05**
10102	700		430		26000	1.37E-03	480	6.67E-04	96	1.33E-04	6400		2900		**2.2E-03**
10102dup	0		0		26000	1.37E-03	0	0.00E+00	0	0.00E+00	0		0		**1.4E-03**
10103	340		310		0	0.00E+00	1300	1.81E-03	160	2.22E-04	0		0		**2.0E-03**
10104	15000		0		380	2.00E-05	14000	1.94E-02	2000	2.78E-03	0		0		**2.2E-02**
10105	0		440		0	0.00E+00	1900	2.64E-03	220	3.06E-04	270		380		**2.9E-03**
10106	27000		4700		280	1.47E-05	15000	2.08E-02	2000	2.78E-03	0		0		**2.4E-02**
10106dup	27000		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10107	5900		0		0	0.00E+00	7600	1.06E-02	1100	1.53E-03	0		0		**1.2E-02**
10108	9100		3400		0	0.00E+00	7400	1.03E-02	1200	1.67E-03	0		0		**1.2E-02**
10109	0		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10110	1.2		0		1.5	7.89E-08	1.5	2.08E-06	0.26	3.61E-07	0.68		0		2.5E-06
10111	12		5.4		0	0.00E+00	14	1.94E-05	1.9	2.64E-06	2.3		0		**2.2E-05**
10112	2.2		0		0	0.00E+00	9.8	1.36E-05	1.0	1.39E-06	0		0		**1.5E-05**
10113	0.88		0.41		0	0.00E+00	1.3	1.81E-06	0.26	3.61E-07	0.27		0.25		2.2E-06
10114	7.7		2		0	0.00E+00	4.7	6.53E-06	0.46	6.39E-07	0		0		7.2E-06
10115	10		2.0		0	0.00E+00	4.0	5.56E-06	0.48	6.67E-07	0.42		0		6.2E-06
10116	7.7		2.1		0	0.00E+00	2.7	3.75E-06	0.21	2.92E-07	0.03		0		4.0E-06
10117	400		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10118	82		0		0	0.00E+00	79	1.10E-04	0	0.00E+00	0		0		**1.1E-04**
10119	530		0		0	0.00E+00	0	0.00E+00	0	0.00E+00	0		0		0.0E+00
10120	420		0		0	0.00E+00	270	3.75E-04	71	9.86E-05	81		0		**4.7E-04**
10121	620		0		0	0.00E+00	50	6.94E-05	0	0.00E+00	59		0		**6.9E-05**
10122	400		79		0	0.00E+00	82	1.14E-04	0	0.00E+00	83		100		**1.1E-04**
10123	1400		130		0	0.00E+00	310	4.31E-04	110	1.53E-04	200		220		**5.8E-04**
10124	1700		460		63	3.32E-06	420	5.83E-04	0	0.00E+00	380		480		**5.9E-04**
60-Foot Step-Out															
10137	0		0		0	0	0	0	0	0	0		0		0.0E+00
10129	0.21		0		0.76	4.00E-08	0.32	4.44E-07	0.32	4.44E-07	0.45		0.66		9.3E-07
10157	2.2		0.026		0	0	0	0	0	0	0		0		0.0E+00
90-Foot Step-Out															
10182	3.2		1.2		10	5.26E-07	1.6	2.22E-06	0.46	6.39E-07	1.1		1.2		3.4E-06
10069	0		0		0	0	0	0	0	0	0		0		0.0E+00
10089	0		0		0	0	0	0	0	0	0		0		0.0E+00
10196	1.5		0.42		0.14	7.37E-09	1.6	2.22E-06	0.21	2.92E-07	0.30		0		2.5E-06
MAXIMUM	27000		5900		26000		22000		3000		6400		2900		
MAXIMUM minus 30' step-outs	3.2		1.2		10		1.6		0.46		1.1		1.2		

RSL = U.S. EPA November 2012 Regional Screening Level; 2-ADNT = 2-amino-4,6-dinitrotoluene; 4-ADNT = 4-amino-2,6-dinitrotoluene; mg/kg = concentration in milligrams per kilogram; ILCR = incremental lifetime cancer risk;
NA = not applicable; dup = duplicate sample; dil = sample run as a dilution; "0" = analyte was not detected in associated sample.

NOTE: Bold, shaded values indicate that the sample ILCR value exceeds 1E-5 (rounded to one significant figure).

Source of Analytical Data: McTech Corp, 2009, Non-Time Critical Removal Action Report, Soil Excavation, Composting, and Disposal, Pentolite Road Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio, April.

Table C-4

Sample-by-Sample Noncancer Hazard Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

May 2009 Sample Identification	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE HI
Noncancer Risk-Based RSL:	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	**(mg/kg)**	**HQ**	
Rows North and South of NTCRA Excavation	2200		6.1		36		120		61		150		150		
393	1.4	0.0006	0.51	0.0836	0	0.0000	0.37	0.0031	0	0.0000	0.084	0.0006	0	0.0000	0.088
394	7.0	0.0032	1.2	0.1967	0	0.0000	5.4	0.0450	0.56	0.0092	0.38	0.0025	0	0.0000	0.257
395	3.6	0.0016	0.58	0.0951	0	0.0000	2.9	0.0242	0.28	0.0046	0.36	0.0024	0	0.0000	0.128
396	7.8	0.0035	2.4	0.3934	0.26	0.0072	5.5	0.0458	0.6	0.0098	0.77	0.0051	0	0.0000	0.465
397	5.6	0.0025	1.6	0.2623	0.52	0.0144	5.8	0.0483	0.75	0.0123	0.76	0.0051	0	0.0000	0.345
398	7.0	0.0032	0	0.0000	4.5	0.1250	19	0.1583	2.4	0.0393	0	0.0000	0	0.0000	0.326
399	3.2	0.0015	2.2	0.3607	0	0.0000	4.1	0.0342	0.58	0.0095	0.37	0.0025	0	0.0000	0.408
400	0.39	0.0002	0	0.0000	0	0.0000	2.1	0.0175	0.23	0.0038	0	0.0000	0	0.0000	0.021
401	18	0.0082	5.4	0.8852	0	0.0000	17	0.1417	1.9	0.0311	1.6	0.0107	0	0.0000	1.077
402	9.9	0.0045	3.4	0.5574	0	0.0000	9.6	0.0800	1.2	0.0197	0.74	0.0049	0	0.0000	0.666
403	0.099	0.0000	0.058	0.0095	0	0.0000	0.8	0.0067	0	0.0000	0.098	0.0007	0.11	0.0007	0.018
404	2.2	0.0010	1.4	0.2295	0	0.0000	2.6	0.0217	0.33	0.0054	0.39	0.0026	0	0.0000	0.260
405	28	0.0127	12	1.9672	0.1	0.0028	33	0.2750	3.6	0.0590	2.0	0.0133	0	0.0000	**2.330**
405dup	27	0.0123	0	0.0000	0	0.0000	30	0.2500	0	0.0000	0	0.0000	0	0.0000	0.262
406	18	0.0082	7.6	1.2459	0	0.0000	18	0.1500	1.8	0.0295	0.98	0.0065	0	0.0000	1.440
407	0.39	0.0002	0.29	0.0475	0.074	0.0021	0.88	0.0073	0	0.0000	0.21	0.0014	0	0.0000	0.059
408	2.3	0.0010	1.3	0.2131	0	0.0000	2.8	0.0233	0.39	0.0064	0.38	0.0025	0	0.0000	0.246
409	0.92	0.0004	0.62	0.1016	0.1	0.0028	1.5	0.0125	0.19	0.0031	0	0.0000	0	0.0000	0.120
410	8.3	0.0038	3.6	0.5902	0	0.0000	8.7	0.0725	0.89	0.0146	0	0.0000	0	0.0000	0.681
411	9.8	0.0045	3.6	0.5902	0	0.0000	6	0.0500	0.8	0.0131	0	0.0000	0	0.0000	0.658
412	9.1	0.0041	3.3	0.5410	0	0.0000	5.7	0.0475	0.67	0.0110	0	0.0000	0	0.0000	0.604
413	12	0.0055	4.9	0.8033	0	0.0000	5.7	0.0475	0.95	0.0156	1.1	0.0073	0	0.0000	0.879
414	1.8	0.0008	0.46	0.0754	0	0.0000	1.3	0.0108	0.23	0.0038	0	0.0000	0	0.0000	0.091
415	3.2	0.0015	1.0	0.1639	0	0.0000	4	0.0333	0.61	0.0100	0	0.0000	0	0.0000	0.209
416	19	0.0086	0	0.0000	0	0.0000	16	0.1333	2.6	0.0426	0	0.0000	0	0.0000	0.185
417	7.2	0.0033	3.0	0.4918	0	0.0000	7.5	0.0625	1.1	0.0180	0	0.0000	0	0.0000	0.576
418	22	0.0100	7.8	1.2787	0	0.0000	19	0.1583	3.1	0.0508	2.0	0.0133	0	0.0000	**1.511**
419	3.9	0.0018	2.4	0.3934	0	0.0000	4.6	0.0383	0.85	0.0139	0	0.0000	0	0.0000	0.447
420	10	0.0045	4.1	0.6721	0	0.0000	10	0.0833	1.4	0.0230	0	0.0000	0	0.0000	0.783
421	10	0.0045	3.7	0.6066	0	0.0000	9.7	0.0808	1.2	0.0197	0	0.0000	0	0.0000	0.712
422	14	0.0064	6	0.9836	0.054	0.0015	16	0.1333	2.5	0.0410	0	0.0000	0	0.0000	1.166
423	31	0.0141	15	2.4590	0.13	0.0036	27	0.2250	3.4	0.0557	1.9	0.0127	0	0.0000	**2.770**
423dil	29	0.0132	0	0.0000	0	0.0000	26	0.2167	0	0.0000	0	0.0000	0	0.0000	0.230
424	1.5	0.0007	0.77	0.1262	0.04	0.0011	2.9	0.0242	0.46	0.0075	0	0.0000	0	0.0000	0.160
425	2.4	0.0011	0.44	0.0721	0	0.0000	1.8	0.0150	0.36	0.0059	0.19	0.0013	0	0.0000	0.095
426	0	0.0000	0.086	0.0141	0.71	0.0197	0.21	0.0018	0.036	0.0006	0.23	0.0015	0	0.0000	0.038
427	0	0.0000	0.011	0.0018	0.31	0.0086	0.12	0.0010	0.031	0.0005	0.25	0.0017	0.22	0.0015	0.015
428	0.32	0.0001	0.033	0.0054	0.16	0.0044	0.14	0.0012	0.038	0.0006	0.25	0.0017	0.31	0.0021	0.016
429	0.86	0.0004	0	0.0000	0	0.0000	0.062	0.0005	0	0.0000	39	0.2600	0.088	0.0006	0.261
430	4.5	0.0020	2.2	0.3607	0	0.0000	8.9	0.0742	1.3	0.0213	0	0.0000	0	0.0000	0.458
431	1.9	0.0009	0	0.0000	0	0.0000	4.1	0.0342	0.66	0.0108	0.49	0.0033	0	0.0000	0.049
432	0.067	0.0000	0	0.0000	0	0.0000	0.16	0.0013	0	0.0000	0	0.0000	0	0.0000	0.001
433	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
434	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
435	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000

Table C-4

Sample-by-Sample Noncancer Hazard Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

May 2009 Sample Identification	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE HI
Noncancer Risk-Based RSL:	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	
Rows North and South of NTCRA Excavation	2200		6.1		36		120		61		150		150		
436	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
437	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
438	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
439	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
440	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
441	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
442	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
443	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
444	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
445	0	0.0000	0	0.0000	0	0.0000	0.052	0.0004	0	0.0000	0	0.0000	0	0.0000	0.0004
446	6.7	0.0030	0	0.0000	0	0.0000	1.3	0.0108	0.26	0.0043	0.4	0.0027	0	0.0000	0.021
447	0.3	0.0001	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.063	0.0004	0.082	0.0005	0.001
448	0.078	0.0000	0.019	0.0031	0.49	0.0136	0.067	0.0006	0	0.0000	0.046	0.0003	0.46	0.0031	0.021
449	0	0.0000	0.036	0.0059	0	0.0000	0.16	0.0013	0	0.0000	0.038	0.0003	0	0.0000	0.007
450	0.071	0.0000	0	0.0000	0	0.0000	0.11	0.0009	0	0.0000	0.075	0.0005	0.12	0.0008	0.002
451	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
452	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
453	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
454	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
455	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
456	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
457	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
458	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
459	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
460	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.060	0.0004	0.000
461	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
462	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
463	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
30-Foot Step-Out		0		0		0		0		0.0000		0		0.0000	0
10001	1800	0.8182	50	8.1967	0	0.0000	43	0.3583	0	0.0000	99	0.6600	0	0.0000	**10.03**
10002	1200	0.5455	77	12.6230	0	0.0000	1400	11.6667	280	4.5902	260	1.7333	0	0.0000	**31.16**
10003	660	0.3000	0	0.0000	0	0.0000	150	1.2500	89	1.4590	160	1.0667	240	1.6000	**5.68**
10004	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10006	0	0.0000	31	5.0820	38	1.0556	42	0.3500	0	0.0000	0	0.0000	0	0.0000	**6.49**
10014	20000	9.0909	5900	967.2131	560	15.5556	22000	183.3333	3000	49.1803	0	0.0000	0	0.0000	**1224.37**
10015	16	0.0073	0	0.0000	0	0.0000	7.8	0.0650	0.52	0.0085	0	0.0000	0	0.0000	0.08
10021	1.3	0.0006	0.88	0.1443	0	0.0000	2.1	0.0175	0.3	0.0049	0	0.0000	0	0.0000	0.17
10022	17	0.0077	3.6	0.5902	0	0.0000	8.2	0.0683	1.2	0.0197	0.56	0.0037	0	0.0000	0.69
10023	14	0.0064	4.5	0.7377	0.27	0.0075	8.5	0.0708	1.1	0.0180	0	0.0000	0	0.0000	0.84
10025	12	0.0055	3.3	0.5410	0	0.0000	5.7	0.0475	0.44	0.0072	0	0.0000	0	0.0000	0.60
10026	2.5	0.0011	0.46	0.0754	0	0.0000	1.5	0.0125	0	0.0000	0	0.0000	0	0.0000	0.09
10027	200	0.0909	0	0.0000	0	0.0000	85	0.7083	0	0.0000	160	1.0667	0	0.0000	**1.87**
10096	560	0.2545	530	86.8852	0	0.0000	1500	12.5000	240	3.9344	170	1.1333	0	0.0000	**104.71**
10097	600	0.2727	64	10.4918	170	4.7222	94	0.7833	0	0.0000	120	0.8000	240	1.6000	**18.67**
10098	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00

Table C-4

Sample-by-Sample Noncancer Hazard Calculations
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

May 2009 Sample Identification	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT		SAMPLE HI
Noncancer Risk-Based RSL:	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	(mg/kg)	HQ	
Rows North and South of NTCRA Excavation	2200		6.1		36		120		61		150		150		
10099	0	0.0000	0	0.0000	77	2.1389	0	0.0000	0	0.0000	32	0.2133	0	0.0000	**2.35**
10100	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10101	140	0.0636	0	0.0000	230	6.3889	58	0.4833	0	0.0000	260	1.7333	300	2.0000	**10.67**
10102	700	0.3182	430	70.4918	26000	722.2222	480	4.0000	96	1.5738	6400	42.6667	2900	19.3333	**860.61**
10102dup	0	0.0000	0	0.0000	26000	722.2222	0	0.0000	0	0.0000	0	0.0000	0	0.0000	**722.22**
10103	340	0.1545	310	50.8197	0	0.0000	1300	10.8333	160	2.6230	0	0.0000	0	0.0000	**64.43**
10104	15000	6.8182	0	0.0000	380	10.5556	14000	116.6667	2000	32.7869	0	0.0000	0	0.0000	**166.83**
10105	0	0.0000	440	72.1311	0	0.0000	1900	15.8333	220	3.6066	270	1.8000	380	2.5333	**95.90**
10106	27000	12.2727	4700	770.4918	280	7.7778	15000	125.0000	2000	32.7869	0	0.0000	0	0.0000	**948.33**
10106dup	27000	12.2727	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	**12.27**
10107	5900	2.6818	0	0.0000	0	0.0000	7600	63.3333	1100	18.0328	0	0.0000	0	0.0000	**84.05**
10108	9100	4.1364	3400	557.3770	0	0.0000	7400	61.6667	1200	19.6721	0	0.0000	0	0.0000	**642.85**
10109	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10110	1.2	0.0005	0	0.0000	1.5	0.0417	1.5	0.0125	0.26	0.0043	0.68	0.0045	0	0.0000	0.06
10111	12	0.0055	5.4	0.8852	0	0.0000	14	0.1167	1.9	0.0311	2.3	0.0153	0	0.0000	1.05
10112	2.2	0.0010	0	0.0000	0	0.0000	9.8	0.0817	1.0	0.0164	0	0.0000	0	0.0000	0.10
10113	0.88	0.0004	0.41	0.0672	0	0.0000	1.3	0.0108	0.26	0.0043	0.27	0.0018	0.25	0.0017	0.09
10114	7.7	0.0035	2	0.3279	0	0.0000	4.7	0.0392	0.46	0.0075	0	0.0000	0	0.0000	0.38
10115	10	0.0045	2.0	0.3279	0	0.0000	4.0	0.0333	0.48	0.0079	0.42	0.0028	0	0.0000	0.38
10116	7.7	0.0035	2.1	0.3443	0	0.0000	2.7	0.0225	0.21	0.0034	0.03	0.0002	0	0.0000	0.37
10117	400	0.1818	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.18
10118	82	0.0373	0	0.0000	0	0.0000	79	0.6583	0	0.0000	0	0.0000	0	0.0000	0.70
10119	530	0.2409	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.24
10120	420	0.1909	0	0.0000	0	0.0000	270	2.2500	71	1.1639	81	0.5400	0	0.0000	**4.14**
10121	620	0.2818	0	0.0000	0	0.0000	50	0.4167	0	0.0000	59	0.3933	0	0.0000	1.09
10122	400	0.1818	79	12.9508	0	0.0000	82	0.6833	0	0.0000	83	0.5533	100	0.6667	**15.04**
10123	1400	0.6364	130	21.3115	0	0.0000	310	2.5833	110	1.8033	200	1.3333	220	1.4667	**29.13**
10124	1700	0.7727	460	75.4098	63	1.7500	420	3.5000	0	0.0000	380	2.5333	480	3.2000	**87.17**
60-Foot Step-Out														0.0000	
10137	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.000
10129	0.21	0.0001	0	0.0000	0.76	0.0211	0.32	0.0027	0.32	0.0052	0.45	0.0030	0.66	0.0044	0.037
10157	2.2	0.0010	0.026	0.0043	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.005
90-Foot Step-Out														0.0000	
10182	3.2	0.0015	1.2	0.1967	10	0.2778	1.6	0.0133	0.46	0.0075	1.1	0.0073	1.2	0.0080	0.51
10069	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10089	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.00
10196	1.5	0.0007	0.42	0.0689	0.14	0.0039	1.6	0.0133	0.21	0.0034	0.30	0.0020	0	0.0000	0.09

RSL = U.S. EPA November 2012 Regional Screening Level; 2-ADNT = 2-amino-4,6-dinitrotoluene; 4-ADNT = 4-amino-2,6-dinitrotoluene; mg/kg = concentration in milligrams per kilogram; HQ = hazard quotient; HI = hazard index; NA = not applicable; dup = duplicate sample; dil = sample run as a dilution; "0" = analyte was not detected in associated sample.

NOTE: Bold, shaded values indicate that the sample HI value exceeds 1 (rounded to one significant figure).

Source of Analytical Data: McTech Corp, 2009, Non-Time Critical Removal Action Report, Soil Excavation, Composting, and Disposal, Pentolite Road Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio, April.

APPENDIX D

DATA VALIDATION SUMMARIES

Data Validation Summary Report
Pentolite Road Sampling November 2010
Former Plum Brook Ordnance Works
Sandusky, Ohio

1.0 Introduction

Level IV data validation was performed on 100 percent of the environmental soil samples collected for the November 2010 Pentolite Road sampling events. The analytical data consisted of one sample delivery group (F78128), which was analyzed by Accutest of Orlando, Florida. In addition, validation of the field-split data, one SDG (A0K170493), which was analyzed by Test America, was performed and findings are discussed in section 5.0 of this report.

The following samples were validated for this investigation:

SDG Number	Sample Number
F78128	PR0200, PR0201, PR0202, PR0203, PR0204, PR0205, PR0206, PR0207, PR0208, PR0209, PR0210, PR0212, PR0213, PR0214, PR0215, PR0216, PR0217, PR0218, PR0219, PR0220, PR0222, PR0223, PR0224, PR0225, PR0226, PR0227, PR0228, PR0229, PR0230, PR0231, PR0232, PR0233, PR0234, PR0235, PR0236, PR0237, PR0239, PR0240, PR0241, PR0242, PR0243

The chemical parameter, for which the samples were analyzed, is identified below:

Parameter (Prep/Analytical Method)
Nitroaromatic and Nitramine Explosives by SW846 8330M

2.0 Procedures

The sample data were validated following the logic identified in the EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Review (June 2008) for all areas except blanks. EPA Region III Modifications to National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration (September 1994) were applied to the areas associated with blank contamination. Specific quality control (QC) criteria as identified in the quality assurance plan (QAP), analytical methods, and laboratory standard operating procedures (SOP) were applied to all sample results. As a result of the use of Update III SW846 test methods for the analytical data and the application of the Contract Laboratory Program (CLP) guidelines during the validation process, there were instances where the specific QC requirements for all target compounds were not defined. This primarily occurred in the organic, GC/MS calibration areas and is due to the fact that the analytical methods are performance-based and allow the use of average calibration responses in lieu of individual responses, which are defined by CLP protocol. In light of applying CLP guidelines to SW846 methods and evaluating the usability of the data during the validation process, specific QC criteria were determined to address all target compounds and are identified in this report for each parameter, as well as in the validation checklists, which function as worksheets. For those analytical methods not addressed by the CLP and Region III guidelines, the validation was based on the method requirements (i.e.,

SW846, Code of Federal Regulations, SOPs) and technical judgment, following the logic of the CLP validation guidelines. Lab-specific criteria may be found in Attachment A.

3.0 Summary of Data Validation Findings

The overall quality of the data was determined to be acceptable with minimal qualifications. None of the data were rejected.

An individual validation report has been prepared for the parameter analyzed, and the overall results of the validation findings are summarized in this report. A listing of the validation qualifiers and the reason codes, along with their definitions, is found in Attachment A. The following section highlights the key findings of the data validation.

4.0 Analysis-Specific Data Validation Summaries

4.1 Nitroaromatic and Nitroamine Explosives by SW846 8330

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The initial calibration (ICAL) and continuing calibrations (CCAL) associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits.

Matrix Spike/Matrix Spike Duplicate

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis was performed for the project samples, and all QC criteria were met with the following exception(s):

SDG Number	Samples Affected	Compound(s)	Validation Qualifier
F78128	PR0203	1,3,5-Trinitrobenzene	J

Laboratory Control Sample

Laboratory Control Sample (LCS) analysis was performed for the project samples and all QC criteria were met.

Field Duplicates
Original and field duplicate results were evaluated and no problems were identified with the following exception(s):

SDG	Samples Affected	Compound(s)	Validation Qualifier
F78128	PR0209(original), PR0210(FD)	1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4-Dinitrotoluene, RDX	J
	PR0219(original), PR0220(FD)	2,4-Dinitrotoluene	

Second Column Confirmation
Samples having analytes with positive detects were verified on a second confirmation column; and all QC criteria (40% RPD) were met.

SDG	Samples Affected	Compound(s)	Validation Qualifier
F78128	PR0200	2,4,6-Trinitrotoluene	J
	PR0209, PR0231	1,3-Dinitrobenzene	
	PR0215, PR0240, PR0243	4-amino-2,6-Dinitrotoluene	
	PR0222, PR0242	2,6-Dinitrotoluene	
	PR0232, PR0227	2,4-Dinitrotoluene	
	PR0220	RDX	

Quantitation
Results quantitated between the method detection limit (MDL) and the reporting limit (RL), which the lab qualified as “J”, were qualified as estimated “J” unless blank contamination was present or the results were rejected.

The analyte RDX could not be confirmed in the following samples because of high levels of 1,3,5-trinitrobenzene: PR0200, PR0201, PR0202, PR0203, PR0204, PR0205, PR0206, PR0207, PR0208, PR0209, PR0210, PR0212, PR0213, PR0214, PR0215, and PR0216. These data were qualified as estimated (J).

5.0 Quality Assurance Field Split Sample Data Evaluation

Data from the quality assurance split samples, (SDG: A0K170493), were validated. The field split (FS) samples were analyzed for Explosives by SW846 Method 8330. The following section highlights the key findings of the data validation for this analysis.

The following samples were validated for this site investigation:

SDG Number	Sample Number
A0K170493	PR0211, PR0221, PR0238

5.1 Nitroaromatic and Nitroamine Explosives by SW846 8330

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The initial calibration (ICAL) and continuing calibrations (CCAL) associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits with the following exception(s):

SDG Number	Samples Affected	Analyte	Validation Qualifier
A0K170493	PR0211	(All positives) 1,3,5-Trinitrobenzene, 2,4,6-Trinitrotoluene, 2,4-Dinitrotoluene	J

Matrix Spike/Matrix Spike Duplicate

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample

Laboratory Control Sample (LCS) analysis was performed for the project samples and all QC criteria were met.

Second Column Confirmation

Samples having analytes with positive detects were verified on a second confirmation column; QC criteria (40% RPD) were met with the following exception(s):

SDG Number	Samples Affected	Analyte	Validation Qualifier
A0K170493	PR0211	2,4,6-Trinitrotoluene	J

Field Splits

Original and field split results were evaluated. Table 2 of the Data Quality Evaluation found in Appendix G shows the comparison of original, field duplicate and field split samples. No action was taken to qualify data based on sample/field split RPD performance. Explosives by SW846 8330 analysis was performed on the original, field duplicate and field split samples listed below.

Sample/FD/FS
PR0209 (Original) / PR0210 (FD) / PR0211 (FS)
PR0219 (Original) / PR0220 (FD) / PR0221 (FS)
PR0236 (Original) / PR0237 (FD) / PR0238 (FS)

Quantitation

Results quantitated between the method detection limit (MDL) and the reporting limit (RL), which the lab qualified as “J”, were qualified as estimated “J” unless blank contamination was present or the results were rejected.

Data Validation Summary Report
Pentolite Road Sampling May – November 2009
Former Plum Brook Ordnance Works
Sandusky, Ohio

1.0 Introduction

Level IV data validation was performed on 100 percent of the environmental samples collected for the July, August, October, and November 2009 PWRRP sampling events. The analytical data consisted of seven sample delivery groups (F67482, F69034, F69700, F66987, F66924, and F67052), which were analyzed by Accutest of Orlando, Florida. In addition, validation of the field-split data, four SDGs (A9H210260, A9G290123, A9G250125, and A9G310186), which were analyzed by Test America, was performed and findings are discussed in section 5.0 of this report. Water and soil matrices were validated.

The following samples were validated for this investigation:

SDG Number	Sample Number
F67482	PR0050, PR0051, PR0052, PR0053, PR0054, PR0056, PR0057, PR0058, PR0059, PR0060, PR0061, PR0062, PR0063, PR0064, PR0065, PR0066, PR0068, PR0070, PR0071, PR0072, PR0073
F69034	PR-00507, PR-00508, PR-00509, PR-00510, PR-00511, PR-00512
F69700	PR-00513, PR-00514, PR-00515, PR-00516
F66987	PR0017, PR0018, PR0019, PR0020, PR0021, PR0022, PR0023, PR0024, PR0025, PR0026, PR0027, PR0028, PR0029, PR0030, PR0031, PR0032, PR0034
F66924	PR0001, PR0002, PR0004, PR0005, PR0006, PR0007, PR0008, PR0009, PR0010, PR0011, PR0012, PR0013, PR0014, PR0015, PR0016
F67052	PR0036, PR0037, PR0038, PR0039, PR0040, PR0041, PR0042, PR0043, PR0044, PR0045, PR0046

The chemical parameters, for which the samples were analyzed, are identified below:

Parameter (Prep/Analytical Method)
Nitroaromatic and Nitramine Explosives by SW846 8330M

GC/MS – Gas chromatography/mass spectrometry.

2.0 Procedures

The sample data were validated following the logic identified in the EPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (October 2004) and the EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Review (June 2008) for all areas except blanks. EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (April 1993) and Region III Modifications to National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration (September 1994) were applied to the areas associated with blank contamination. Specific quality control (QC) criteria as identified in the quality assurance plan (QAP), analytical methods, and laboratory standard operating procedures (SOP) were applied to all sample results. As a result of the use of Update III SW846 test methods for the analytical data and the application of the Contract Laboratory Program (CLP) guidelines during

the validation process, there were instances where the specific QC requirements for all target compounds were not defined. This primarily occurred in the organic, GC/MS calibration areas and is due to the fact that the analytical methods are performance-based and allow the use of average calibration responses in lieu of individual responses, which are defined by CLP protocol. In light of applying CLP guidelines to SW846 methods and evaluating the usability of the data during the validation process, specific QC criteria were determined to address all target compounds and are identified in this report for each parameter, as well as in the validation checklists, which function as worksheets. For those analytical methods not addressed by the CLP and Region III guidelines, the validation was based on the method requirements (i.e., SW846, Code of Federal Regulations, SOPs) and technical judgment, following the logic of the CLP validation guidelines. Lab-specific criteria may be found in Attachment A.

3.0 Summary of Data Validation Findings

The overall quality of the data was determined to be acceptable with minimal qualifications. The only rejected data ("R" qualified) was due to samples having analytes with more than one set of results. Those analyte(s) were rejected to indicate that a given result should not be used to characterize a particular constituent or an analysis for a given sample.

Individual validation reports have been prepared for each parameter, and the overall results of the validation findings are summarized in this report. A listing of the validation qualifiers and the reason codes, along with their definitions, is found in Attachment A. The following section highlights the key findings of the data validation for each analysis.

4.0 Analysis-Specific Data Validation Summaries

4.1 Nitroaromatic and Nitroamine Explosives by SW846 8330

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The initial calibration (ICAL) and continuing calibrations (CCAL) associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits, with the following exception(s):

SDG Number	Samples Affected	Compound(s)	Validation Qualifier
F66924	PR0011	1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4-Dinitrotoluene , 2,4,6-Trinitrotoluene, 2-amino-4,6-Dinitrotoluene,	J
F69700	PR-00513, PR-00514, PR-00515	1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4-Dinitrotoluene	J
	PR-00515	RDX	J

Matrix Spike/Matrix Spike Duplicate

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis was performed for the project samples, and all QC criteria were met with the following exception(s):

SDG Number	Samples Affected	Compound(s)	Validation Qualifier
F67482	PR0065	2,4-Dinitrotoluene*, 2,6-Dinitrotoluene*	J
F69034	PR-00507	2,4-Dinitrotoluene	J
F66987	PR0031	4-Amino-2,6-dinitrotoluene, 2-Amino-4,6-dinitrotoluene	UJ

*Analytes were qualified for %RPD outside QC limits for the MS/MSD analysis.

Laboratory Control Sample

Laboratory Control Sample (LCS) analysis was performed for the project samples and all QC criteria were met.

Field Duplicates

Original and field duplicate results were evaluated and no problems were identified with the following exception(s):

SDG	Samples Affected	Compound(s)	Validation Qualifier
F67482	PR0053(original), PR0054(FD)	1,3,5-Trinitrobenzene, 1,3-Dinitrobenzene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene	J
	PR0065original), PR0066(FD)		

Second Column Confirmation

Samples having analytes with positive detects were verified on a second confirmation column; and all QC criteria (40% RPD) were met.

Quantitation

Results quantitated between the method detection limit (MDL) and the reporting limit (RL), which the lab qualified as “J”, were qualified as estimated “J” unless blank contamination was present or the results were rejected.

5.0 Quality Assurance Field Split Sample Data Evaluation

Data from the quality assurance split samples, (SDGs: A9H210260, A9G290123, A9G250125 and A9G310186), were validated. The field split (FS) samples were analyzed for Explosives by SW846 Method 8330. The following section highlights the key findings of the data validation for each analysis.

The following samples were validated for this site investigation:

SDG Number	Sample Number
A9H210260	PR0055, PR0067
A9G290123	PR0033, PR0035
A9G250125	PR0003
A9G310186	PR-0047

5.1 Nitroaromatic and Nitroamine Explosives by SW846 8330

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The initial calibration (ICAL) and continuing calibrations (CCAL) associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits.

Matrix Spike/Matrix Spike Duplicate

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample

Laboratory Control Sample (LCS) analysis was performed for the project samples and all QC criteria were met.

Second Column Confirmation

Samples having analytes with positive detects were verified on a second confirmation column; QC criteria (40% RPD) were met with the following exception(s):

SDG Number	Samples Affected	Analyte	Validation Qualifier
A9H210260	PR0067	2,6-Dinitrotoluene	J
A9G250125	PR0003	4-amino-4,6-Dinitrotoluene, 4-Nitrotoluene	J
A9G310186	PR-0047	4-amino-4,6-Dinitrotoluene, 4-Nitrotoluene	J

Field Splits

Parent sample and field split sample results were evaluated. Table 2 of the Data Quality Evaluation found in Appendix G shows the comparison of original, field duplicate and field split samples. No action was taken to qualify data based on sample/field split RPD performance. Explosives by SW846 8330 analysis was performed on the original and field split samples listed below.

Sample/FD/FS
PR0053 (Original) / PR0054 (FD) / PR0055 (FS)
PR0065 (Original) / PR0066 (FD) / PR0067 (FS)
PR0031 (Original) / PR0032 (FD) / PR0033 (FS)
PR0018 (Original) / PR0034 (FD) / PR0035 (FS)
PR0001 (Original) / PR0002 (FD) / PR0003 (FS)
PR0045 (Original) / PR0046 (FD) / PR-0047(FS)

Quantitation

Results quantitated between the method detection limit (MDL) and the reporting limit (RL), which the lab qualified as “J”, were qualified as estimated “J” unless blank contamination was present or the results were rejected.

ATTACHMENT A

Summary of Data Validation Reason Codes
Former Plum Brook Ordnance Works
Sandusky, Ohio

Reason Code	Description
01	Sample received outside of 4+/-2 degrees Celsius
01A	Improper sample preservation
02	Holding Time Exceeded
02A	Extraction
02B	Analysis
03	Instrument Performance - Outside Criteria
03A	BFB
03B	DFTPP
03C	DDT and/or Endrin % breakdown exceeds criteria
03D	retention time windows
03E	Resolution
04	Initial Calibration results outside specified criteria
04A	Compound mean RRF<0.05
04B	Compound %RSD>30
04C	Correlation Coefficient<0.995
05	Continuing Calibration results outside specified criteria
05A	Compound mean RRF<0.05
05B	Compound %D>25
06	Result qualified as a result of the 5x/10x blank correction
06A	Method or Preparation Blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate Recoveries outside control limits
07A	Sample
07B	Associated method blank or LCS
08	MS/MSD/Duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	%RPD outside acceptance criteria (precision)
09	Post Digestion Spike outside criteria (GFAA)
10	Internal Standards outside specified control limits
10A	Recovery
10B	Retention Time
11	Laboratory Control Sample recoveries outside specified control limits
11A	Recovery
11B	%RPD (if run in duplicate)
12	Interference Check Standard
13	Serial Dilution
14	Tentatively Identified Compounds
15	Quantitation
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria exceeded
18	Percent difference between original and second column > 25%
19	Professional judgement was used to qualify the data
20	Pesticide clean-up checks
21	Target compound identification
22	Radiological calibration
23	Radiological quantitation
24	Reported result and/or lab qualifier revised to reflect validation findings
999	See hard copy for details.

Laboratory and Validation Qualifier Definitions
Former Plum Brook Ordnance Works
Sandusky, Ohio

Qualifier	Definition
Laboratory	
B (metals)	The analyte was detected; the concentration is below the reporting limit.
B (organics)	Indicates analyte is found in associated method blank.
J (metals)	The compound was detected in the blank.
J (organics)	The compound was positively identified; the reported value is below the reporting limit.
U	Not detected. The compound was analyzed for, but not detected above the associated reporting limit.
E	Indicates that the result is above the maximum calibration range.
N	Indicates presumptive evidence of a compound.
P	RPD > 40% between the primary and confirmation column results for dual column chromatographic method (e.g. GC and HPLC methods).
COL	RPD > 40% between the primary and confirmation column results for dual column chromatographic method (e.g. GC and HPLC methods).

Validation	
B	The compound/analyte was detected in a lab or field blank.
J	The compound/analyte was positively identified; the reported value is an estimated concentration.
U	Not detected. The compound/analyte was analyzed for, but not detected above the associated reporting limit.
UJ	The analyte is not detected; the result is an estimated value.
R	Analyte is rejected.

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works

Spiked Compound	Accutest			Test America		
	Soil - LCS	Soil - MS/MSD		Soil - LCS	Soil - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
Nitroaromatics and Nitroamines, SW-846 8330						
HMX	75 - 156	75 - 156	27	75 - 125	75 - 125	N/A
RDX	77 - 131	77 - 131	28	70 - 135	70 - 135	N/A
1,3-Dinitrobenzene	82 - 134	82 - 134	20	80 - 125	80 - 125	N/A
2,6-Dinitrotoluene	86 - 142	86 - 142	17	80 - 120	80 - 120	N/A
2,4-Dinitrotoluene	74 - 129	74 - 129	18	80 - 125	80 - 125	N/A
2-amino-4,6-Dinitrotoluene	83 - 123	83 - 123	22	80 - 125	80 - 125	N/A
4-amino-2,6-Dinitrotoluene	85 - 137	85 - 137	18	80 - 125	80 - 125	N/A
Nitrobenzene	82 - 138	82 - 138	19	75 - 125	75 - 125	N/A
o-Nitrotoluene	85 - 129	85 - 129	21	75 - 120	75 - 120	N/A
m-Nitrotoluene	85 - 136	85 - 136	22	80 - 125	80 - 125	N/A
p-Nitrotoluene	86 - 133	86 - 133	19	75 - 125	75 - 125	N/A
Tetryl	53 - 124	53 - 124	22	10 - 150	10 - 150	N/A
1,3,5-Trinitrobenzene	81 - 138	81 - 138	24	75 - 125	75 - 125	N/A
2,4,6-Trinitrotoluene	70 - 137	70 - 137	29	55 - 140	55 - 140	N/A

LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
N/A - Not Applicable

APPENDIX E

CHEMICAL ANALYTICAL DATA SUMMARY

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PR-00502			PR-00503			PR-00504			PR-00505			PR-00505			PR-00505			PR-00506			PR-00507			PR-00508		
Sample Number:		PR0050			PR0051			PR0052			PR0053			PR0054			PR0055			PR0056			PR-00507			PR-00508		
Sample Date:		18-Aug-09			18-Aug-09			18-Aug-09			18-Aug-09			18-Aug-09			18-Aug-09			18-Aug-09			21-Oct-09			21-Oct-09		
Sample Depth:		0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 0 Ft			0 - 0 Ft		
Sampel Purpose:		REG			REG			REG			REG			FD			FS			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluene	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.321			0.51	U	U	0.25	U	U	0.102	J	J	0.18	U	U	0.14	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.167	J	J	0.15	U	U	0.15	U	U	0.25			0.413			0.25	U	U	0.102	J	J	0.18	U	U	0.14	U	U
Dinitrobenzene, 1,3-	mg/kg	0.0959	J	J	7.36			5.97			0.0797	J	J	0.995		J	0.25	U	U	0.0904	J	J	1.09			6.09		
Dinitrotoluene, 2,4-	mg/kg	2.06			12.9			13.1			1.01		J	6.75		J	0.25	U	U	0.827			4.09		J	15.2		
Dinitrotoluene, 2,6-	mg/kg	0.18	U	U	0.3	U	U	0.6	U	U	0.106	J	J	1.12		J	0.25	U	U	0.18	U	U	0.24			0.973		
HMX	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.25	U	U	0.18	U	U	0.18	U	U	0.14	U	U
Nitrobenzene	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.25	U	U	0.18	U	U	0.18	U	U	0.14	U	U
Nitrotoluene, 2-	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.25	U	U	0.18	U	U	0.18	U	U	0.14	U	U
Nitrotoluene, 3-	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.5	U	U	0.18	U	U	0.18	U	U	0.14	U	U
Nitrotoluene, 4-	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.4	U	U	0.18	U	U	0.18	U	U	0.14	U	U
RDX	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.25	U	U	0.18	U	U	0.18	U	U	0.14	U	U
Tetryl	mg/kg	0.18	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.5	U	U	0.18	U	U	0.18	U	U	0.14	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.75			23.5			32			0.115	J	J	1.53		J	0.25	U	U	0.16	J	J	2.54			18.1		
Trinitrotoluene, 2,4,6-	mg/kg	0.0602	J	J	0.15	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.25	U	U	0.18	U	U	0.18	U	U	0.3		

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PR-00509			PR-00510			PR-00511			PR-00512			PR-00513			PR-00514			PR-00515			PR-00516		
Sample Number:		PR-00509			PR-00510			PR-00511			PR-00512			PR-00513			PR-00514			PR-00515			PR-00516		
Sample Date:		21-Oct-09			21-Oct-09			21-Oct-09			21-Oct-09			19-Nov-09			19-Nov-09			19-Nov-09			19-Nov-09		
Sample Depth:		0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
Sampel Purpose:		REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																									
Amino-2,6-dinitrotoluene	mg/kg	1.4			0.15	U	U	0.15	U	U	0.15	U	U	0.32	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Dinitrobenzene, 1,3-	mg/kg	5.32			2.78			1.25			0.572			9.62		J	6.86		J	6.62		J	0.919		
Dinitrotoluene, 2,4-	mg/kg	11.6			4.4			4.41			0.538			22.5		J	13.5		J	16.5		J	2.33		
Dinitrotoluene, 2,6-	mg/kg	0.6	U	U	0.308			0.562			0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
HMX	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Nitrobenzene	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Nitrotoluene, 2-	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Nitrotoluene, 3-	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Nitrotoluene, 4-	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
RDX	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	8.1		J	0.15	U	U
Tetryl	mg/kg	0.15	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U
Trinitrobenzene, 1,3,5-	mg/kg	16.9			4.12			3.67			0.717			40.4		J	31.2		J	30.2		J	3.29		
Trinitrotoluene, 2,4,6-	mg/kg	0.15	U	U	0.15	U	U	0.0613	J	J	0.15	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.15	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PR-10035			PR-10036			PR-10037			PR-10040			PR-10060			PR-10125			PR-10126			PR-10127			PR-10128		
Sample Number:		PR0025			PR0028			PR0030			PR0068			PR0017			PR0026			PR0027			PR0029			PR0031		
Sample Date:		24-Jul-09			24-Jul-09			24-Jul-09			19-Aug-09			24-Jul-09			24-Jul-09			23-Jul-09			24-Jul-09			24-Jul-09		
Sample Depth:		0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			2 - 12 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
Sampel Purpose:		REG			REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluene	mg/kg	0.17	U	U	0.17	U	U	0.385			0.0577	J	J	0.16	U	U	0.18	U	U	0.17	U	U	0.0503	J	J	0.14	U	UJ
Amino-4,6-dinitrotoluene	mg/kg	0.17	U	U	0.17	U	U	0.33			0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	UJ
Dinitrobenzene, 1,3-	mg/kg	0.362			0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Dinitrotoluene, 2,4-	mg/kg	0.298			0.17	U	U	0.364			0.14	U	U	0.121	J	J	0.363			0.159	J	J	0.0675	J	J	0.14	U	U
Dinitrotoluene, 2,6-	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
HMX	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Nitrobenzene	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Nitrotoluene, 2-	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Nitrotoluene, 3-	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Nitrotoluene, 4-	mg/kg	0.17	U	U	0.17	U	U	0.0892	J	J	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
RDX	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Tetryl	mg/kg	0.17	U	U	0.17	U	U	0.17	U	U	0.14	U	U	0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U
Trinitrobenzene, 1,3,5-	mg/kg	1.47			1.66			0.628			0.14	U	U	0.235			0.236			0.17	U	U	0.19			0.14	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.17	U	U	0.17	U	U	1.99			0.167			0.16	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.14	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PR-10128			PR-10128			PR-10132			PR-10133			PR-10134			PR-10135			PR-10136			PR-10138		
	Sample Number:	PR0032			PR0033			PR0060			PR0061			PR0062			PR0063			PR0072			PR0057		
	Sample Date:	24-Jul-09			24-Jul-09			19-Aug-09			19-Aug-09			19-Aug-09			19-Aug-09			19-Aug-09			19-Aug-09		
	Sample Depth:	0 - 0 Ft			0 - 0 Ft			1 - 11 Ft			4 - 14 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft		
	Sampel Purpose:	FD			FS			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																									
Amino-2,6-dinitrotoluene	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.112	J	J	0.48	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.35		
Dinitrobenzene, 1,3-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	1.93		
Dinitrotoluene, 2,4-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	5.44		
Dinitrotoluene, 2,6-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.32	U	U
HMX	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
Nitrobenzene	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
Nitrotoluene, 2-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
Nitrotoluene, 3-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
Nitrotoluene, 4-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
RDX	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
Tetryl	mg/kg	0.18	U	U	0.3	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.18	U	U	0.2	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.0508	J	J	3.58		
Trinitrotoluene, 2,4,6-	mg/kg	0.18	U	U	0.2	U	U	0.888			0.185			0.16	U	U	0.17	U	U	0.15	U	U	0.16	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PR-10139			PR-10140			PR-10149			PR-10158			PR-10158			PR-10158			PR-10159			PR-10160			PR-10161		
Sample Number:		PR0058			PR0059			PR0016			PR0018			PR0034			PR0035			PR0019			PR0020			PR0021		
Sample Date:		19-Aug-09			19-Aug-09			22-Jul-09			24-Jul-09			24-Jul-09			24-Jul-09			24-Jul-09			24-Jul-09			24-Jul-09		
Sample Depth:		0 - 10 Ft			0 - 10 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
Sampel Purpose:		REG			REG			REG			REG			FD			FS			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluene	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.14	U	U	0.15	U	U	0.0923	J	J	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Dinitrobenzene, 1,3-	mg/kg	4.07			0.45	U	U	0.813			0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Dinitrotoluene, 2,4-	mg/kg	9.65			3.89			2.02			0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Dinitrotoluene, 2,6-	mg/kg	0.84	U	U	0.45	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
HMX	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Nitrobenzene	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Nitrotoluene, 2-	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Nitrotoluene, 3-	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Nitrotoluene, 4-	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
RDX	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Tetryl	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.3	U	U	0.16	U	U	0.15	U	U	0.16	U	U
Trinitrobenzene, 1,3,5-	mg/kg	9.16			3.58			1.47			0.0433	J	J	0.0583	J	J	0.2	U	U	0.16	U	U	0.15	U	U	0.138	J	J
Trinitrotoluene, 2,4,6-	mg/kg	0.14	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.15	U	U	0.2	U	U	0.16	U	U	0.15	U	U	0.16	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PR-10162			PR-10163			PR-10164			PR-10174			PR-10175			PR-10176			PR-10178A			PR-10179		
	Sample Number:	PR0022			PR0023			PR0024			PR0004			PR0005			PR0006			PR0073			PR0070		
	Sample Date:	24-Jul-09			24-Jul-09			24-Jul-09			23-Jul-09			23-Jul-09			23-Jul-09			19-Aug-09			19-Aug-09		
	Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 10 Ft			0 - 10 Ft		
	Sampel Purpose:	REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																									
Amino-2,6-dinitrotoluene	mg/kg	0.18	U	U	0.116	J	J	0.322			0.18	U	U	0.14	U	U	0.197			0.0569	J	J	0.16	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.18	U	U	0.17	U	U	0.214			0.18	U	U	0.14	U	U	0.345			0.16	U	U	0.16	U	U
Dinitrobenzene, 1,3-	mg/kg	0.18	U	U	0.17	U	U	0.241			0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Dinitrotoluene, 2,4-	mg/kg	0.18	U	U	0.0737	J	J	0.802			0.18	U	U	0.14	U	U	0.218			0.16	U	U	0.16	U	U
Dinitrotoluene, 2,6-	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
HMX	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Nitrobenzene	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Nitrotoluene, 2-	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Nitrotoluene, 3-	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Nitrotoluene, 4-	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
RDX	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Tetryl	mg/kg	0.18	U	U	0.17	U	U	0.17	U	U	0.18	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.18	U	U	0.345			0.468			0.18	U	U	0.14	U	U	0.0457	J	J	0.16	U	U	0.16	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.18	U	U	0.17	U	U	0.0459	J	J	0.18	U	U	0.14	U	U	1.75			0.0692	J	J	0.16	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PR-10180			PR-10181			PR-10183			PR-10183			PR-10183			PR-10184			PR-477			PR-478			PR-479		
	Sample Number:	PR0071			PR0064			PR0065			PR0066			PR0067			PR0007			PR0011			PR0010			PR0008		
	Sample Date:	19-Aug-09			19-Aug-09			19-Aug-09			19-Aug-09			19-Aug-09			23-Jul-09			22-Jul-09			22-Jul-09			22-Jul-09		
	Sample Depth:	0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
	Sampel Purpose:	REG			REG			REG			FD			FS			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluene	mg/kg	0.14	U	U	0.18	U	U	0.0584	J	J	0.17	U	U	0.25	U	U	0.16	U	U	1.8	U	U	0.14	U	U	0.14	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.182			0.25	U	U	0.229			9.04		J	0.14	U	U	0.14	U	U
Dinitrobenzene, 1,3-	mg/kg	0.14	U	U	0.18	U	U	0.0949	J	J	2.54		J	1.2			4.38			8.45		J	0.822			0.0594	J	J
Dinitrotoluene, 2,4-	mg/kg	0.14	U	U	0.18	U	U	0.491		J	10.6		J	8			8.77			16.7		J	0.677			0.14	U	U
Dinitrotoluene, 2,6-	mg/kg	0.14	U	U	0.18	U	U	0.124	J	J	1.56		J	0.79	COL	J	0.48	U	U	1.8	U	U	0.425			0.14	U	U
HMX	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.25	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
Nitrobenzene	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.25	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
Nitrotoluene, 2-	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.25	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
Nitrotoluene, 3-	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.5	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
Nitrotoluene, 4-	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.4	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
RDX	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.25	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
Tetryl	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.5	U	U	0.16	U	U	0.18	U	U	0.14	U	U	0.14	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.14	U	U	0.18	U	U	0.161		J	4.39		J	3			9.07			6.68		J	3.62			0.324		
Trinitrotoluene, 2,4,6-	mg/kg	0.14	U	U	0.18	U	U	0.15	U	U	0.17	U	U	0.25	U	U	0.16	U	U	0.121	J	J	0.14	U	U	0.14	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PR-480			PR-480			PR-480			PR-481			PR-482			PR-486			PR-487			PR-488		
Sample Number:		PR0001			PR0002			PR0003			PR0009			PR0012			PR0013			PR0014			PR0015		
Sample Date:		22-Jul-09			22-Jul-09			22-Jul-09			22-Jul-09			22-Jul-09			23-Jul-09			23-Jul-09			23-Jul-09		
Sample Depth:		0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
Sampel Purpose:		REG			FD			FS			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																									
Amino-2,6-dinitrotoluene	mg/kg	0.32	U	U	0.36	U	U	0.32	COL	J	0.34	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.0677	J	J
Amino-4,6-dinitrotoluene	mg/kg	0.185			0.203			0.2	U	U	0.411			0.246			0.0953	J	J	0.15	U	U	0.17	U	U
Dinitrobenzene, 1,3-	mg/kg	4.47			4.55			4.8			9.33			2.07			5.1			0.15	U	U	0.0836	J	J
Dinitrotoluene, 2,4-	mg/kg	8.82			9.79			10	D		16.8			6.29			3.84			0.15	U	U	0.348		
Dinitrotoluene, 2,6-	mg/kg	0.48	U	U	0.72	U	U	1			1.5	U	U	0.34	U	U	0.34	U	U	0.15	U	U	0.17	U	U
HMX	mg/kg	0.16	U	U	0.18	U	U	0.2	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
Nitrobenzene	mg/kg	0.16	U	U	0.18	U	U	0.2	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
Nitrotoluene, 2-	mg/kg	0.16	U	U	0.18	U	U	0.2	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
Nitrotoluene, 3-	mg/kg	0.16	U	U	0.18	U	U	0.2	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
Nitrotoluene, 4-	mg/kg	0.16	U	U	0.18	U	U	0.34	COL	J	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
RDX	mg/kg	0.16	U	U	0.18	U	U	0.2	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
Tetryl	mg/kg	0.16	U	U	0.18	U	U	0.3	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U
Trinitrobenzene, 1,3,5-	mg/kg	12.4			13.7			14	D		11.4			6.64			6.72			0.212			0.844		
Trinitrotoluene, 2,4,6-	mg/kg	0.0608	J	J	0.18	U	U	0.2	U	U	0.17	U	U	0.17	U	U	0.17	U	U	0.15	U	U	0.17	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PR-492			PR-493			PR-494			PR-495			PR-496			PR-497			PR-498			PR-499			PR-499		
Sample Number:		PR0036			PR0037			PR0040			PR0041			PR0042			PR0043			PR0044			PR0045			PR0046		
Sample Date:		24-Jul-09			24-Jul-09			27-Jul-09			27-Jul-09			27-Jul-09			27-Jul-09			27-Jul-09			27-Jul-09			27-Jul-09		
Sample Depth:		0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
Sampel Purpose:		REG			REG			REG			REG			REG			REG			REG			REG			FD		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluene	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Amino-4,6-dinitrotoluene	mg/kg	0.0981	J	J	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Dinitrobenzene, 1,3-	mg/kg	1.6			0.324			0.981			0.15	U	U	0.15	U	U	0.225			0.102	J	J	4.27			3.29		
Dinitrotoluene, 2,4-	mg/kg	2.15			1.39			1.43			0.15	U	U	0.262			0.31			0.151	J	J	11.1			8.6		
Dinitrotoluene, 2,6-	mg/kg	0.89			0.453			0.496			0.15	U	U	0.0599	J	J	0.15	U	U	0.18	U	U	0.7	U	U	0.3	U	U
HMX	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Nitrobenzene	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Nitrotoluene, 2-	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Nitrotoluene, 3-	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Nitrotoluene, 4-	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
RDX	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Tetryl	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U
Trinitrobenzene, 1,3,5-	mg/kg	3.76			1.19			1.58			0.25			0.391			0.991			0.641			14.5			11		
Trinitrotoluene, 2,4,6-	mg/kg	0.18	U	U	0.18	U	U	0.17	U	U	0.15	U	U	0.15	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.15	U	U

Table E-1

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Area
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PR-499			PR-500			PR-501			PRWP-SO020			PRWP-SO022			PRWP-SO024		
	Sample Number:	PR-0047			PR0038			PR0039			PR0200			PR0201			PR0202		
	Sample Date:	27-Jul-09			24-Jul-09			24-Jul-09			8-Nov-10			8-Nov-10			8-Nov-10		
	Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
	Sampel Purpose:	FS			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																			
Amino-2,6-dinitrotoluen	mg/kg	0.24			0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Amino-4,6-dinitrotoluen	mg/kg	0.26	COL	J	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Dinitrobenzene, 1,3-	mg/kg	5.5			0.15	U	U	0.323			21.7			8.25			0.175	J	J
Dinitrotoluene, 2,4-	mg/kg	17	D		0.15	U	U	0.349			50.1			16.4			0.36	U	U
Dinitrotoluene, 2,6-	mg/kg	1.3			0.15	U	U	0.194			1.7	U	U	0.58	U	U	0.18	U	U
HMX	mg/kg	0.2	U	U	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Nitrobenzene	mg/kg	0.2	U	U	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Nitrotoluene, 2-	mg/kg	0.2	U	U	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Nitrotoluene, 3-	mg/kg	0.2	U	U	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Nitrotoluene, 4-	mg/kg	0.45	COL	J	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
RDX	mg/kg	0.2	U	U	0.15	U	U	0.15	U	U	21.3		J	8.37		J	0.21		J
Tetryl	mg/kg	0.3	U	U	0.15	U	U	0.15	U	U	1.7	U	U	0.58	U	U	0.18	U	U
Trinitrobenzene, 1,3,5-	mg/kg	18	D		0.858			1.28			74			28.9			1.72		
Trinitrotoluene, 2,4,6-	mg/kg	0.2	U	U	0.15	U	U	0.15	U	U	9.74		J	0.58	U	U	0.18	U	U

Lab Qualifiers (LQ)
U - Compound not detected above reporting limit; quantitation limit given.
J - Estimated result detected above method detection limit but below reporting limit.
COL - Greater than 40% difference between the two GC columns.
D - Reported result taken from analysis of a diluted sample.

Validation Qualifiers (VQ)
U - Not detected. The compound/analyte was analzyed for but not detected above the associated reporting limit.
J - The compound/analyte was positively identified; the reported value is the estimated concentration of the compound/analyte detected in the sample analyzed.
UJ - The compound/analyte was analyzed for but not detected above the associated reporting limit.

FD - Field duplicate sample.
FS - Field split sample.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
HMX - Cyclotetramethylenetetranitramine.
RDX - Cyclotrimethylenetrinitramine.

Table E-2

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Areas
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PRWP-SO026			PRWP-SO027			PRWP-SO028			PRWP-SO029			PRWP-SO030			PRWP-SO031			PRWP-SO035			PRWP-SO035			PRWP-SO035		
Sample Number:		PR0203			PR0204			PR0205			PR0206			PR0207			PR0208			PR0209			PR0210			PR0211		
Sample Date:		9-Nov-10			9-Nov-10			9-Nov-10			9-Nov-10			9-Nov-10			9-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10		
Sample Depth:		1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
Sampel Purpose:		REG			REG			REG			REG			REG			REG			REG			FD			FS		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluen	mg/kg	0.73	U	U	0.28	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.152	J	J	0.16	U	U	0.24	PG U	U
Amino-4,6-dinitrotoluen	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.29	U	U
Dinitrobenzene, 1,3-	mg/kg	12.6			3.61			1.62			1.61			1.13			0.497			0.131	J	J	0.658		J	0.24	U	U
Dinitrotoluene, 2,4-	mg/kg	36.3			9.28			2.37			3.58			2.05			0.492			5.08		J	1.02		J	0.31		J
Dinitrotoluene, 2,6-	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.24	U	U
HMX	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.24	CON	U
Nitrobenzene	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.24	U	U
Nitrotoluene, 2-	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.24	U	U
Nitrotoluene, 3-	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.24	U	U
Nitrotoluene, 4-	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.48	U	U
RDX	mg/kg	9.81		J	1.52		J	0.714		J	1.21		J	1.57		J	0.47		J	0.801		J	0.351		J	0.24	U	U
Tetryl	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.24	U	U
Trinitrobenzene, 1,3,5-	mg/kg	43.4		J	11.4			6.29			7.27			5.67			2.55			5.31		J	2.27		J	1.6		J
Trinitrotoluene, 2,4,6-	mg/kg	0.73	U	U	0.14	U	U	0.15	U	U	0.16	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.76	PG	J

Table E-2

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Areas
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PRWP-SO040			PRWP-SO041			PRWP-SO042			PRWP-SO043			PRWP-SO044			PRWP-SO045			PRWP-SO053			PRWP-SO055			PRWP-SO055		
	Sample Number:	PR0212			PR0213			PR0214			PR0215			PR0216			PR0217			PR0218			PR0219			PR0220		
	Sample Date:	10-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10		
	Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
	Sampel Purpose:	REG			REG			REG			REG			REG			REG			REG			REG			FD		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluen	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.118	J	J	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Amino-4,6-dinitrotoluen	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Dinitrobenzene, 1,3-	mg/kg	3.08			1.46			0.558			0.431			0.204			0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Dinitrotoluene, 2,4-	mg/kg	5.51			1.69			0.518			2.52			0.725			0.16	U	U	0.16	U	U	0.72		J	0.402		J
Dinitrotoluene, 2,6-	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
HMX	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Nitrobenzene	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Nitrotoluene, 2-	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Nitrotoluene, 3-	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Nitrotoluene, 4-	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
RDX	mg/kg	2.35		J	0.321		J	0.449		J	0.7		J	0.308		J	0.11	J	J	0.118	J	J	0.15	U	U	0.298		J
Tetryl	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U
Trinitrobenzene, 1,3,5-	mg/kg	10.5			3.52			4			6.01			1.34			0.437			0.407			2.13			1.42		
Trinitrotoluene, 2,4,6-	mg/kg	0.16	U	U	0.16	U	U	0.15	U	U	0.16	U	U	0.17	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.18	U	U

Table E-2

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Areas
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PRWP-SO055			PRWP-SO056			PRWP-SO057			PRWP-SO058			PRWP-SO061			PRWP-SO062			PRWP-SO063			PRWP-SO064			PRWP-SO065		
	Sample Number:	PR0221			PR0222			PR0223			PR0224			PR0225			PR0226			PR0227			PR0228			PR0229		
	Sample Date:	11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10		
	Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
	Sampel Purpose:	FS			REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluen	mg/kg	0.25	PG U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
Amino-4,6-dinitrotoluen	mg/kg	0.3	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.186			0.14	U	U	0.259		
Dinitrobenzene, 1,3-	mg/kg	0.25	U	U	0.602			1.15			0.557			1.43			0.279			0.16	U	U	0.14	U	U	0.17	U	U
Dinitrotoluene, 2,4-	mg/kg	0.81			0.777			3.58			1.66			1.81			0.28	U	U	0.101	J	J	1.19			0.789		
Dinitrotoluene, 2,6-	mg/kg	0.25	PG U	U	0.115	J	J	0.36	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
HMX	mg/kg	0.25	CON	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
Nitrobenzene	mg/kg	0.25	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
Nitrotoluene, 2-	mg/kg	0.25	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
Nitrotoluene, 3-	mg/kg	0.25	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
Nitrotoluene, 4-	mg/kg	0.5	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
RDX	mg/kg	0.25	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.32	U	U	0.14	U	U	0.17	U	U
Tetryl	mg/kg	0.25	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U
Trinitrobenzene, 1,3,5-	mg/kg	2.4			2.69			3.35			1.91			3.62			0.843			1.11			3.19			3.02		
Trinitrotoluene, 2,4,6-	mg/kg	0.25	U	U	0.15	U	U	0.18	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.16	U	U	0.14	U	U	0.17	U	U

Table E-2

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Areas
Plum Brook Ordnance Works, Sandusky, Ohio

Location:		PRWP-SO066			PRWP-SO067			PRWP-SO068			PRWP-SO070			PRWP-SO071			PRWP-SO072			PRWP-SO073			PRWP-SO073			PRWP-SO073		
Sample Number:		PR0230			PR0231			PR0232			PR0233			PR0234			PR0235			PR0236			PR0237			PR0238		
Sample Date:		11-Nov-10			11-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10		
Sample Depth:		1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			#NAME?		
Sampel Purpose:		REG			REG			REG			REG			REG			REG			REG			FD			FS		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																												
Amino-2,6-dinitrotoluen	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	PG U	U
Amino-4,6-dinitrotoluen	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.3	U	U
Dinitrobenzene, 1,3-	mg/kg	0.185			0.624		J	0.388			1.05			1.25			0.258			0.18	U	U	0.15	U	U	0.25	U	U
Dinitrotoluene, 2,4-	mg/kg	2.26			5.35			0.629		J	2.41			7.3			0.638			0.18	U	U	0.15	U	U	0.25	U	U
Dinitrotoluene, 2,6-	mg/kg	0.15	U	U	0.32	U	U	0.15	U	U	0.34	U	U	1.44			0.17	U	U	0.18	U	U	0.15	U	U	0.25	U	U
HMX	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	CON	U
Nitrobenzene	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	U	U
Nitrotoluene, 2-	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	U	U
Nitrotoluene, 3-	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	U	U
Nitrotoluene, 4-	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.5	U	U
RDX	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	U	U
Tetryl	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.16	U	U	0.17	U	U	0.18	U	U	0.15	U	U	0.25	U	U
Trinitrobenzene, 1,3,5-	mg/kg	2.17			6.26			1.74			4.2			8.27			1.1			0.231			0.334			0.25	PG U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.15	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.317			0.17	U	U	0.18	U	U	0.15	U	U	0.25	PG U	U

Table E-2

Chemical Analytical Data Summary
Pentolite Road Red Water Pond Areas
Plum Brook Ordnance Works, Sandusky, Ohio

	Location:	PRWP-SO074			PRWP-SO075			PRWP-SO076			PRWP-SO077			PRWP-SO078		
	Sample Number:	PR0239			PR0240			PR0241			PR0242			PR0243		
	Sample Date:	12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10		
	Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
	Sampel Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluen	mg/kg	0.16	U	U	1.78		J	0.85	U	U	0.17	U	U	1.03		J
Amino-4,6-dinitrotoluen	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
Dinitrobenzene, 1,3-	mg/kg	0.16	U	U	4.83			5.37			3.87			1.79		
Dinitrotoluene, 2,4-	mg/kg	0.16	U	U	10.5			11.1			4.33			3.88		
Dinitrotoluene, 2,6-	mg/kg	0.16	U	U	1.1			1.25			0.511		J	0.19	U	U
HMX	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
Nitrobenzene	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
Nitrotoluene, 2-	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
Nitrotoluene, 3-	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
Nitrotoluene, 4-	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
RDX	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	1.9	U	U
Tetryl	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.19	U	U
Trinitrobenzene, 1,3,5-	mg/kg	1.54			22.1			27.2			12.3			7.58		
Trinitrotoluene, 2,4,6-	mg/kg	0.16	U	U	0.14	U	U	0.17	U	U	0.17	U	U	0.38	U	U

Lab Qualifiers (LQ)
U - Compound not detected above reporting limit; quantitation limit given.
J - Estimated result detected above method detection limit but below reporting limit.
D - Reported result taken from analysis of a diluted sample.
P - Greater than 40% difference between the two GC columns.
CON - Confirmation analysis performed.

Validation Qualifiers (VQ)
U - Not detected. The compound/analyte was analzyed for but not detected above the associated reporting limit.
J - The compound/analyte was positively identified; the reported value is the estimated concentration of the compound/analyte detected in the sample analyzed.
UJ - The compound/analyte was analyzed for but not detected above the associated reporting limit.

FD - Field duplicate sample.
FS - Field split sample.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
HMX - Cyclotetramethylenetetranitramine.
RDX - Cyclotrimethylenetrinitramine.

APPENDIX F

DATA QUALITY EVALUATIONS

DATA QUALITY EVALUATION

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List of Acronyms

AR/COC	analysis request/chain of custody
CCAL	continuing calibration
CFR	Code of Federal Regulations
CI	chemical investigation
DI	deionized
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ICAL	initial calibration
ICS	Interference Check Sample
ID	identification
LCS	laboratory control sample
MB	material blank or method blank
MDL	method detection limit
MQL	method quantitation limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NFG	national functional guidelines
PBOW	Plum Brook Ordnance Works
PQL	practical quanitation limit
QA/QC	quality assurance/quality control
SAP	quality assurance project plan
RI	remedial investigation
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SOP	standard operating procedures
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compounds

1.0 Introduction

This appendix presents results of the quality assurance/quality control (QA/QC) measures implemented for the sampling and analysis activities at the Plum Brook Ordnance Works (PBOW), Sandusky, Ohio. The quality indicators from every aspect of the data collection were reviewed, and an assessment of the data with regard to project-specific objectives is presented. Successful execution of project-specific objectives and procedures provides strong support for the acceptance of the data generated as adequate for the purpose of evaluating the analytical results from this assessment at PBOW.

Shaw Environmental, Inc. (Shaw) conducted investigative work at the Pentolite Road Red Water Pond (PRRWP) area in July and August of 2009. Primary and field duplicate project samples collected in July and August 2009 were analyzed by Accutest Laboratories, of Orlando, Florida. Field splits were analyzed by Test America, Inc., Canton, Ohio. Analysis for nitroaromatic field split samples was performed by Test America of Denver, Colorado. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the *EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, June 2008 (EPA, 2008) and *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004 (EPA, 2004), the QAPP (Shaw, 2008c), 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). The criteria for blank evaluation were based on those detailed in *Region III Modifications to National Functional Guidelines for Organic Data Review*, September 1994 (EPA, 1994b) and *Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA, 1993). Since these documents specify procedures for Contract Laboratory Program (CLP) data, they are used as guidelines only. Method and laboratory quality assurance and quality control requirements supercede these guidelines, where applicable. 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). To verify that these DQOs 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 defined in the SAP. The results of this review are presented in the

following sections, with all analytical outliers or nonconformances discussed where they occurred.

This report is divided into three subsections. Section 2.0 discusses the field investigation and QC procedures used during the sampling effort. Section 3.0 outlines the analytical program and the associated QC activities performed. The final part of this document, Section 4.0, summarizes the data findings and their overall impact on the usability of the analytical data.

2.0 Field Sampling and Quality Control Activities

Shaw was retained by the U. S. Army Corps of Engineers, Nashville District to conduct investigative and sampling activities at PBOW. Field activities at this site included collection of soil, groundwater samples. The collection of these samples and their associated QC samples are discussed in this section of the Data Quality Evaluation (DQE).

Sixty-eight project and six field duplicate soil samples were submitted to Accutest for analysis. Sample shipments from the field were performed under custody and documented using standard Shaw Analysis Request/Chain of Custody (AR/COC) forms. These forms provided project-specific analytical specifications and QC instructions to the laboratory. A formal COC transfer record was prepared and included with these forms to document custody during sample transportation, storage, and disposition by the laboratory. Table 1 summarizes the field sample number, location, sample type, date of collection, lot number, and laboratory for each sample collected.

2.1 Trip Blanks

Aqueous samples designated for volatile organic compound (VOC) analysis may be susceptible to contamination by diffusion of organic compounds into the sample container. Trip blanks are analyzed in order to assess the potential for contamination to be introduced to an aqueous volatile sample during transport and handling procedures. A trip blank is a sample of analyte free deionized (DI) water that is prepared at the laboratory, shipped to the field with sample containers, and returned to the laboratory with the water matrix samples receiving VOC analysis. A trip blank is then analyzed for volatile organics using the same sample preparation and analysis procedures used for the actual field samples.

Only soil samples were collected and analyzed for nitroaromatics for the PRRWP area. No trip blanks were required.

2.2 Equipment Rinsates

Equipment rinsates are used to assess the effectiveness of the decontamination procedures used by the sampling team on reusable sampling equipment. No sample qualification was required due to associated equipment rinsates.

2.3 Field Duplicates

Field duplicate samples are collected and submitted to the laboratory for analysis along with their corresponding original sample. The data generated from the analysis of field duplicate samples are used to evaluate the precision of the sample collection and analysis procedures. It is difficult to collect and analyze sediment samples in duplicate due to the heterogeneous nature of sediment. High relative percent difference (RPD) between an original sample and its field duplicate may indicate a difference in sample matrix or sample collection rather than true problems with precision of sample analysis. Also, when estimated “J” or nondetected “U” results are reported, there is a potential for increased variability between the primary and duplicate sample results

Field duplicate samples were collected at a frequency of one for every ten samples (10 percent). Six field duplicate samples were collected during this sampling event. Table 2 compares the parent sample and field duplicate results. In addition, if a constituent is detected in either the parent sample or the field duplicate but not detected in the QC partner, the detected result is presented along with the non-detect. For cases where the result is detected in the parent sample or field duplicate but not in the QC partner, an RPD is not calculated. Sample sets with no detections are not presented in the table. In cases where duplicates were performed and one result is less than the reporting limit, but greater than the method detection limit, the RPD is reported, but is of limited value. Only samples with detections in both the regular and the duplicate were qualified for high RPDs.

The acceptance criterion of 30 percent RPD for waters and 50 percent RPD for soils was used to evaluate these sample results. The data compared well when detected concentrations were greater than the reporting limit. RPD is calculated by using the following formula:

$$RPD = \left| \frac{A - B}{(A + B)/2} \right| \quad x \quad 100$$

where:

RPD	=	relative percent difference
A	=	original result
B	=	field duplicate result.

2.4 Field Split Samples

Split samples were collected in conjunction with field duplicate samples and sent to Test America Laboratories, Inc. of North Canton. The split samples were submitted to the laboratory for the same analysis as their corresponding field duplicates and original field samples. The split samples are used to determine if data results are reproducible when analyzed by two different laboratories. Results are also evaluated to determine if a contracted laboratory's preparation and analysis procedures are in control and meet the approved method criteria.

Field split samples were collected at a frequency of approximately one for every ten regular samples. Six splits were collected during this sampling event.

Table 2 compares the original and field split results and shows the RPDs calculated for those detected compounds. Compounds not presented in the table were not detected in either the original or field split samples. Samples with no detections are not presented in the table. Samples were not qualified because of sample RPDs.

3.0 Analytical Program and Quality Control Activities

The project QA/QC program described in the SAP was followed for the collection and laboratory analysis of samples. Each of the analytical methods used require that method-specific QA/QC protocols be followed during sample analysis. These protocols are a critical part of the methods employed and were followed by the laboratory during sample analysis. Specific measures included detailed record keeping procedures, instrument calibrations, and analysis of method blanks, blank spikes, MS/MSD, surrogates, and internal standards. The following SW-846 and USEPA methods were used to analyze PBOW samples:

Analysis	Method
Nitroaromatics	SW-846 8330

The validator used the QA/QC criteria defined in the SAP, laboratory-derived acceptance criteria, and analytical method criteria to qualify data. Any qualifiers added to these data by the data validator are included in the data summary report.

3.1 Laboratory Quality Assurance/Quality Control Procedures

The following sections discuss specific QA/QC protocols required and performed by the laboratory during this investigation.

3.1.1 Calibration

The calibration of instruments is required to ensure that the instruments are operating properly. Calibration is achieved when instrument response can be related to the concentration of an analyte. All instrument calibration criteria were met. No sample qualification required.

3.1.2 Method/Calibration Blanks

Method blanks are analyzed with each analytical "batch" processed on a per matrix (i.e., soil and water) basis. Method blanks are carried step-wise through the same analytical procedure as their associated field samples including the addition of solvents, surrogate and standard spikes, and reagents as required in the analysis process. The purpose of a method blank is to identify any contaminants that may be introduced to the sample as a result of the analytical process. The data validator evaluated all blank data associated with each sample. Associated method blanks were all non-detect. No sample qualification required.

3.1.3 Surrogate Recoveries

Surrogate standards are defined as non-target compounds added to standards, blanks, and samples prior to extraction or purging. They are used in organic analyses to monitor the percent recovery efficiencies of the sample preparation and analytical procedures.

The following samples were qualified due to surrogate recoveries outside of QC limits:

SDG Number	Samples Affected	Surrogate	Validation Qualifier
F66924	PR011	1-Chloro-3-nitrobenzene	J
F69700	PR00513, PR00514, PR00515	1-Chloro-3-nitrobenzene	J

3.1.4 Matrix Spikes and Laboratory Control Spikes

Two types of spikes were performed for all analyses: matrix spikes (MS) and laboratory control samples (LCS). MS compounds are spiked into an aliquot of a field sample. LCS compounds are spiked into a blank matrix. The spiked compounds are representative compounds that are quantified during performance of the method. Recovery of the spiked compound is used as an assessment of analytical accuracy for the sample matrix analyzed. These results are useful in distinguishing sample matrix interferences from analysis interferences through a comparison of MS and LCS recovery data. Often, spikes are performed in duplicate as a matrix spike duplicate (MSD) or LCS duplicate. In this manner, the precision of the assessment can be quantified as the RPD of the original and duplicate spike.

Matrix spikes were assigned at a frequency of at least 1 for every 20 field samples collected. Ten MS/MSD pairs were assigned to samples. Additional sample volume was provided to the laboratory for the MS/MSD analyses. This sampling frequency meets the collection criteria for this program as specified in the SAP. In addition to the overall collection frequency, the analytical method requires that the laboratory analyze 1 set of spikes per analytical batch. To comply with this method requirement, the laboratory may analyze additional MS/MSD pairs. The validator evaluated all batch QC. The laboratory's statistically determined target acceptance limits were used to assess the spike recovery and RPD.

The following MS/MSD recoveries are outside of established QC criteria:

SDG Number	Samples Affected	Analytes(s)	Validation Qualifier
F66987	PR0031	2-amino-4,6-Dinitrotoluene, 4-Amino-2,6-Dinitrotoluene	UJ
F67482	PR0065	2,4-Dinitrotoluene*, 2,6-Dinitrotoluene*	J
F69034	PR-00507	2,4-Dinitrotoluene	J

*Analytes were qualified for %RPD outside QC limits for the MS/MSD analysis.

LCS results are used to evaluate lab method performance in the same manner as the MS/MSD results except the LCS is not performed on an actual field sample matrix. The LCS is prepared for each analytical batch and for each parameter and matrix analyzed. All LCS recoveries met QC criteria.

3.1.5 Laboratory Duplicate Sample Analysis

Laboratory Duplicate determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate Sample analyses are also performed to generate data

in order to determine the long-term precision of the analytical method on various matrices. Laboratory duplicates are not required for nitroaromatic analysis. No qualification of data required.

3.1.6 Column Agreement

For high performance liquid chromatography (HPLC) analyses, sample results are confirmed using two dissimilar columns. In order for an analyte to be reported, it must be detected on both columns. Results differing by greater than 40 percent are qualified estimated, "J".

All detections were in agreement with the exception of the following:

SDG Number	Samples Affected	Analyte(s)	Validation Qualifier
A9G250125	PR0003	1,3,5-Trinitrobenzene, 4-amino-2,6-Dinitrotoluene, 4-Nitrotoluene	J
A9G3101186	PR-0047	2-amino-4,6-Dinitrotoluene, 4-Nitrotoluene	J
A9H210260	PR0067	2,6-Dintrotololuene	J

3.2 Reporting Limits

Limits have been established to describe project sensitivity requirements. Each laboratory is required to demonstrate method performance through method detection limit (MDL) studies for every method employed. These studies are required to be laboratory-specific so that individual laboratory variables such as equipment brands, reagent suppliers, and chemist technique are factored into the performance study. MDLs are established using controlled matrices (i.e., DI water). Practical quantitation limits (PQL) or method quantitation limits (MQL), used for this project are those statistically determined by the laboratories. The analytical program executed for this project required the use of SW-846 methods, which specify the procedure for calculating the MDLs. The PQL/MQL calculation adjusts the limit by a predetermined mathematical factor for the analysis of actual environmental sample matrices (i.e. soil, groundwater, etc.). Method reporting limits (MRL) are based on the project action or decision levels.

These limits are generally defined as follows:

- ***MDL.*** The minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the concentration is greater than zero.

- ***MQL/PQL.*** The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. It is set at the lowest standard used for the calibration curve.

- ***MRL.*** A threshold value below which the laboratory reports a result as non-detected. Ideally, the MRL will be established anywhere between the MDL and 1/2 the project action levels.

An MDL is the lower limit at which the laboratory can differentiate a measurement from background. The MDL is determined in accordance with the procedures in 40 CFR Part 136. If project action levels are near or below the MDL, it is unlikely the sensitivity of the method will be achievable. A compromise must be reached. The PQL/MQL is the lower limit at which a measurement becomes meaningful. This measurement (the PQL or the RL) is generally a multiple of three to five times the MDL.

Most samples were handled and analyzed as expected without significant changes to the anticipated project MQLs**.** Thirteen samples had elevated MQLs due to dilutions.

3.3 Holding Times/Preservation

All laboratory results submitted for this investigation have been reviewed with respect to laboratory adherence to extraction and analysis holding times. All hold times and preservation requirements were met. No qualification required.

4.0 Data Evaluation and Usability

The analytical data review process identified a few analytical nonconformance issues that were noted during this analytical program. These anomalies have been discussed in the previous sections of this appendix. Table 3 summarizes all compounds requiring qualifier application due to anomalies discovered during data validation. Table 4 defines the reason codes for qualification and Table 5 defines the data validation qualifiers.

The following definitions are used for defining precision, accuracy, representativeness, completeness, and comparability as they have been applied to this evaluation.

Precision. Precision is a measurement of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision data were obtained through the analysis and evaluation of duplicate QA samples. Accuracy was determined through

the analysis and evaluation of method blanks, LCSs, trip blanks, equipment rinsates, and MS samples.

Accuracy. Accuracy is a measurement of bias in a system and is expressed as a percent recovery. These QA samples were collected and/or analyzed at the frequency established in the SAP, verifying the completeness element of the DQOs along with the evaluation of holding times and reporting limits. Percent recovery is calculated as follows:

$$Percent\ \mathrm{Recovery} = \left(\frac{(x - s)}{T} \right) * 100$$

Where:

X = the lab determined concentration of a spiked sample
S = the sample native concentration prior to spike
T = the true concentration of the spike

Relative Percent Difference is calculated as follows:

$$\mathrm{Re}lative\ Percent\ Difference = \left[\frac{|D1 - D2|}{\frac{D1 + D2}{2}} \right] * 100$$

Where:

D1 and D2 = the results of duplicate measurements

Representativeness. Representativeness is a qualitative parameter that expresses the degree to which sample data actually represent the matrix and site conditions. For example, in conducting ground water monitoring, representativeness requires proper location of wells and the collection of samples under consistent, documented procedures. Wells are located based upon the results of the hydrological study in progress and are designed to provide maximum coverage of the flow conditions. Requirements and procedures for sample collection and handling are designed to maximize sample representativeness. Representativeness also can be monitored by reviewing field documentation and by performing field audits.

The samples were collected using Shaw SOPs and were fully documented through the use of standard Shaw field forms. Samples are representative of the matrix and site sampled.

Completeness. Completeness is a measure of the amount of valid data that are obtained during a sampling event as compared to the amount of data planned to be collected under optimum conditions. Some data for this project were qualified as estimated in the validation process because of the outliers noted in the MS recoveries, duplicate results for certain elements, and various other calibration and column confirmation percent difference results. Completeness is calculated as follows:

$$Completeness\ \% = \left(\frac{D_r}{D_c}\right) X\ 100$$

Where:

D_r = the number of data points for which valid results are reported

D_c = the number of valid samples/data points that are collected and reach the laboratory for analysis.

During this task, 68 regular project samples were collected resulting in approximately 952 targeted analytical records. No results were rejected. Using the above calculation, 100% completeness was achieved for the task.

Comparability. 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.

Statement of Data Usability. The overall results of the analyses, as discussed in this evaluation, suggest that representative samples were collected and analyzed, and the results are indicative of the media analyzed, with the exception of the few anomalies noted. The data do reflect expected site conditions and are usable for their intended purpose.

Tables 1 through 5 summarize the analytical program and the results for the data validation effort for all samples collected by Shaw at PBOW.

TABLES

Table 1

Sample Cross Reference
Former Plum Brook Ordnance Works
Sandusky, Ohio

Sample Type	Sample Location	Sample Number	Sample Date	Sample Purpose	Sample Delivery Group
SB	PR-00502	PR0050	08/18/2009	REG	F67482
SB	PR-00503	PR0051	08/18/2009	REG	F67482
SB	PR-00504	PR0052	08/18/2009	REG	F67482
SB	PR-00505	PR0053	08/18/2009	REG	F67482
SB	PR-00505	PR0054	08/18/2009	FD	F67482
SB	PR-00505	PR0055	08/18/2009	FS	A9H210260
SB	PR-00506	PR0056	08/18/2009	REG	F67482
SB	PR-10040	PR0068	08/19/2009	REG	F67482
SB	PR-10132	PR0060	08/19/2009	REG	F67482
SB	PR-10133	PR0061	08/19/2009	REG	F67482
SB	PR-10134	PR0062	08/19/2009	REG	F67482
SB	PR-10135	PR0063	08/19/2009	REG	F67482
SB	PR-10136	PR0072	08/19/2009	REG	F67482
SB	PR-10138	PR0057	08/19/2009	REG	F67482
SB	PR-10139	PR0058	08/19/2009	REG	F67482
SB	PR-10140	PR0059	08/19/2009	REG	F67482
SB	PR-10178A	PR0073	08/19/2009	REG	F67482
SB	PR-10179	PR0070	08/19/2009	REG	F67482
SB	PR-10180	PR0071	08/19/2009	REG	F67482
SB	PR-10181	PR0064	08/19/2009	REG	F67482
SB	PR-10183	PR0065	08/19/2009	REG	F67482
SB	PR-10183	PR0066	08/19/2009	FD	F67482
SB	PR-10183	PR0067	08/19/2009	FS	A9H210260
SO	PR-00507	PR-00507	10/21/2009	REG	F69034
SO	PR-00508	PR-00508	10/21/2009	REG	F69034
SO	PR-00509	PR-00509	10/21/2009	REG	F69034
SO	PR-00510	PR-00510	10/21/2009	REG	F69034
SO	PR-00511	PR-00511	10/21/2009	REG	F69034
SO	PR-00512	PR-00512	10/21/2009	REG	F69034
SO	PR-00513	PR-00513	11/19/2009	REG	F69700
SO	PR-00514	PR-00514	11/19/2009	REG	F69700
SO	PR-00515	PR-00515	11/19/2009	REG	F69700
SO	PR-00516	PR-00516	11/19/2009	REG	F69700
SO	PR-10035	PR0025	07/24/2009	REG	F66987
SO	PR-10036	PR0028	07/24/2009	REG	F66987
SO	PR-10037	PR0030	07/24/2009	REG	F66987
SO	PR-10060	PR0017	07/24/2009	REG	F66987
SO	PR-10125	PR0026	07/24/2009	REG	F66987
SO	PR-10126	PR0027	07/23/2009	REG	F66987
SO	PR-10127	PR0029	07/24/2009	REG	F66987
SO	PR-10128	PR0031	07/24/2009	REG	F66987
SO	PR-10128	PR0032	07/24/2009	FD	F66987
SO	PR-10128	PR0033	07/24/2009	FS	A9G290123
SO	PR-10158	PR0018	07/24/2009	REG	F66987
SO	PR-10158	PR0034	07/24/2009	FD	F66987
SO	PR-10158	PR0035	07/24/2009	FS	A9G290123
SO	PR-10159	PR0019	07/24/2009	REG	F66987
SO	PR-10160	PR0020	07/24/2009	REG	F66987
SO	PR-10161	PR0021	07/24/2009	REG	F66987
SO	PR-10162	PR0022	07/24/2009	REG	F66987

Table 1

Sample Cross Reference
Former Plum Brook Ordnance Works
Sandusky, Ohio

Sample Type	Sample Location	Sample Number	Sample Date	Sample Purpose	Sample Delivery Group
SO	PR-10163	PR0023	07/24/2009	REG	F66987
SO	PR-10164	PR0024	07/24/2009	REG	F66987
SO	PR-10149	PR0016	07/22/2009	REG	F66924
SO	PR-10174	PR0004	07/23/2009	REG	F66924
SO	PR-10175	PR0005	07/23/2009	REG	F66924
SO	PR-10176	PR0006	07/23/2009	REG	F66924
SO	PR-10184	PR0007	07/23/2009	REG	F66924
SO	PR-477	PR0011	07/22/2009	REG	F66924
SO	PR-478	PR0010	07/22/2009	REG	F66924
SO	PR-479	PR0008	07/22/2009	REG	F66924
SO	PR-480	PR0001	07/22/2009	REG	F66924
SO	PR-480	PR0002	07/22/2009	FD	F66924
SO	PR-480	PR0003	07/22/2009	FS	A9G250125
SO	PR-481	PR0009	07/22/2009	REG	F66924
SO	PR-482	PR0012	07/22/2009	REG	F66924
SO	PR-486	PR0013	07/23/2009	REG	F66924
SO	PR-487	PR0014	07/23/2009	REG	F66924
SO	PR-488	PR0015	07/23/2009	REG	F66924
SO	PR-492	PR0036	07/24/2009	REG	F67052
SO	PR-493	PR0037	07/24/2009	REG	F67052
SO	PR-494	PR0040	07/27/2009	REG	F67052
SO	PR-495	PR0041	07/27/2009	REG	F67052
SO	PR-496	PR0042	07/27/2009	REG	F67052
SO	PR-497	PR0043	07/27/2009	REG	F67052
SO	PR-498	PR0044	07/27/2009	REG	F67052
SO	PR-499	PR-0047	07/27/2009	FS	A9G310186
SO	PR-499	PR0045	07/27/2009	REG	F67052
SO	PR-499	PR0046	07/27/2009	FD	F67052
SO	PR-500	PR0038	07/24/2009	REG	F67052
SO	PR-501	PR0039	07/24/2009	REG	F67052
SW	PRRW-001	PRRW-001	05/27/2009	REG	F65523

Table 2

Summary of Original, Field Duplicate, and Field Split Hits with Relative Percent Difference Calculations
Former Plum Brook Ordnance Works
Sandusky, Ohio

		Location:	PR-00505		PR-00505		PR-00505		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0053		PR0054		PR0055			
		Sample Date:	18-Aug-09		18-Aug-09		18-Aug-09			
		Sample Depth;	0 - 10 Ft		0 - 10 Ft		0 - 10 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Amino-2,6-dinitrotoluene, 4-	N	mg/kg	0.321		ND	U	ND	U	-	-
Amino-4,6-dinitrotoluene, 2-	N	mg/kg	0.25		0.413		ND	U	49.17	-
Dinitrobenzene, 1,3-	N	mg/kg	0.0797	J	0.995	J	ND	U	170.34	-
Dinitrotoluene, 2,4-	N	mg/kg	1.01	J	6.75	J	ND	U	147.94	-
Dinitrotoluene, 2,6-	N	mg/kg	0.106	J	1.12	J	ND	U	165.42	-
Trinitrobenzene, 1,3,5-	N	mg/kg	0.115	J	1.53	J	ND	U	172.04	-

		Location:	PR-10183		PR-10183		PR-10183		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0065		PR0066		PR0067			
		Sample Date:	19-Aug-09		19-Aug-09		19-Aug-09			
		Sample Depth;	0 - 10 Ft		0 - 10 Ft		0 - 10 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Amino-2,6-dinitrotoluene, 4-	N	mg/kg	0.0584	J	ND	U	ND	U	-	-
Amino-4,6-dinitrotoluene, 2-	N	mg/kg	ND	U	0.182		ND	U	-	-
Dinitrobenzene, 1,3-	N	mg/kg	0.0949	J	2.54	J	1.2		185.59	170.68
Dinitrotoluene, 2,4-	N	mg/kg	0.491	J	10.6	J	8		182.29	176.87
Dinitrotoluene, 2,6-	N	mg/kg	0.124	J	1.56	J	0.79	J	170.55	145.73
Trinitrobenzene, 1,3,5-	N	mg/kg	0.161	J	4.39	J	3		185.85	179.63

		Location:	PR-10158		PR-10158		PR-10158		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0018		PR0034		PR0035			
		Sample Date:	24-Jul-09		24-Jul-09		24-Jul-09			
		Sample Depth;	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Trinitrobenzene, 1,3,5-	N	mg/kg	0.0433	J	0.0583	J	ND	U	29.53	-

Table 2

Summary of Original, Field Duplicate, and Field Split Hits with Relative Percent Difference Calculations
Former Plum Brook Ordnance Works
Sandusky, Ohio

		Location:	PR-480		PR-480		PR-480		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0001		PR0002		PR0003			
		Sample Date:	22-Jul-09		22-Jul-09		22-Jul-09			
		Sample Depth;	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Amino-2,6-dinitrotoluene, 4-	N	mg/kg	ND	U	ND	U	0.32	J	-	-
Amino-4,6-dinitrotoluene, 2-	N	mg/kg	0.185		0.203		ND	U	9.28	-
Dinitrobenzene, 1,3-	N	mg/kg	4.47		4.55		4.8		1.77	7.12
Dinitrotoluene, 2,4-	N	mg/kg	8.82		9.79		10		10.42	12.54
Dinitrotoluene, 2,6-	N	mg/kg	ND	U	ND	U	1		-	-
Nitrotoluene, 4-	N	mg/kg	ND	U	ND	U	0.34	J	-	-
Trinitrobenzene, 1,3,5-	N	mg/kg	12.4		13.7		14		9.96	12.12
Trinitrotoluene, 2,4,6-	N	mg/kg	0.0608	J	ND	U	ND	U	-	-

		Location:	PR-499		PR-499		PR-499		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0045		PR0046		PR-0047			
		Sample Date:	27-Jul-09		27-Jul-09		27-Jul-09			
		Sample Depth;	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Amino-2,6-dinitrotoluene, 4-	N	mg/kg	ND	U	ND	U	0.24		-	-
Amino-4,6-dinitrotoluene, 2-	N	mg/kg	ND	U	ND	U	0.26	J	-	-
Dinitrobenzene, 1,3-	N	mg/kg	4.27		3.29		5.5		25.93	25.18
Dinitrotoluene, 2,4-	N	mg/kg	11.1		8.6		17		25.38	41.99
Dinitrotoluene, 2,6-	N	mg/kg	ND	U	ND	U	1.3		-	-
Nitrotoluene, 4-	N	mg/kg	ND	U	ND	U	0.45	J	-	-
Trinitrobenzene, 1,3,5-	N	mg/kg	14.5		11		18		27.45	21.54

		Location:	PR-10128		PR-10128		PR-10128		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0031		PR0032		PR0033			
		Sample Date:	24-Jul-09		24-Jul-09		24-Jul-09			
		Sample Depth;	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
All Constituents Non-Detect										

Table 3

Summary of Data Validation Reason Codes
Former Plum Brook Ordnance Works
Sandusky, Ohio

Reason Code	Description
01	Sample received outside of 4+/-2 degrees Celsius
01A	Improper sample preservation
02	Holding Time Exceeded
02A	Extraction
02B	Analysis
03	Instrument Performance - Outside Criteria
03A	BFB
03B	DFTPP
03C	DDT and/or Endrin % breakdown exceeds criteria
03D	retention time windows
03E	Resolution
04	Initial Calibration results outside specified criteria
04A	Compound mean RRF<0.05
04B	Compound %RSD>30
04C	Correlation Coefficient<0.995
05	Continuing Calibration results outside specified criteria
05A	Compound mean RRF<0.05
05B	Compound %D>25
06	Result qualified as a result of the 5x/10x blank correction
06A	Method or Preparation Blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate Recoveries outside control limits
07A	Sample
07B	Associated method blank or LCS
08	MS/MSD/Duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	%RPD outside acceptance criteria (precision)
09	Post Digestion Spike outside criteria (GFAA)
10	Internal Standards outside specified control limits
10A	Recovery
10B	Retention Time
11	Laboratory Control Sample recoveries outside specified control limits
11A	Recovery
11B	%RPD (if run in duplicate)
12	Interference Check Standard
13	Serial Dilution
14	Tentatively Identified Compounds
15	Quantitation
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria exceeded
18	Percent difference between original and second column > 25%
19	Professional judgement was used to qualify the data
20	Pesticide clean-up checks
21	Target compound identification
22	Radiological calibration
23	Radiological quantitation
24	Reported result and/or lab qualifier revised to reflect validation findings
999	See hard copy for details.

Table 4

Summary of Data Validation Qualifiers Assigned and Reason Codes for Qualification
Former Plum Brook Ordnance Works
Sandusky, Ohio

Work Order	Sample Number	Analysis	Parameter	Reason Codes				
				VQ	R1	R2	R3	R4
A9G250125	PR0003	EXPLOSIVES	1,3,5-Trinitrobenzene	R	16			
A9G250125	PR0003	EXPLOSIVES	2,4-Dinitrotoluene	R	16			
A9G250125	PR0003	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	18			
A9G250125	PR0003	EXPLOSIVES	4-Nitrotoluene	J	18			
A9G310186	PR-0047	EXPLOSIVES	1,3,5-Trinitrobenzene	R	16			
A9G310186	PR-0047	EXPLOSIVES	2,4-Dinitrotoluene	R	16			
A9G310186	PR-0047	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	18			
A9G310186	PR-0047	EXPLOSIVES	4-Nitrotoluene	J	18			
A9H210260	PR0067	EXPLOSIVES	2,6-Dinitrotoluene	J	18			
F65523	PRRW-001	METALS	Barium	J	15			
F65523	PRRW-001	METALS	Cadmium	J	15			
F65523	PRRW-001	METALS	Potassium	J	15			
F65523	PRRW-001	METALS	Vanadium	J	15			
F66924	PR0001	EXPLOSIVES	2,4,6-Trinitrotoluene	J	15			
F66924	PR0006	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15			
F66924	PR0008	EXPLOSIVES	1,3-Dinitrobenzene	J	15			
F66924	PR0011	EXPLOSIVES	1,3,5-Trinitrobenzene	J	07A			
F66924	PR0011	EXPLOSIVES	1,3-Dinitrobenzene	J	07A			
F66924	PR0011	EXPLOSIVES	2,4,6-Trinitrotoluene	J	07A	15		
F66924	PR0011	EXPLOSIVES	2,4-Dinitrotoluene	J	07A			
F66924	PR0011	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	07A			
F66924	PR0013	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	15			
F66924	PR0015	EXPLOSIVES	1,3-Dinitrobenzene	J	15			
F66924	PR0015	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F66924	PR0016	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	15			
F66987	PR0017	EXPLOSIVES	2,4-Dinitrotoluene	J	15			
F66987	PR0018	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15			
F66987	PR0021	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15			
F66987	PR0023	EXPLOSIVES	2,4-Dinitrotoluene	J	15			
F66987	PR0023	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F66987	PR0024	EXPLOSIVES	2,4,6-Trinitrotoluene	J	15			
F66987	PR0027	EXPLOSIVES	2,4-Dinitrotoluene	J	15			
F66987	PR0029	EXPLOSIVES	2,4-Dinitrotoluene	J	15			
F66987	PR0029	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F66987	PR0030	EXPLOSIVES	p-Nitrotoluene	J	15			
F66987	PR0031	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	UJ	08A			
F66987	PR0031	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	UJ	08A			
F66987	PR0034	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15			
F67052	PR0036	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	15			
F67052	PR0042	EXPLOSIVES	2,6-Dinitrotoluene	J	15			
F67052	PR0044	EXPLOSIVES	1,3-Dinitrobenzene	J	15			
F67052	PR0044	EXPLOSIVES	2,4-Dinitrotoluene	J	15			
F67482	PR0050	EXPLOSIVES	1,3-Dinitrobenzene	J	15			
F67482	PR0050	EXPLOSIVES	2,4,6-Trinitrotoluene	J	15			
F67482	PR0050	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	15			
F67482	PR0053	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15	17		
F67482	PR0053	EXPLOSIVES	1,3-Dinitrobenzene	J	15	17		
F67482	PR0053	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F67482	PR0053	EXPLOSIVES	2,6-Dinitrotoluene	J	15	17		

Table 4

Summary of Data Validation Qualifiers Assigned and Reason Codes for Qualification
Former Plum Brook Ordnance Works
Sandusky, Ohio

Work Order	Sample Number	Analysis	Parameter	Reason Codes				
				VQ	R1	R2	R3	R4
F67482	PR0054	EXPLOSIVES	1,3,5-Trinitrobenzene	J	17			
F67482	PR0054	EXPLOSIVES	1,3-Dinitrobenzene	J	17			
F67482	PR0054	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F67482	PR0054	EXPLOSIVES	2,6-Dinitrotoluene	J	17			
F67482	PR0056	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15			
F67482	PR0056	EXPLOSIVES	1,3-Dinitrobenzene	J	15			
F67482	PR0056	EXPLOSIVES	2-amino-4,6-Dinitrotoluene	J	15			
F67482	PR0056	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F67482	PR0065	EXPLOSIVES	1,3,5-Trinitrobenzene	J	17			
F67482	PR0065	EXPLOSIVES	1,3-Dinitrobenzene	J	15	17		
F67482	PR0065	EXPLOSIVES	2,4-Dinitrotoluene	J	08B	17		
F67482	PR0065	EXPLOSIVES	2,6-Dinitrotoluene	J	08B	15	17	
F67482	PR0065	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F67482	PR0066	EXPLOSIVES	1,3,5-Trinitrobenzene	J	17			
F67482	PR0066	EXPLOSIVES	1,3-Dinitrobenzene	J	17			
F67482	PR0066	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F67482	PR0066	EXPLOSIVES	2,6-Dinitrotoluene	J	17			
F67482	PR0068	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F67482	PR0072	EXPLOSIVES	1,3,5-Trinitrobenzene	J	15			
F67482	PR0072	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F67482	PR0073	EXPLOSIVES	2,4,6-Trinitrotoluene	J	15			
F67482	PR0073	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F69034	PR-00507	EXPLOSIVES	2,4-Dinitrotoluene	J	08A			
F69034	PR-00511	EXPLOSIVES	2,4,6-Trinitrotoluene	J	15			
F69700	PR-00513	EXPLOSIVES	1,3,5-Trinitrobenzene	J	07A			
F69700	PR-00513	EXPLOSIVES	1,3-Dinitrobenzene	J	07A			
F69700	PR-00513	EXPLOSIVES	2,4-Dinitrotoluene	J	07A			
F69700	PR-00514	EXPLOSIVES	1,3,5-Trinitrobenzene	J	07A			
F69700	PR-00514	EXPLOSIVES	1,3-Dinitrobenzene	J	07A			
F69700	PR-00514	EXPLOSIVES	2,4-Dinitrotoluene	J	07A			
F69700	PR-00515	EXPLOSIVES	1,3,5-Trinitrobenzene	J	07A			
F69700	PR-00515	EXPLOSIVES	1,3-Dinitrobenzene	J	07A			
F69700	PR-00515	EXPLOSIVES	2,4-Dinitrotoluene	J	07A			
F69700	PR-00515	EXPLOSIVES	RDX	J	07A			

Table 5

Laboratory and Validation Qualifier Definitions
Former Plum Brook Ordnance Works
Sandusky, Ohio

Qualifier	Definition
Laboratory	
B (metals)	The analyte was detected; the concentration is below the reporting limit.
B (organics)	Indicates analyte is found in associated method blank.
J (metals)	The compound was detected in the blank.
J (organics)	The compound was positively identified; the reported value is below the reporting limit.
U	Not detected. The compound was analyzed for, but not detected above the associated reporting limit.
E	Indicates that the result is above the maximum calibration range.
N	Indicates presumptive evidence of a compound.
P	RPD > 40% between the primary and confirmation column results for dual column chromatographic method (e.g. GC and HPLC methods).
COL	RPD > 40% between the primary and confirmation column results for dual column chromatographic method (e.g. GC and HPLC methods).
Validation	
B	The compound/analyte was detected in a lab or field blank.
J	The compound/analyte was positively identified; the reported value is an estimated concentration.
U	Not detected. The compound/analyte was analyzed for, but not detected above the associated reporting limit.
UJ	The analyte is not detected; the result is an estimated value.
R	Analyte is rejected.

DATA QUALITY EVALUATION

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List of Acronyms

AR/COC	analysis request/chain of custody
CCAL	continuing calibration
CFR	Code of Federal Regulations
CI	chemical investigation
DI	deionized
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ICAL	initial calibration
ICS	Interference Check Sample
ID	identification
LCS	laboratory control sample
MB	material blank or method blank
MDL	method detection limit
MQL	method quantitation limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NFG	national functional guidelines
PBOW	Plum Brook Ordnance Works
PQL	practical quanitation limit
QA/QC	quality assurance/quality control
SAP	quality assurance project plan
RI	remedial investigation
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SOP	standard operating procedures
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compounds

1.0 Introduction

This appendix presents results of the quality assurance/quality control (QA/QC) measures implemented for the sampling and analysis activities at the Plum Brook Ordnance Works (PBOW), Sandusky, Ohio. The quality indicators from every aspect of the data collection were reviewed, and an assessment of the data with regard to project-specific objectives is presented. Successful execution of project-specific objectives and procedures provides strong support for the acceptance of the data generated as adequate for the purpose of evaluating the analytical results from this assessment at PBOW.

Shaw Environmental, Inc. (Shaw) conducted investigative work at the Pentolite Road Red Water Pond (PRRWP) area in November 2010. Primary and field duplicate project samples collected in November 2010 were analyzed by Accutest Laboratories, of Orlando, Florida. Field splits were analyzed by Test America, Inc., Canton, Ohio. Analysis for nitroaromatic field split samples was performed by Test America of Denver, Colorado. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the *EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, June 2008 (EPA, 2008) and *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004 (EPA, 2004), the QAPP (Shaw, 2008c), 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). The criteria for blank evaluation were based on those detailed in *Region III Modifications to National Functional Guidelines for Organic Data Review*, September 1994 (EPA, 1994b) and *Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA, 1993). Since these documents specify procedures for Contract Laboratory Program (CLP) data, they are used as guidelines only. Method and laboratory quality assurance and quality control requirements supercede these guidelines, where applicable. 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). To verify that these DQOs 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 defined in the SAP. The results of this review are presented in the following sections, with all analytical outliers or nonconformances discussed where they occurred.

This report is divided into three subsections. Section 2.0 discusses the field investigation and QC procedures used during the sampling effort. Section 3.0 outlines the analytical program and the associated QC activities performed. The final part of this document, Section 4.0, summarizes the data findings and their overall impact on the usability of the analytical data.

2.0 Field Sampling and QC Activities

Shaw was retained by the U. S. Army Corps of Engineers, Nashville District to conduct investigative and sampling activities at PBOW. Field activities at this site included collection of soil, groundwater samples. The collection of these samples and their associated QC samples are discussed in this section of the Data Quality Evaluation (DQE).

Thirty-five project and three field duplicate soil samples were submitted to Accutest for analysis. Sample shipments from the field were performed under custody and documented using standard Shaw Analysis Request/Chain of Custody (AR/COC) forms. These forms provided project-specific analytical specifications and QC instructions to the laboratory. A formal COC transfer record was prepared and included with these forms to document custody during sample transportation, storage, and disposition by the laboratory. Table 1 summarizes the field sample number, location, sample type, date of collection, lot number, and laboratory for each sample collected.

2.1 Trip Blanks

Aqueous samples designated for volatile organic compound (VOC) analysis may be susceptible to contamination by diffusion of organic compounds into the sample container. Trip blanks are analyzed in order to assess the potential for contamination to be introduced to an aqueous volatile sample during transport and handling procedures. A trip blank is a sample of analyte free deionized (DI) water that is prepared at the laboratory, shipped to the field with sample containers, and returned to the laboratory with the water matrix samples receiving VOC analysis. A trip blank is then analyzed for volatile organics using the same sample preparation and analysis procedures used for the actual field samples.

Only soil samples were collected and analyzed for nitroaromatics for the PRRWP area. No trip blanks were required.

2.2 Equipment Rinsates

Equipment rinsates are used to assess the effectiveness of the decontamination procedures used by the sampling team on reusable sampling equipment. No sample qualification was required due to associated equipment rinsates.

2.3 Field Duplicates

Field duplicate samples are collected and submitted to the laboratory for analysis along with their corresponding original sample. The data generated from the analysis of field duplicate samples are used to evaluate the precision of the sample collection and analysis procedures. It is difficult to collect and analyze sediment samples in duplicate due to the heterogeneous nature of sediment. High relative percent difference (RPD) between an original sample and its field duplicate may indicate a difference in sample matrix or sample collection rather than true problems with precision of sample analysis. Also, when estimated "J" or nondetected "U" results are reported, there is a potential for increased variability between the primary and duplicate sample results

Field duplicate samples were collected at a frequency of one for every ten samples (10 percent). Three field duplicate samples were collected during this sampling event. Table 2 compares the parent sample and field duplicate results. In addition, if a constituent is detected in either the parent sample or the field duplicates but not detected in the QC partner, the detected result is presented along with the non-detect. For cases where the result is detected in the parent sample or field duplicate but not in the QC partner, an RPD is not calculated. Sample sets with no detections are not presented in the table. In cases where duplicates were performed and one result is less than the reporting limit, but greater than the method detection limit, the RPD is reported, but is of limited value. Only samples with detections in both the regular and the duplicate were qualified for high RPDs.

The acceptance criterion of 30 percent RPD for waters and 50 percent RPD for soils was used to evaluate these sample results. The data compared well when detected concentrations were greater than the reporting limit. RPD is calculated by using the following formula:

$$RPD = \left| \frac{A - B}{(A + B)/2} \right| \quad x \quad 100$$

where:

RPD = relative percent difference
A = original result
B = field duplicate result.

2.4 Field Split Samples

Split samples were collected in conjunction with field duplicate samples and sent to Test America Laboratories, Inc. of North Canton. The split samples were submitted to the laboratory for the same analysis as their corresponding field duplicates and original field samples. The split samples are used to determine if data results are reproducible when analyzed by two different laboratories. Results are also evaluated to determine if a contracted laboratory's preparation and analysis procedures are in control and meet the approved method criteria.

Field split samples were collected at a frequency of approximately one for every ten regular samples. Three splits were collected during this sampling event.

Table 2 compares the original and field split results and shows the RPDs calculated for those detected compounds. Compounds not presented in the table were not detected in either the original or field split samples. Samples with no detections are not presented in the table. Samples were not qualified because of sample RPDs.

3.0 Analytical Program and QC Activities

The project QA/QC program described in the SAP was followed for the collection and laboratory analysis of samples. Each of the analytical methods used require that method-specific QA/QC protocols be followed during sample analysis. These protocols are a critical part of the methods employed and were followed by the laboratory during sample analysis. Specific measures included detailed record keeping procedures, instrument calibrations, and analysis of method blanks, blank spikes, MS/MSD, surrogates, and internal standards. The following SW-846 and USEPA methods were used to analyze PBOW samples:

Analysis	Method
Nitroaromatics	SW-846 8330

The validator used the QA/QC criteria defined in the SAP, laboratory-derived acceptance criteria, and analytical method criteria to qualify data. Any qualifiers added to these data by the data validator are included in the data summary report.

3.1 Laboratory QA/QC Procedures

The following sections discuss specific QA/QC protocols required and performed by the laboratory during this investigation.

3.1.1 Calibration

The calibration of instruments is required to ensure that the instruments are operating properly. Calibration is achieved when instrument response can be related to the concentration of an analyte. All instrument calibration criteria were met. No sample qualification required.

3.1.2 Method/Calibration Blanks

Method blanks are analyzed with each analytical "batch" processed on a per matrix (i.e., soil and water) basis. Method blanks are carried step-wise through the same analytical procedure as their associated field samples including the addition of solvents, surrogate and standard spikes, and reagents as required in the analysis process. The purpose of a method blank is to identify any contaminants that may be introduced to the sample as a result of the analytical process. The data validator evaluated all blank data associated with each sample. Associated method blanks were all non-detect. No sample qualification required.

3.1.3 Surrogate Recoveries

Surrogate standards are defined as non-target compounds added to standards, blanks, and samples prior to extraction or purging. They are used in organic analyses to monitor the percent recovery efficiencies of the sample preparation and analytical procedures. All surrogate recoveries were within QC limits. No sample qualification required.

3.1.4 Matrix Spikes and Laboratory Control Spikes

Two types of spikes were performed for all analyses: matrix spikes (MS) and laboratory control samples (LCS). MS compounds are spiked into an aliquot of a field sample. LCS compounds are spiked into a blank matrix. The spiked compounds are representative compounds that are quantified during performance of the method. Recovery of the spiked compound is used as an assessment of analytical accuracy for the sample matrix analyzed. These results are useful in distinguishing sample matrix interferences from analysis interferences through a comparison of MS and LCS recovery data. Often, spikes are performed in duplicate as a matrix spike duplicate (MSD) or LCS duplicate. In this manner, the precision of the assessment can be quantified as the RPD of the original and duplicate spike.

Matrix spikes were assigned at a frequency of at least 1 for every 20 field samples collected. Ten MS/MSD pairs were assigned to samples. Additional sample volume was provided to the laboratory for the MS/MSD analyses. This sampling frequency meets the collection criteria for this program as specified in the SAP. In addition to the overall collection frequency, the analytical method requires that the laboratory analyze 1 set of spikes per analytical batch. To comply with this method requirement, the laboratory may analyze additional MS/MSD pairs. The validator evaluated all batch QC. The laboratory's statistically determined target acceptance limits were used to assess the spike recovery and RPD.

The following MS/MSD recoveries are outside of established QC criteria:

SDG Number	Samples Affected	Analytes(s)	Validation Qualifier
F78128	PR0203	1,3,5-Trinitrobenzene	J

LCS results are used to evaluate lab method performance in the same manner as the MS/MSD results except the LCS is not performed on an actual field sample matrix. The LCS is prepared for each analytical batch and for each parameter and matrix analyzed. All LCS recoveries met QC criteria.

3.1.5 Laboratory Duplicate Sample Analysis

Laboratory Duplicate determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate Sample analyses are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. Laboratory duplicates are not required for nitoraromatic analysis. No qualification of data required.

3.1.6 Column Agreement

For high performance liquid chromatography (HPLC) analyses, sample results are confirmed using two dissimilar columns. In order for an analyte to be reported, it must be detected on both columns. Results differing by greater than 40 percent are qualified estimated, "J".

All detections were in agreement with the exception of the following:

SDG	Samples Affected	Compound(s)	Validation Qualifier
F78128	PR0200	2,4,6-Trinitrotoluene	J
	PR0209, PR0231	1,3-Dinitrobenzene	
	PR0215, PR0240, PR0243	4-amino-2,6-Dinitrotoluene	
	PR0222, PR0242	2,6-Dinitrotoluene	
	PR0232, PR0227	2,4-Dinitrotoluene	
	PR0220	RDX	

3.2 Reporting Limits

Limits have been established to describe project sensitivity requirements. Each laboratory is required to demonstrate method performance through method detection limit (MDL) studies for every method employed. These studies are required to be laboratory-specific so that individual laboratory variables such as equipment brands, reagent suppliers, and chemist technique are factored into the performance study. MDLs are established using controlled matrices (i.e., DI water). Practical quantitation limits (PQL) or method quantitation limits (MQL), used for this project are those statistically determined by the laboratories. The analytical program executed for this project required the use of SW-846 methods, which specify the procedure for calculating the MDLs. The PQL/MQL calculation adjusts the limit by a predetermined mathematical factor for the analysis of actual environmental sample matrices (i.e. soil, groundwater, etc.). Method reporting limits (MRL) are based on the project action or decision levels.

These limits are generally defined as follows:

- ***MDL.*** The minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the concentration is greater than zero.

- ***MQL/PQL.*** The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. It is set at the lowest standard used for the calibration curve.

- ***MRL.*** A threshold value below which the laboratory reports a result as non-detected. Ideally, the MRL will be established anywhere between the MDL and 1/2 the project action levels.

An MDL is the lower limit at which the laboratory can differentiate a measurement from background. The MDL is determined in accordance with the procedures in 40 CFR Part 136. If project action levels are near or below the MDL, it is unlikely the sensitivity of the method will be achievable. A compromise must be reached. The PQL/MQL is the lower limit at which a measurement becomes meaningful. This measurement (the PQL or the RL) is generally a multiple of three to five times the MDL.

Most samples were handled and analyzed as expected without significant changes to the anticipated project MQLs**.** Thirteen samples had elevated MQLs due to dilutions.

3.3 Holding Times/Preservation

All laboratory results submitted for this investigation have been reviewed with respect to laboratory adherence to extraction and analysis holding times. All hold times and preservation requirements were met. No qualification required.

4.0 Data Evaluation and Usability

The analytical data review process identified a few analytical nonconformance issues that were noted during this analytical program. These anomalies have been discussed in the previous sections of this appendix. Table 3 summarizes all compounds requiring qualifier application due to anomalies discovered during data validation. Table 4 defines the reason codes for qualification and Table 5 defines the data validation qualifiers.

The following definitions are used for defining precision, accuracy, representativeness, completeness, and comparability as they have been applied to this evaluation.

Precision. Precision is a measurement of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision data were obtained through the analysis and evaluation of duplicate QA samples. Accuracy was determined through the analysis and evaluation of method blanks, LCSs, trip blanks, equipment rinsates, and MS samples.

Accuracy. Accuracy is a measurement of bias in a system and is expressed as a percent recovery. These QA samples were collected and/or analyzed at the frequency established in the SAP, verifying the completeness element of the DQOs along with the evaluation of holding times and reporting limits. Percent recovery is calculated as follows:

$$Percent\ \mathrm{Re}\,\mathrm{cov}ery = \left(\frac{(x-s)}{T}\right) * 100$$

Where:

X = the lab determined concentration of a spiked sample

S = the sample native concentration prior to spike

T = the true concentration of the spike

Relative Percent Difference is calculated as follows:

$$\mathrm{Re}\,lative\ Percent\ Difference = \left[\frac{|D1 - D2|}{\frac{D1 + D2}{2}}\right] * 100$$

Where:

D1 and D2 = the results of duplicate measurements

Representativeness. Representativeness is a qualitative parameter that expresses the degree to which sample data actually represent the matrix and site conditions. For example, in conducting ground water monitoring, representativeness requires proper location of wells and the collection of samples under consistent, documented procedures. Wells are located based upon the results of the hydrological study in progress and are designed to provide maximum coverage of the flow conditions. Requirements and procedures for sample collection and handling are designed to maximize sample representativeness. Representativeness also can be monitored by reviewing field documentation and by performing field audits.

The samples were collected using Shaw SOPs and were fully documented through the use of standard Shaw field forms. Samples are representative of the matrix and site sampled.

Completeness. Completeness is a measure of the amount of valid data that are obtained during a sampling event as compared to the amount of data planned to be collected under optimum conditions. Some data for this project were qualified as estimated in the validation process because of the outliers noted in the MS recoveries, duplicate results for certain elements, and various other calibration and column confirmation percent difference results. Completeness is calculated as follows:

$$Completeness\ \% = \left(\frac{D_r}{D_c}\right) X\ 100$$

Where:

D_r = the number of data points for which valid results are reported

D_c = the number of valid samples/data points that are collected and reach the laboratory for analysis.

During this task, 35 regular project samples were collected resulting in approximately 490 targeted analytical records. No results were rejected. Using the above calculation, 100% completeness was achieved for the task.

Comparability. 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.

4.1 Statement of Data Usability

The overall results of the analyses, as discussed in this evaluation, suggest that representative samples were collected and analyzed, and the results are indicative of the media analyzed, with the exception of the few anomalies noted. The data do reflect expected site conditions and are usable for their intended purpose.

Tables 1 through 5 summarize the analytical program and the results for the data validation effort for all samples collected by Shaw at PBOW.

Table 1

Sample Cross Reference
Former Plum Brook Ordnance Works
Sandusky, Ohio

Sample Type	Sample Location	Sample Number	Sample Date	Sample Purpose	Sample Delivery Group	Laboratory ID
SO	PRWP-SO020	PR0200	8-Nov-10	REG	F78128	Accutest
SO	PRWP-SO022	PR0201	8-Nov-10	REG	F78128	Accutest
SO	PRWP-SO024	PR0202	8-Nov-10	REG	F78128	Accutest
SO	PRWP-SO026	PR0203	9-Nov-10	REG	F78128	Accutest
SO	PRWP-SO027	PR0204	9-Nov-10	REG	F78128	Accutest
SO	PRWP-SO028	PR0205	9-Nov-10	REG	F78128	Accutest
SO	PRWP-SO029	PR0206	9-Nov-10	REG	F78128	Accutest
SO	PRWP-SO030	PR0207	9-Nov-10	REG	F78128	Accutest
SO	PRWP-SO031	PR0208	9-Nov-10	REG	F78128	Accutest
SO	PRWP-SO035	PR0209	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO035	PR0210	10-Nov-10	FD	F78128	Accutest
SO	PRWP-SO035	PR0211	10-Nov-10	FS	A0K170493	Test America
SO	PRWP-SO040	PR0212	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO041	PR0213	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO042	PR0214	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO043	PR0215	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO044	PR0216	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO045	PR0217	10-Nov-10	REG	F78128	Accutest
SO	PRWP-SO053	PR0218	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO055	PR0219	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO055	PR0220	11-Nov-10	FD	F78128	Accutest
SO	PRWP-SO055	PR0221	11-Nov-10	FS	A0K170493	Test America
SO	PRWP-SO056	PR0222	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO057	PR0223	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO058	PR0224	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO061	PR0225	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO062	PR0226	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO063	PR0227	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO064	PR0228	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO065	PR0229	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO066	PR0230	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO067	PR0231	11-Nov-10	REG	F78128	Accutest
SO	PRWP-SO068	PR0232	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO070	PR0233	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO071	PR0234	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO072	PR0235	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO073	PR0236	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO073	PR0237	12-Nov-10	FD	F78128	Accutest
SO	PRWP-SO073	PR0238	12-Nov-10	FS	A0K170493	Test America
SO	PRWP-SO074	PR0239	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO075	PR0240	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO076	PR0241	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO077	PR0242	12-Nov-10	REG	F78128	Accutest
SO	PRWP-SO078	PR0243	12-Nov-10	REG	F78128	Accutest

Table 2

Summary of Original, Field Duplicate, and Field Split Hits with Relative Percent Difference Calculations
Former Plum Brook Ordnance Works
Sandusky, Ohio

		Location:	PRWP-SO035		PRWP-SO035		PRWP-SO035		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0209		PR0210		PR0211			
		Sample Date:	10-Nov-10		10-Nov-10		10-Nov-10			
		Depth:	1 - 10 Ft		1 - 10 Ft		1 - 10 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Amino-2,6-dinitrotoluene, 4-	N	mg/kg	0.152	J	ND		ND		-	-
RDX	N	mg/kg	0.801	J	0.351	J	ND		78.13	-
Trinitrobenzene, 1,3,5-	N	mg/kg	5.31	J	2.27	J	1.6	J	80.21	107.38
Dinitrotoluene, 2,4-	N	mg/kg	5.08	J	1.02	J	0.31	J	133.11	176.99
Dinitrobenzene, 1,3-	N	mg/kg	0.131	J	0.658	J	ND		133.59	-
Trinitrotoluene, 2,4,6-	N	mg/kg	ND		ND		0.76	J	-	-

		Location:	PRWP-SO055		PRWP-SO055		PRWP-SO055		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0219		PR0220		PR0221			
		Sample Date:	11-Nov-10		11-Nov-10		11-Nov-10			
		Depth:	1 - 10 Ft		1 - 10 Ft		1 - 10 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Dinitrotoluene, 2,4-	N	mg/kg	0.72	J	0.402	J	0.81		56.68	11.76
RDX	N	mg/kg	ND		0.298	J	ND		-	-
Trinitrobenzene, 1,3,5-	N	mg/kg	2.13		1.42		2.4		40.00	11.92

		Location:	PRWP-SO073		PRWP-SO073		PRWP-SO073		Relative Percent Difference REG and FD	Relative Percent Difference REG and FS
		Sample Number:	PR0236		PR0237		PR0238			
		Sample Date:	12-Nov-10		12-Nov-10		12-Nov-10			
		Depth:	1 - 10 Ft		1 - 10 Ft		1 - 10 Ft			
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Trinitrobenzene, 1,3,5-	N	mg/kg	0.231		0.334		ND		36.46	-

Table 3

Summary of Data Validation Reason Codes
Former Plum Brook Ordnance Works
Sandusky, Ohio

Reason Code	Description
01	Sample received outside of 4+/-2 degrees Celsius
01A	Improper sample preservation
02	Holding Time Exceeded
02A	Extraction
02B	Analysis
03	Instrument Performance - Outside Criteria
03A	BFB
03B	DFTPP
03C	DDT and/or Endrin % breakdown exceeds criteria
03D	retention time windows
03E	Resolution
04	Initial Calibration results outside specified criteria
04A	Compound mean RRF<0.05
04B	Compound %RSD>30
04C	Correlation Coefficient<0.995
05	Continuing Calibration results outside specified criteria
05A	Compound mean RRF<0.05
05B	Compound %D>25
06	Result qualified as a result of the 5x/10x blank correction
06A	Method or Preparation Blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate Recoveries outside control limits
07A	Sample
07B	Associated method blank or LCS
08	MS/MSD/Duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	%RPD outside acceptance criteria (precision)
09	Post Digestion Spike outside criteria (GFAA)
10	Internal Standards outside specified control limits
10A	Recovery
10B	Retention Time
11	Laboratory Control Sample recoveries outside specified control limits
11A	Recovery
11B	%RPD (if run in duplicate)
12	Interference Check Standard
13	Serial Dilution
14	Tentatively Identified Compounds
15	Quantitation
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria exceeded
18	Percent difference between original and second column > 25%
19	Professional judgement was used to qualify the data
20	Pesticide clean-up checks
21	Target compound identification
22	Radiological calibration
23	Radiological quantitation
24	Reported result and/or lab qualifier revised to reflect validation findings
999	See hard copy for details.

Table 4

Summary of Data Validation Qualifiers Assigned and Reason Codes for Qualification
Former Plum Brook Ordnance Works
Sandusky, Ohio

Work Order	Sample Number	Analysis	Parameter	Reason Codes				
				VQ	R1	R2	R3	R4
A0K170493	PR0211	EXPLOSIVES	1,3,5-Trinitrobenzene	J	07A			
A0K170493	PR0211	EXPLOSIVES	2,4,6-Trinitrotoluene	J	18	07A		
A0K170493	PR0211	EXPLOSIVES	2,4-Dinitrotoluene	J	07A			
F78128	PR0200	EXPLOSIVES	2,4,6-Trinitrotoluene	J	18			
F78128	PR0200	EXPLOSIVES	RDX	J	19			
F78128	PR0201	EXPLOSIVES	RDX	J	19			
F78128	PR0202	EXPLOSIVES	RDX	J	19			
F78128	PR0202	EXPLOSIVES	1,3-Dinitrobenzene	J	15			
F78128	PR0203	EXPLOSIVES	1,3,5-Trinitrobenzene	J	08A			
F78128	PR0203	EXPLOSIVES	RDX	J	19			
F78128	PR0204	EXPLOSIVES	RDX	J	19			
F78128	PR0205	EXPLOSIVES	RDX	J	19			
F78128	PR0206	EXPLOSIVES	RDX	J	19			
F78128	PR0207	EXPLOSIVES	RDX	J	19			
F78128	PR0208	EXPLOSIVES	RDX	J	18			
F78128	PR0209	EXPLOSIVES	1,3,5-Trinitrobenzene	J	17			
F78128	PR0209	EXPLOSIVES	1,3-Dinitrobenzene	J	18	17	15	
F78128	PR0209	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F78128	PR0209	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	15			
F78128	PR0209	EXPLOSIVES	RDX	J	17	19		
F78128	PR0210	EXPLOSIVES	1,3,5-Trinitrobenzene	J	17			
F78128	PR0210	EXPLOSIVES	1,3-Dinitrobenzene	J	17			
F78128	PR0210	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F78128	PR0210	EXPLOSIVES	RDX	J	19	17		
F78128	PR0212	EXPLOSIVES	RDX	J	19			
F78128	PR0213	EXPLOSIVES	RDX	J	19			
F78128	PR0214	EXPLOSIVES	RDX	J	19			
F78128	PR0215	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	18	15		
F78128	PR0215	EXPLOSIVES	RDX	J	19			
F78128	PR0216	EXPLOSIVES	RDX	J	19			
F78128	PR0217	EXPLOSIVES	RDX	J	15			
F78128	PR0218	EXPLOSIVES	RDX	J	15			
F78128	PR0219	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F78128	PR0220	EXPLOSIVES	2,4-Dinitrotoluene	J	17			
F78128	PR0220	EXPLOSIVES	RDX	J	18			
F78128	PR0222	EXPLOSIVES	2,6-Dinitrotoluene	J	18	15		
F78128	PR0227	EXPLOSIVES	2,4-Dinitrotoluene	J	18	15		
F78128	PR0231	EXPLOSIVES	1,3-Dinitrobenzene	J	18			
F78128	PR0232	EXPLOSIVES	2,4-Dinitrotoluene	J	18			
F78128	PR0240	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	18			
F78128	PR0242	EXPLOSIVES	2,6-Dinitrotoluene	J	18			
F78128	PR0243	EXPLOSIVES	4-amino-2,6-Dinitrotoluene	J	18			

Table 5

Laboratory and Validation Qualifier Definitions
Former Plum Brook Ordnance Works
Sandusky, Ohio

Qualifier	Definition
Laboratory	
B (organics)	Indicates analyte is found in associated method blank.
J (organics)	The compound was positively identified; the reported value is below the reporting limit.
U	Not detected. The compound was analyzed for, but not detected above the associated reporting limit.
E	Indicates that the result is above the maximum calibration range.
N	Indicates presumptive evidence of a compound.
P	RPD > 40% between the primary and confirmation column results for dual column chromatographic method (e.g. GC and HPLC methods).
COL	RPD > 40% between the primary and confirmation column results for dual column chromatographic method (e.g. GC and HPLC methods).
Validation	
B	The compound/analyte was detected in a lab or field blank.
J	The compound/analyte was positively identified; the reported value is an estimated concentration.
U	Not detected. The compound/analyte was analyzed for, but not detected above the associated reporting limit.
UJ	The analyte is not detected; the result is an estimated value.
R	Analyte is rejected.

APPENDIX D

DERIVATION OF EXPOSURE POINT CONCENTRATIONS

Appendix D

Derivation of Exposure Point Concentrations for the Identification of Chemicals of Concern

Exposure point concentrations (EPC) were initially derived for chemicals of potential concern in the Pentolite Road Red Water Pond (PRRWP) Area baseline human health risk assessment (BHHRA) (IT Corporation, 2000). However, after completion of the BHHRA, additional and extensive contamination was identified during delineation sampling described in the Site Delineation Report (Shaw Environmental, Inc., 2011) and conducted as part of the feasibility study (FS). The Site Delineation Report is included as Appendix C of the PRRWP Area FS report. As a result, the EPCs identified in the BHHRA are not representative of contamination as it is currently known at the PRRWP Area. The EPCs are typically used in the BHHRA to calculate exposure and risk, which is then used to support remediation decisions. EPCs are calculated in this appendix to identify chemicals of concern (COC).

The PRRWP Area is approximately 0.5 mile from the residential areas that abut the facility boundary. These off-site residential lots appear to comprise approximately one-half acre. Therefore, for purposes of the FS, an exposure unit of 0.5 acre was selected to derive the EPCs of detected nitroaromatic compounds. The 0.5-acre exposure area shown on Figure D-1 was selected as representative because it includes some of the higher concentrations of detected nitroaromatics as well as samples in which no nitroaromatics were detected. The data sets for this exposure unit include analytical results from the 27 samples depicted on Figure D-1. These data are summarized in Table D-1, which includes the following information:

- Chemical name
- Frequency of detection
- Range of detected concentrations
- Range of reporting limits
- Arithmetic mean of site concentrations
- Risk-based screening concentration (RBSC)
- Determination of whether the maximum detected concentration exceeds the RBSC
- 95th percent upper confidence limit on the arithmetic mean (UCL) for those chemicals that exceed the RBSCs

- EPC
- Determination of whether the EPC exceeds the RBSC.

The RBSCs are the November 2012 residential soil regional screening level (RSL) (U.S. Environmental Protection Agency [EPA], 2012) values, based on an adjusted hazard quotient (HQ) of 0.1 and an incremental lifetime cancer risk (ILCR) of 1E-6. The EPC was selected as the lesser of the maximum detected concentration or the UCL, which was calculated in using ProUCL software (EPA, 2011) as shown in Attachment D-1. For each chemical, the UCL was selected as the EPC. As presented in Table D-1, both the maximum detected concentration and the EPC of each detected nitroaromatic exceed the RBSC.

In Table D-2, the EPC for each nitroaromatic is compared against the non-cancer-based and cancer-based RSLs (as applicable) to estimate the associated noncancer hazard and cancer risk for each chemical. These RSL values are taken directly from the RSL residential soil supporting tables that include both non-cancer-based (HQ=1) and cancer-based (ILCR=1E-6) RSL values (EPA, 2012). The estimated HQ and ILCR values at the EPC are presented in Table D-2.

The estimated HQ for each of the seven detected nitroaromatics exceeds the hazard index criterion of 1, indicating that at the EPC, each detected nitroaromatic cannot be regarded as unlikely to result in adverse human health effects for an exposed individual (EPA, 1989). This does not even take into account the potential for additive risks of multiple chemicals. Therefore, each of the detected nitroaromatics is identified as a COC based on potential noncancer effects.

The estimated ILCR value for each of the three carcinogenic nitroaromatics (2,4-dinitrotoluene, 2,6-dinitrotoluene, and 2,4,6-trinitrotoluene) exceeds the 1E-6 to 1E-4 ILCR range that is described by the National Oil and Hazardous Substances Pollution Contingency Plan (EPA, 1990) as associated with acceptable risk. Thus, each of these chemicals is identified as a COC based on carcinogenicity as well as adverse noncancer health effects. Please note that the ILCR of 2,4-dinitrotoluene is an order of magnitude higher than the other two carcinogens combined.

References

IT Corporation, 2000, ***Risk Assessment and Direct-Push Investigation of Red Water Pond Areas***, Final, Former Plum Brook Ordnance Works, Sandusky, Ohio, August.

Shaw Environmental, Inc. (Shaw), 2011, ***Pentolite Road Red Water Pond Area Site Delineation Report,*** Final, Former Plum Brook Ordnance Works, Sandusky, Ohio, October.

U.S. Environmental Protection Agency (EPA), 2012, ***Regional Screening Level Table***, November, on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

U.S. Environmental Protection Agency (EPA), 2011, ***ProUCL Version 4.1***, Office of Research and Development, Technology Support Center Characterization and Monitoring Branch, Las Vegas, Nevada, February, on line at http://www.epa.gov/esd/tsc/form.htm.

U.S. Environmental Protection Agency (EPA), 1990, "National Oil and Hazardous Substances Pollution Contingency Plan," ***Federal Register*** 55(46): 8666-8865.

U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund***, ***Volume I, Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

TABLES

Table D-1

Summary of Analytical Data Used to Derive Exposure Point Concentrations
Pentolite Road Red Water Pond Feasibility Study Addendum
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values (mg/kg) Detected Concentrations Minimum		Range of Values (mg/kg) Detected Concentrations Maximum	Range of Values (mg/kg) Reporting Limits Minimum	Range of Values (mg/kg) Reporting Limits Maximum	Mean (mg/kg)	RBSC [a] (mg/kg)	MDC Exceeds RBSC?	95% UCL [b] (mg/kg)	EPC [c] (mg/kg)	EPC Exceeds RBSC?
Amino-2,6-dinitrotoluene, 4-	7 / 27	26	0.112	J	2900	0.036	0.51	133	15	Yes	327.8	328	Yes
Amino-4,6-dinitrotoluene, 2-	10 / 27	37	0.133		6400	0.078	0.18	257	15	Yes	1324	1324	Yes
Dinitrobenzene, 1,3-	15 / 27	56	0.537	J	5900	0.038	0.45	564	0.61	Yes	1862	1862	Yes
Dinitrotoluene, 2,4-	20 / 27	74	1.6		22000	0.043	0.16	2587	0.72	Yes	7394	7394	Yes
Dinitrotoluene, 2,6-	14 / 27	52	0.23		3000	0.038	0.84	362	0.72	Yes	621.6	622	Yes
Trinitrobenzene, 1,3,5-	19 / 27	70	0.0508	J	27000	0.036	0.17	2898	220	Yes	8751	8751	Yes
Trinitrotoluene, 2,4,6-	7 / 27	26	10		26000	0.036	0.18	1019	3.6	Yes	5465	5465	Yes

mg/kg - Milligrams per kilogram; RBSC - Risk-based screening concentration; MDC - Maximum detected concentration; UCL - Upper confidence limit of the mean concentration; EPC - Exposure point concentration; "J" indicates that value is qualified as estimated.

[a] RBSCs are based on EPA Regional Screening Level Table (November 2012) residential soil values and are based on a cancer risk level of 1.0E-06 and a hazard quotient of 0.1.

[b] The 95% UCL values were calculated using ProUCL version 4.1 software (EPA, 2011). The input and ProUCL output are attached to this appendix.

[c] EPC is selected as the 95% UCL or mMDC, whichever is less. For each of these values, the EPC equals the UCL.

Note: As described in the text of this appendix, this table is based on a one-half acre exposure unit within the Pentolite Road Red Water Pond Area. Sample locations for the exposure unit represented by this table are shown on Figure D-1.

Table D-2

Estimate of Noncancer Hazard and Cancer Risk for Nitroaromatics
Pentolite Road Red Water Pond Fesibility Study Addendum
Former Plum Brook Ordnance Works, Sandusky, Ohio

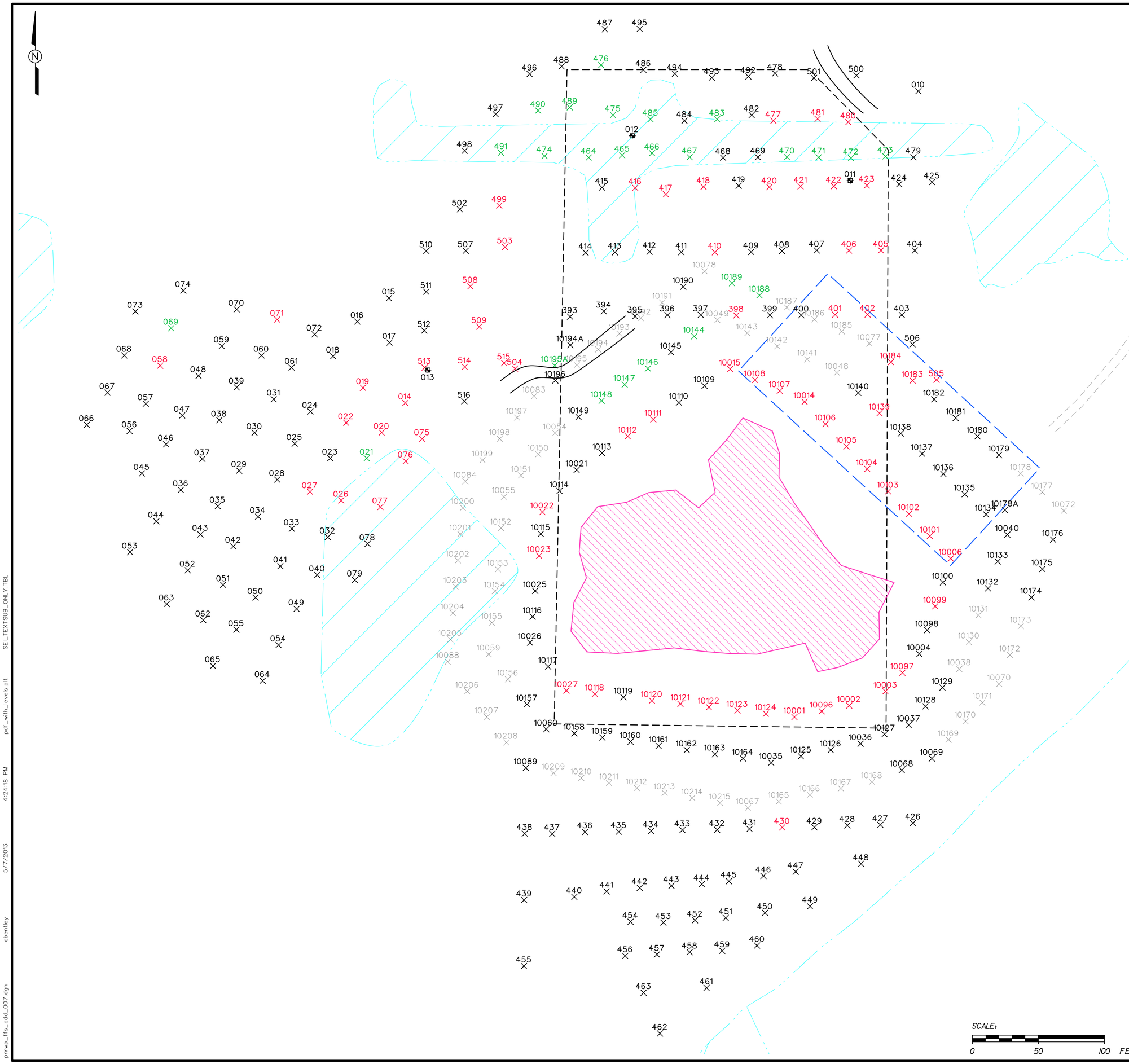
Chemical	EPC (mg/kg)	Non-Cancer-Based RSL[a] (mg/kg)	Cancer-Based RSL[b] (mg/kg)	Estimated HQ	Estimated ILCR
Amino-2,6-dinitrotoluene, 4-	328	150	NA	2	NA
Amino-4,6-dinitrotoluene, 2-	1324	150	NA	9	NA
Dinitrobenzene, 1,3-	1862	6.1	NA	305	NA
Dinitrotoluene, 2,4-	7394	120	0.72	62	1.E-02
Dinitrotoluene, 2,6-	622	61	0.72	10	9.E-04
Trinitrobenzene, 1,3,5-	8751	2200	NA	4	NA
Trinitrotoluene, 2,4,6-	5465	36	19	152	3.E-04

EPC - Exposure point concentration; mg/kg - Milligrams per kilogram; RSL - Regional screening level;
HQ - Hazard quotient; ILCR - Incremental lifetime cancer risk; NA - Not applicable.

[a] Noncancer RSL values are from the EPA November 2012 residential soil table and are based on an HQ of 1.
[a] Cancer-based RSL values are from the EPA November 2012 residential soil table and based on an ILCR of 1E-6.

Note: As described in the text of this appendix, this table is based on a one-half acre exposure unit within the Pentolite Road Red Water Pond Area. Sample locations for the exposure unit represented by this table are shown on Figure D-1.

FIGURE



LEGEND:

- INTERPRETED EXTENT OF POND BASED ON AN HISTORICAL DRAWING
- GRAVEL ROAD
- SURFACE DRAINAGE
- SURFACE WATER
- COMPLETED TNT SOIL REMEDIATION AREA FOR NONTIME CRITICAL REMOVAL ACTION
- SHALLOW SOIL BORING LOCATION
- STAKED AS POTENTIAL SAMPLING LOCATION BUT NOT SAMPLED (SEE NOTE 2)
- SAMPLE LOCATION THAT DID NOT EXCEED ANY REMEDIAL GOALS (RG)
- SAMPLE LOCATION THAT EXCEEDS AT LEAST ONE RG
- ONLY SCREENING DATA WERE COLLECTED AND THE TOTAL NITROAROMATICS CONCENTRATION EXCEEDS 10 mg/kg (SEE NOTE 4)
- SOIL BERMS
- ASSUMED HYPOTHETICAL 0.5-ACRE RESIDENTIAL LOT USED FOR CALCULATING EXPOSURE POINT CONCENTRATIONS OF THE CHEMICALS OF CONCERN

NOTES:

1. LOCATION OF SAMPLE 10194A IS APPROXIMATE.
2. NUMEROUS LOCATIONS WERE STAKED BUT, BASED ON TEST KIT AND/OR LABORATORY RESULTS OF SAMPLES AT OTHER LOCATIONS, THE FIELD TEAM DETERMINED THAT SAMPLE COLLECTION WAS NOT NECESSARY.
3. SHALLOW SOIL BORING SAMPLES WERE COLLECTED AT 0-3 FT. BELOW GROUND SURFACE (BGS). OTHER SAMPLES WERE COLLECTED AT 0-10 FT. BGS OR 1-10 FT. BGS.
4. BASED ON COMPARISON OF SCREENING DATA TO LAB DATA FROM THE SAME LOCATION, CONCENTRATIONS GREATER THAN 10 MILLIGRAMS PER KILOGRAM (mg/kg) WERE IDENTIFIED AS MORE LIKELY TO HAVE ELEVATED LABORATORY RESULTS. THIS 10 mg/kg VALUE IS NOT REGARDED AS A "BRIGHT LINE" CRITERION, BUT IS A GENERAL OBSERVATION.
5. TEST KIT RESULTS FOR TOTAL NITROAROMATICS CONCENTRATIONS ARE PRESENTED ON FIGURE 5-1 OF THE SITE DELINEATION REPORT (APPENDIX C OF THE FEASIBILITY STUDY).
6. RESIDENTIAL LOTS ABUTTING THE PLUM BROOK STATION BOUNDARY ARE APPROXIMATELY 0.5 ACRE.

FIGURE D-1
HYPOTHETICAL 0.5-ACRE RESIDENTIAL LOT USED TO CALCULATE EXPOSURE POINT CONCENTRATIONS

PENTOLITE ROAD RED WATER POND AREA
ADDENDUM TO THE FOCUSED FEASIBILITY STUDY
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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

prrwp_ffs_add_007.dgn cbentley 5/7/2013 4:24:18 PM pdf_with_levels.plt SEL_TEXTSUB_ONLY.TBL

ATTACHMENT D-1

ProUCL INPUT AND OUTPUT

		Amino-2,6-dinitrotoluene, 4-	D_Amino-2,6-dinitrotoluene, 4-
400	200708M-RR-400	0.16	0
401	200708M-RR-401	0.16	0
402	200708M-RR-402	0.15	0
10006	200708M-RR-247.5	0.16	0
10014	200708M-RR-241	0.15	0
10101	200708M-RR-247	300	1
10102	200708M-RR-246	2900	1
10103	200708M-RR-245	0.15	0
10104	200708M-RR-244	0.51	0
10105	200708M-RR-243	380	1
10106	200708M-RR-242	0.48	0
10107	200708M-RR-240	0.18	0
10108	200708M-RR-239	0.17	0
10137	200708M-RR-286	0.17	0
10182	200708M-RR-337	1.2	1
PR-00505	PR0053PR0054	0.4155	1
PR-10134	PR0062	0.039	0
PR-10135	PR0063	0.043	0
PR-10136	PR0072	0.112	1
PR-10138	PR0057	0.48	0
PR-10139	PR0058	0.14	0
PR-10140	PR0059	0.15	0
PR-10179	PR0070	0.04	0
PR-10180	PR0071	0.036	0
PR-10181	PR0064	0.045	0
PR-10183	PR0065PR0066	0.1142	1
PR-10184	PR0007	0.16	0

Amino-4,6-dinitrotoluene, 2-	D_Amino-4,6-dinitrotoluene, 2	Dinitrobenzene, 1,3-	D_Dinitrobenzene, 1,3
0.14	0	0.18	0
1.6	1	5.4	1
0.74	1	3.4	1
0.18	0	31	1
0.17	0	5900	1
260	1	0.17	0
6400	1	430	1
0.16	0	310	1
0.16	0	0.15	0
270	1	440	1
0.15	0	4700	1
0.15	0	0.16	0
0.15	0	3400	1
0.14	0	0.45	0
1.1	1	1.2	1
0.3315	1	0.53735	1
0.084	0	0.041	0
0.094	0	0.046	0
0.082	0	0.04	0
0.35	1	1.93	1
0.078	0	4.07	1
0.081	0	0.45	0
0.087	0	0.042	0
0.079	0	0.038	0
0.098	0	0.048	0
0.133	1	1.31745	1
0.229	1	4.38	1

Dinitrotoluene, 2,4-	D_Dinitrotoluene, 2,4	Dinitrotoluene, 2,6-	D_Dinitrotoluene, 2,6	Trinitrobenzene, 1,3,5-
2.1	1	0.23	1	0.39
17	1	1.9	1	18
9.6	1	1.2	1	9.9
42	1	0.15	0	0.14
22000	1	3000	1	20000
58	1	0.16	0	140
480	1	96	1	700
1300	1	160	1	340
14000	1	2000	1	15000
1900	1	220	1	0.16
15000	1	2000	1	27000
7600	1	1100	1	5900
7400	1	1200	1	9100
0.16	0	0.84	0	0.17
1.6	1	0.46	1	3.2
3.88	1	0.613	1	0.8225
0.047	0	0.041	0	0.039
0.052	0	0.046	0	0.043
0.045	0	0.04	0	0.0508
5.44	1	0.32	0	3.58
9.65	1	0.84	0	9.16
3.89	1	0.45	0	3.58
0.048	0	0.042	0	0.04
0.043	0	0.038	0	0.036
0.054	0	0.048	0	0.045
5.5455	1	0.842	1	2.2755
8.77	1	0.48	0	9.07

D_Trinitrobenzene, 1,3,5	Trinitrotoluene, 2,4,6-	D_Trinitrotoluene, 2,4,6-		
1	0.16	0	U	0.16
1	0.16	0	U	0.16
1	0.16	0	U	0.15
0	38	1	U	0.16
1	560	1	U	0.15
1	230	1		300
1	26000	1		2900
1	0.18	0	U	0.15
1	380	1	U	0.51
0	0.17	0		380
1	280	1	U	0.48
1	0.17	0	U	0.18
1	0.17	0	U	0.17
0	0.16	0	U	0.17
1	10	1		1.2
1	0.042	0	U/	0.4155
0	0.039	0	U	0.039
0	0.043	0	U	0.043
1	0.038	0	J	0.112
1	0.041	0	U	0.48
1	0.036	0	U	0.14
1	0.037	0	U	0.15
0	0.04	0	U	0.04
0	0.036	0	U	0.036
0	0.045	0	U	0.045
1	0.0405	0	JU	0.1142
1	0.041	0	U	0.16

	A	B	C	D	E	F	G	H	I	J	K	L
1				General UCL Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	Sheet1.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	Amino-2,6-dinitrotoluene, 4-											
10												
11						General Statistics						
12						Number of Valid Data	27			Number of Detected Data		7
13						Number of Distinct Detected Data	7			Number of Non-Detect Data		20
14										Percent Non-Detects		74.07%
15												
16				Raw Statistics						Log-transformed Statistics		
17						Minimum Detected	0.112			Minimum Detected		-2.189
18						Maximum Detected	2900			Maximum Detected		7.972
19						Mean of Detected	511.7			Mean of Detected		2.08
20						SD of Detected	1065			SD of Detected		4.309
21						Minimum Non-Detect	0.036			Minimum Non-Detect		-3.324
22						Maximum Non-Detect	0.51			Maximum Non-Detect		-0.673
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		23
25	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		4
26	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		85.19%
27												
28						Warning: There are only 7 Detected Values in this data						
29						Note: It should be noted that even though bootstrap may be performed on this data set						
30						the resulting calculations may not be reliable enough to draw conclusions						
31												
32						It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.						
33												
34												
35						UCL Statistics						
36				Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only		
37						Shapiro Wilk Test Statistic	0.567			Shapiro Wilk Test Statistic		0.847
38						5% Shapiro Wilk Critical Value	0.803			5% Shapiro Wilk Critical Value		0.803
39						Data not Normal at 5% Significance Level				Data appear Lognormal at 5% Significance Level		
40												
41						Assuming Normal Distribution				Assuming Lognormal Distribution		
42						DL/2 Substitution Method				DL/2 Substitution Method		
43						Mean	132.7			Mean		-1.467
44						SD	560.5			SD		3.057
45						95% DL/2 (t) UCL	316.7			95% H-Stat (DL/2) UCL		819.3
46												
47						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
48						MLE yields a negative mean				Mean in Log Scale		-6.301
49										SD in Log Scale		6.047
50										Mean in Original Scale		132.7
51										SD in Original Scale		560.5
52										95% t UCL		316.7
53										95% Percentile Bootstrap UCL		336.4

	A	B	C	D	E	F	G	H	I	J	K	L
54											95% BCA Bootstrap UCL	466
55											95% H-UCL	9.275E+10
56												
57				Gamma Distribution Test with Detected Values Only					Data Distribution Test with Detected Values Only			
58					k star (bias corrected)	0.198			Data appear Gamma Distributed at 5% Significance Level			
59					Theta Star	2584						
60					nu star	2.773						
61												
62					A-D Test Statistic	0.589			Nonparametric Statistics			
63					5% A-D Critical Value	0.829					Kaplan-Meier (KM) Method	
64					K-S Test Statistic	0.829					Mean	132.7
65					5% K-S Critical Value	0.343					SD	550
66				Data appear Gamma Distributed at 5% Significance Level							SE of Mean	114.3
67											95% KM (t) UCL	327.8
68				Assuming Gamma Distribution							95% KM (z) UCL	320.8
69					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	316.7
70					Minimum	0.000001					95% KM (bootstrap t) UCL	1296
71					Maximum	2900					95% KM (BCA) UCL	396.3
72					Mean	132.7					95% KM (Percentile Bootstrap) UCL	347.7
73					Median	0.000001					95% KM (Chebyshev) UCL	631.1
74					SD	560.5					97.5% KM (Chebyshev) UCL	846.8
75					k star	0.0772					99% KM (Chebyshev) UCL	1270
76					Theta star	1718						
77					Nu star	4.169			Potential UCLs to Use			
78					AppChi2	0.79					95% KM (t) UCL	327.8
79					95% Gamma Approximate UCL (Use when n >= 40)	700.4						
80					95% Adjusted Gamma UCL (Use when n < 40)	786.2						
81	Note: DL/2 is not a recommended method.											
82												
83				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.								
84				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).								
85				For additional insight, the user may want to consult a statistician.								
86												
87												
88	Amino-4,6-dinitrotoluene, 2-											
89												
90					General Statistics							
91					Number of Valid Data	27					Number of Detected Data	10
92					Number of Distinct Detected Data	10					Number of Non-Detect Data	17
93											Percent Non-Detects	62.96%
94												
95				Raw Statistics					Log-transformed Statistics			
96					Minimum Detected	0.133					Minimum Detected	-2.017
97					Maximum Detected	6400					Maximum Detected	8.764
98					Mean of Detected	693.4					Mean of Detected	1.454
99					SD of Detected	2008					SD of Detected	3.754
100					Minimum Non-Detect	0.078					Minimum Non-Detect	-2.551
101					Maximum Non-Detect	0.18					Maximum Non-Detect	-1.715
102												
103	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	18
104	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	9
105	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	66.67%
106												

	A	B	C	D	E	F	G	H	I	J	K	L
107	UCL Statistics											
108	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
109					Shapiro Wilk Test Statistic	0.402				Shapiro Wilk Test Statistic		0.811
110					5% Shapiro Wilk Critical Value	0.842				5% Shapiro Wilk Critical Value		0.842
111	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
112												
113	Assuming Normal Distribution						Assuming Lognormal Distribution					
114					DL/2 Substitution Method					DL/2 Substitution Method		
115					Mean	256.9				Mean		-1.249
116					SD	1230				SD		3.067
117					95% DL/2 (t) UCL	660.5				95% H-Stat (DL/2) UCL		1073
118												
119					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
120	MLE yields a negative mean									Mean in Log Scale		-5.606
121										SD in Log Scale		6.11
122										Mean in Original Scale		256.8
123										SD in Original Scale		1230
124										95% t UCL		660.5
125										95% Percentile Bootstrap UCL		730.5
126										95% BCA Bootstrap UCL		1205
127										95% H-UCL		3.602E+11
128												
129	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
130					k star (bias corrected)	0.172	Data do not follow a Discernable Distribution (0.05)					
131					Theta Star	4024						
132					nu star	3.446						
133												
134					A-D Test Statistic	1.404	Nonparametric Statistics					
135					5% A-D Critical Value	0.871				Kaplan-Meier (KM) Method		
136					K-S Test Statistic	0.871				Mean		256.9
137					5% K-S Critical Value	0.296				SD		1207
138	Data not Gamma Distributed at 5% Significance Level									SE of Mean		244.8
139										95% KM (t) UCL		674.5
140	Assuming Gamma Distribution									95% KM (z) UCL		659.6
141					Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL		660.5
142					Minimum	0.000001				95% KM (bootstrap t) UCL		6334
143					Maximum	6400				95% KM (BCA) UCL		731.5
144					Mean	256.8				95% KM (Percentile Bootstrap) UCL		721.3
145					Median	0.000001				95% KM (Chebyshev) UCL		1324
146					SD	1230				97.5% KM (Chebyshev) UCL		1786
147					k star	0.0802				99% KM (Chebyshev) UCL		2693
148					Theta star	3201						
149					Nu star	4.333	Potential UCLs to Use					
150					AppChi2	0.857				99% KM (Chebyshev) UCL		2693
151					95% Gamma Approximate UCL (Use when n >= 40)	1298						
152					95% Adjusted Gamma UCL (Use when n < 40)	1452						
153	Note: DL/2 is not a recommended method.											
154												
155	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
156	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
157	For additional insight, the user may want to consult a statistician.											
158												
159												

	A	B	C	D	E	F	G	H	I	J	K	L
160	Dinitrobenzene, 1,3-											
161												
162						General Statistics						
163					Number of Valid Data	27				Number of Detected Data		15
164					Number of Distinct Detected Data	15				Number of Non-Detect Data		12
165										Percent Non-Detects		44.44%
166												
167				Raw Statistics						Log-transformed Statistics		
168					Minimum Detected	0.537				Minimum Detected		-0.621
169					Maximum Detected	5900				Maximum Detected		8.683
170					Mean of Detected	1016				Mean of Detected		3.525
171					SD of Detected	1954				SD of Detected		3.323
172					Minimum Non-Detect	0.038				Minimum Non-Detect		-3.27
173					Maximum Non-Detect	0.45				Maximum Non-Detect		-0.799
174												
175	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		12
176	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		15
177	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		44.44%
178												
179						UCL Statistics						
180				Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only		
181					Shapiro Wilk Test Statistic	0.588				Shapiro Wilk Test Statistic		0.875
182					5% Shapiro Wilk Critical Value	0.881				5% Shapiro Wilk Critical Value		0.881
183				Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level		
184												
185				Assuming Normal Distribution						Assuming Lognormal Distribution		
186					DL/2 Substitution Method					DL/2 Substitution Method		
187					Mean	564.2				Mean		0.621
188					SD	1523				SD		4.156
189					95% DL/2 (t) UCL	1064				95% H-Stat (DL/2) UCL		6000915
190												
191					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
192				MLE yields a negative mean						Mean in Log Scale		-0.219
193										SD in Log Scale		4.93
194										Mean in Original Scale		564.2
195										SD in Original Scale		1523
196										95% t UCL		1064
197										95% Percentile Bootstrap UCL		1055
198										95% BCA Bootstrap UCL		1242
199										95% H-UCL		1.089E+09
200												
201				Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only		
202					k star (bias corrected)	0.216				Data do not follow a Discernable Distribution (0.05)		
203					Theta Star	4705						
204					nu star	6.475						
205												
206					A-D Test Statistic	1.155				Nonparametric Statistics		
207					5% A-D Critical Value	0.871				Kaplan-Meier (KM) Method		
208					K-S Test Statistic	0.871				Mean		564.4
209					5% K-S Critical Value	0.244				SD		1495
210				Data not Gamma Distributed at 5% Significance Level						SE of Mean		297.8
211										95% KM (t) UCL		1072
212				Assuming Gamma Distribution						95% KM (z) UCL		1054

	A	B	C	D	E	F	G	H	I	J	K	L
213					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	1064
214					Minimum	0.000001					95% KM (bootstrap t) UCL	1513
215					Maximum	5900					95% KM (BCA) UCL	1099
216					Mean	564.2					95% KM (Percentile Bootstrap) UCL	1082
217					Median	1.2					95% KM (Chebyshev) UCL	1862
218					SD	1523					97.5% KM (Chebyshev) UCL	2424
219					k star	0.0953					99% KM (Chebyshev) UCL	3527
220					Theta star	5923						
221					Nu star	5.144					**Potential UCLs to Use**	
222					AppChi2	1.219					99% KM (Chebyshev) UCL	3527
223					95% Gamma Approximate UCL (Use when n >= 40)	2380						
224					95% Adjusted Gamma UCL (Use when n < 40)	2630						
225	**Note: DL/2 is not a recommended method.**											
226												
227	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
228	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
229	**For additional insight, the user may want to consult a statistician.**											
230												
231												
232	**Dinitrotoluene, 2,4-**											
233												
234					**General Statistics**							
235					Number of Valid Data	27					Number of Detected Data	20
236					Number of Distinct Detected Data	20					Number of Non-Detect Data	7
237											Percent Non-Detects	25.93%
238												
239					**Raw Statistics**						**Log-transformed Statistics**	
240					Minimum Detected	1.6					Minimum Detected	0.47
241					Maximum Detected	22000					Maximum Detected	9.999
242					Mean of Detected	3492					Mean of Detected	4.628
243					SD of Detected	6404					SD of Detected	3.438
244					Minimum Non-Detect	0.043					Minimum Non-Detect	-3.147
245					Maximum Non-Detect	0.16					Maximum Non-Detect	-1.833
246												
247	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	7
248	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	20
249	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	25.93%
250												
251					**UCL Statistics**							
252					**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**	
253					Shapiro Wilk Test Statistic	0.625					Shapiro Wilk Test Statistic	0.861
254					5% Shapiro Wilk Critical Value	0.905					5% Shapiro Wilk Critical Value	0.905
255					**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**	
256												
257					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
258					DL/2 Substitution Method						DL/2 Substitution Method	
259					Mean	2587					Mean	2.506
260					SD	5692					SD	4.696
261					95% DL/2 (t) UCL	4455					95% H-Stat (DL/2) UCL	2.394E+09
262												
263					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
264					Mean	1289					Mean in Log Scale	2.623
265					SD	6830					SD in Log Scale	4.535

	A	B	C	D	E	F	G	H	I	J	K	L
266					95% MLE (t) UCL	3531					Mean in Original Scale	2587
267					95% MLE (Tiku) UCL	3559					SD in Original Scale	5692
268											95% t UCL	4455
269											95% Percentile Bootstrap UCL	4471
270											95% BCA Bootstrap UCL	5201
271											95% H UCL	751200000
272												
273			Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only			
274					k star (bias corrected)	0.21			Data do not follow a Discernable Distribution (0.05)			
275					Theta Star	16667						
276					nu star	8.382						
277												
278					A-D Test Statistic	1.514			Nonparametric Statistics			
279					5% A-D Critical Value	0.885					Kaplan-Meier (KM) Method	
280					K-S Test Statistic	0.885					Mean	2587
281					5% K-S Critical Value	0.214					SD	5585
282			Data not Gamma Distributed at 5% Significance Level								SE of Mean	1103
283											95% KM (t) UCL	4468
284			Assuming Gamma Distribution								95% KM (z) UCL	4401
285					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	4456
286					Minimum	0.000001					95% KM (bootstrap t) UCL	6118
287					Maximum	22000					95% KM (BCA) UCL	4471
288					Mean	2587					95% KM (Percentile Bootstrap) UCL	4466
289					Median	8.77					95% KM (Chebyshev) UCL	7394
290					SD	5692					97.5% KM (Chebyshev) UCL	9475
291					k star	0.115					99% KM (Chebyshev) UCL	13560
292					Theta star	22562						
293					Nu star	6.192			Potential UCLs to Use			
294					AppChi2	1.739					99% KM (Chebyshev) UCL	13560
295					95% Gamma Approximate UCL (Use when n >= 40)	9213						
296					95% Adjusted Gamma UCL (Use when n < 40)	10057						
297	Note: DL/2 is not a recommended method.											
298												
299			Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.									
300			These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).									
301			For additional insight, the user may want to consult a statistician.									
302												
303												
304	Dinitrotoluene, 2,6-											
305												
306					General Statistics							
307					Number of Valid Data	27					Number of Detected Data	14
308					Number of Distinct Detected Data	13					Number of Non-Detect Data	13
309											Percent Non-Detects	48.15%
310												
311			Raw Statistics						Log-transformed Statistics			
312					Minimum Detected	0.23					Minimum Detected	-1.47
313					Maximum Detected	3000					Maximum Detected	8.006
314					Mean of Detected	698.7					Mean of Detected	3.589
315					SD of Detected	996.1					SD of Detected	3.698
316					Minimum Non-Detect	0.038					Minimum Non-Detect	-3.27
317					Maximum Non-Detect	0.84					Maximum Non-Detect	-0.174
318												

	A	B	C	D	E	F	G	H	I	J	K	L
319	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	16
320	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	11
321	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	59.26%
322												
323						UCL Statistics						
324					Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only	
325						Shapiro Wilk Test Statistic	0.745				Shapiro Wilk Test Statistic	0.845
326						5% Shapiro Wilk Critical Value	0.874				5% Shapiro Wilk Critical Value	0.874
327						Data not Normal at 5% Significance Level					Data not Lognormal at 5% Significance Level	
328												
329						Assuming Normal Distribution					Assuming Lognormal Distribution	
330						DL/2 Substitution Method					DL/2 Substitution Method	
331						Mean	362.3				Mean	0.575
332						SD	789.1				SD	4.209
333						95% DL/2 (t) UCL	621.3				95% H-Stat (DL/2) UCL	8370291
334												
335						Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method	
336						MLE yields a negative mean					Mean in Log Scale	-0.68
337											SD in Log Scale	5.253
338											Mean in Original Scale	362.3
339											SD in Original Scale	789.1
340											95% t UCL	621.3
341											95% Percentile Bootstrap UCL	629.4
342											95% BCA Bootstrap UCL	694.2
343											95% H-UCL	1.154E+10
344												
345						Gamma Distribution Test with Detected Values Only					Data Distribution Test with Detected Values Only	
346						k star (bias corrected)	0.237				Data appear Gamma Distributed at 5% Significance Level	
347						Theta Star	2945					
348						nu star	6.643					
349												
350						A-D Test Statistic	0.786				Nonparametric Statistics	
351						5% A-D Critical Value	0.856				Kaplan-Meier (KM) Method	
352						K-S Test Statistic	0.856				Mean	362.4
353						5% K-S Critical Value	0.251				SD	774.3
354						Data appear Gamma Distributed at 5% Significance Level					SE of Mean	154.6
355											95% KM (t) UCL	626.1
356						Assuming Gamma Distribution					95% KM (z) UCL	616.7
357						Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL	621.3
358						Minimum	0.000001				95% KM (bootstrap t) UCL	776
359						Maximum	3000				95% KM (BCA) UCL	621.6
360						Mean	362.3				95% KM (Percentile Bootstrap) UCL	615.8
361						Median	0.23				95% KM (Chebyshev) UCL	1036
362						SD	789.1				97.5% KM (Chebyshev) UCL	1328
363						k star	0.0943				99% KM (Chebyshev) UCL	1901
364						Theta star	3843					
365						Nu star	5.091				Potential UCLs to Use	
366						AppChi2	1.194				95% KM (BCA) UCL	621.6
367						95% Gamma Approximate UCL (Use when n >= 40)	1544					
368						95% Adjusted Gamma UCL (Use when n < 40)	1708					
369	Note: DL/2 is not a recommended method.											
370												
371						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.						

	A	B	C	D	E	F	G	H	I	J	K	L
372	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
373	For additional insight, the user may want to consult a statistician.											
374												
375												
376	Trinitrobenzene, 1,3,5-											
377												
378	General Statistics											
379					Number of Valid Data	27				Number of Detected Data		19
380					Number of Distinct Detected Data	18				Number of Non-Detect Data		8
381										Percent Non-Detects		29.63%
382												
383	Raw Statistics						Log-transformed Statistics					
384					Minimum Detected	0.0508				Minimum Detected		-2.98
385					Maximum Detected	27000				Maximum Detected		10.2
386					Mean of Detected	4118				Mean of Detected		3.94
387					SD of Detected	7993				SD of Detected		4.068
388					Minimum Non-Detect	0.036				Minimum Non-Detect		-3.324
389					Maximum Non-Detect	0.17				Maximum Non-Detect		-1.772
390												
391	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		9
392	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		18
393	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		33.33%
394												
395	UCL Statistics											
396	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
397					Shapiro Wilk Test Statistic	0.599				Shapiro Wilk Test Statistic		0.923
398					5% Shapiro Wilk Critical Value	0.901				5% Shapiro Wilk Critical Value		0.901
399	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
400												
401	Assuming Normal Distribution						Assuming Lognormal Distribution					
402					DL/2 Substitution Method					DL/2 Substitution Method		
403					Mean	2898				Mean		1.767
404					SD	6921				SD		4.821
405					95% DL/2 (t) UCL	5170				95% H-Stat (DL/2) UCL		3.17E+09
406												
407					Maximum Likelihood Estimate(MLE) Method					Log ROS Method		
408					Mean	602.9				Mean in Log Scale		1.191
409					SD	8898				SD in Log Scale		5.49
410					95% MLE (t) UCL	3524				Mean in Original Scale		2898
411					95% MLE (Tiku) UCL	3714				SD in Original Scale		6921
412										95% t UCL		5170
413										95% Percentile Bootstrap UCL		5208
414										95% BCA Bootstrap UCL		5855
415										95% H UCL		6.698E+11
416												
417	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
418					k star (bias corrected)	0.18	Data appear Lognormal at 5% Significance Level					
419					Theta Star	22901						
420					nu star	6.833						
421												
422					A-D Test Statistic	1.284	Nonparametric Statistics					
423					5% A-D Critical Value	0.898				Kaplan-Meier (KM) Method		
424					K-S Test Statistic	0.898				Mean		2898

	A	B	C	D	E	F	G	H	I	J	K	L
425					5% K-S Critical Value	0.221					SD	6792
426				Data not Gamma Distributed at 5% Significance Level							SE of Mean	1343
427											95% KM (t) UCL	5188
428				Assuming Gamma Distribution							95% KM (z) UCL	5107
429				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	5170
430					Minimum	0.000001					95% KM (bootstrap t) UCL	6998
431					Maximum	27000					95% KM (BCA) UCL	5293
432					Mean	2898					95% KM (Percentile Bootstrap) UCL	5136
433					Median	3.58					95% KM (Chebyshev) UCL	8751
434					SD	6921					97.5% KM (Chebyshev) UCL	11284
435					k star	0.104					99% KM (Chebyshev) UCL	16260
436					Theta star	27990						
437					Nu star	5.591			Potential UCLs to Use			
438					AppChi2	1.434					99% KM (Chebyshev) UCL	16260
439				95% Gamma Approximate UCL (Use when n >= 40)		11295						
440				95% Adjusted Gamma UCL (Use when n < 40)		12410						
441	Note: DL/2 is not a recommended method.											
442												
443				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.								
444				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).								
445				For additional insight, the user may want to consult a statistician.								
446												
447												
448	Trinitrotoluene, 2,4,6-											
449												
450				General Statistics								
451					Number of Valid Data	27					Number of Detected Data	7
452					Number of Distinct Detected Data	7					Number of Non-Detect Data	20
453											Percent Non-Detects	74.07%
454												
455				Raw Statistics							Log-transformed Statistics	
456					Minimum Detected	10					Minimum Detected	2.303
457					Maximum Detected	26000					Maximum Detected	10.17
458					Mean of Detected	3928					Mean of Detected	5.635
459					SD of Detected	9735					SD of Detected	2.457
460					Minimum Non-Detect	0.036					Minimum Non-Detect	-3.324
461					Maximum Non-Detect	0.18					Maximum Non-Detect	-1.715
462												
463	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	20
464	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	7
465	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	74.07%
466												
467				Warning: There are only 7 Detected Values in this data								
468				Note: It should be noted that even though bootstrap may be performed on this data set								
469				the resulting calculations may not be reliable enough to draw conclusions								
470												
471				It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.								
472												
473												
474				UCL Statistics								
475				Normal Distribution Test with Detected Values Only							Lognormal Distribution Test with Detected Values Only	
476					Shapiro Wilk Test Statistic	0.472					Shapiro Wilk Test Statistic	0.924
477					5% Shapiro Wilk Critical Value	0.803					5% Shapiro Wilk Critical Value	0.803

	A	B	C	D	E	F	G	H	I	J	K	L
478	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
479												
480	Assuming Normal Distribution						Assuming Lognormal Distribution					
481					DL/2 Substitution Method						DL/2 Substitution Method	
482					Mean	1018					Mean	-1.017
483					SD	4995					SD	4.226
484					95% DL/2 (t) UCL	2658					95% H-Stat (DL/2) UCL	1927100
485												
486					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
487	MLE yields a negative mean										Mean in Log Scale	-1.263
488											SD in Log Scale	4.619
489											Mean in Original Scale	1019
490											SD in Original Scale	4995
491											95% t UCL	2658
492											95% Percentile Bootstrap UCL	2931
493											95% BCA Bootstrap UCL	3937
494											95% H-UCL	29777115
495												
496	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
497					k star (bias corrected)	0.247	Data appear Lognormal at 5% Significance Level					
498					Theta Star	15879						
499					nu star	3.463						
500												
501					A-D Test Statistic	0.939	Nonparametric Statistics					
502					5% A-D Critical Value	0.797					Kaplan-Meier (KM) Method	
503					K-S Test Statistic	0.797					Mean	1026
504					5% K-S Critical Value	0.337					SD	4900
505	Data not Gamma Distributed at 5% Significance Level										SE of Mean	1018
506											95% KM (t) UCL	2763
507	Assuming Gamma Distribution										95% KM (z) UCL	2701
508					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	2646
509					Minimum	0.000001					95% KM (bootstrap t) UCL	53352
510					Maximum	26000					95% KM (BCA) UCL	3882
511					Mean	1018					95% KM (Percentile Bootstrap) UCL	2954
512					Median	0.000001					95% KM (Chebyshev) UCL	5465
513					SD	4995					97.5% KM (Chebyshev) UCL	7386
514					k star	0.0738					99% KM (Chebyshev) UCL	11160
515					Theta star	13802						
516					Nu star	3.985	Potential UCLs to Use					
517					AppChi2	0.716					99% KM (Chebyshev) UCL	11160
518					95% Gamma Approximate UCL (Use when n >= 40)	5671						
519					95% Adjusted Gamma UCL (Use when n < 40)	6387						
520	Note: DL/2 is not a recommended method.											
521												
522	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
523	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
524	For additional insight, the user may want to consult a statistician.											
525												

APPENDIX E

COMPARISON OF DELINEATION SAMPLE RESULTS TO REMEDIAL GOALS

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO010			PRWP-SO011			PRWP-SO012			PRWP-SO013			PRWP-SO014		
		Sample No.:	PR0075			PR0076			PR0077			PR0078			PR0079		
		Sample Date:	16-Jun-10			16-Jun-10			16-Jun-10			16-Jun-10			16-Jun-10		
		Sample Depth:	1 - 10 Ft			0 - 3 Ft			0 - 3 Ft			0 - 3 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		0.343			-	-		0.889			-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		0.291			4.68			0.72			3.95		
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		1.38			8.24		X	5.77		X	21.2		X
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	-	-		0.214			3.55			0.435			15.8		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		6.37		

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO015			PRWP-SO016			PRWP-SO017			PRWP-SO018			PRWP-SO019		
		Sample No.:	PR0080			PR0081			PR0082			PR0083			PR0084		
		Sample Date:	16-Jun-10			16-Jun-10			16-Jun-10			16-Jun-10			16-Jun-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	0.104	J		0.182			-	-		0.768			-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		0.448			0.175			1.3			5.57		
Dinitrotoluene, 2,4-	mg/kg	5.6	0.803			1.28			2.9			3.36			18		X
Dinitrotoluene, 2,6-	mg/kg	1.2	0.16	J		-	-		0.551			-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	1.66			1.61			3.29			3.53			18.7		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO019			PRWP-SO020			PRWP-SO022			PRWP-SO024			PRWP-SO026		
		Sample No.:	PR0085			PR0200			PR0201			PR0202			PR0203		
		Sample Date:	16-Jun-10			8-Nov-10			8-Nov-10			8-Nov-10			9-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	FD			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	3.57			21.7		X	8.25		X	0.175	J		12.6		X
Dinitrotoluene, 2,4-	mg/kg	5.6	12.3		X	50.1		X	16.4		X	-	-		36.3		X
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		21.3	J		8.37	J		0.21	J		9.81	J	
Trinitrobenzene, 1,3,5-	mg/kg	220	13.1			74			28.9			1.72			43.4	J	
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		9.74	J		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO027			PRWP-SO028			PRWP-SO029			PRWP-SO030			PRWP-SO031		
		Sample No.:	PR0204			PR0205			PR0206			PR0207			PR0208		
		Sample Date:	9-Nov-10			9-Nov-10			9-Nov-10			9-Nov-10			9-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	3.61			1.62			1.61			1.13			0.497		
Dinitrotoluene, 2,4-	mg/kg	5.6	9.28		X	2.37			3.58			2.05			0.492		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	1.52	J		0.714	J		1.21	J		1.57	J		0.47	J	
Trinitrobenzene, 1,3,5-	mg/kg	220	11.4			6.29			7.27			5.67			2.55		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO035			PRWP-SO035			PRWP-SO035			PRWP-SO040			PRWP-SO041		
		Sample No.:	PR0209			PR0210			PR0211			PR0212			PR0213		
		Sample Date:	10-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			FD			FS			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	0.152	J		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.131	J		0.658	J		-	-		3.08			1.46		
Dinitrotoluene, 2,4-	mg/kg	5.6	5.08	J		1.02	J		0.31	J		5.51			1.69		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	0.801	J		0.351	J		-	-		2.35	J		0.321	J	
Trinitrobenzene, 1,3,5-	mg/kg	220	5.31	J		2.27	J		1.6	J		10.5			3.52		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		0.76	J		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO042			PRWP-SO043			PRWP-SO044			PRWP-SO045			PRWP-SO053		
		Sample No.:	PR0214			PR0215			PR0216			PR0217			PR0218		
		Sample Date:	10-Nov-10			10-Nov-10			10-Nov-10			10-Nov-10			11-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		0.118	J		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.558			0.431			0.204			-	-		-	-	
Dinitrotoluene, 2,4-	mg/kg	5.6	0.518			2.52			0.725			-	-		-	-	
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	0.449	J		0.7	J		0.308	J		0.11	J		0.118	J	
Trinitrobenzene, 1,3,5-	mg/kg	220	4			6.01			1.34			0.437			0.407		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO055			PRWP-SO055			PRWP-SO055			PRWP-SO056			PRWP-SO057		
		Sample No.:	PR0219			PR0220			PR0221			PR0222			PR0223		
		Sample Date:	11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			#NAME?			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			FD			FS			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		-	-		-	-		0.602			1.15		
Dinitrotoluene, 2,4-	mg/kg	5.6	0.72	J		0.402	J		0.81			0.777			3.58		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		0.115	J		-	-	
RDX	mg/kg	NA	-	-		0.298	J		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	2.13			1.42			2.4			2.69			3.35		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO058			PRWP-SO061			PRWP-SO062			PRWP-SO063			PRWP-SO064		
		Sample No.:	PR0224			PR0225			PR0226			PR0227			PR0228		
		Sample Date:	11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10			11-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		0.186			-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.557			1.43			0.279			-	-		-	-	
Dinitrotoluene, 2,4-	mg/kg	5.6	1.66			1.81			-	-		0.101	J		1.19		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	1.91			3.62			0.843			1.11			3.19		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO065			PRWP-SO066			PRWP-SO067			PRWP-SO068			PRWP-SO070		
		Sample No.:	PR0229			PR0230			PR0231			PR0232			PR0233		
		Sample Date:	11-Nov-10			11-Nov-10			11-Nov-10			12-Nov-10			12-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	0.259			-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		0.185			0.624	J		0.388			1.05		
Dinitrotoluene, 2,4-	mg/kg	5.6	0.789			2.26			5.35			0.629	J		2.41		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	3.02			2.17			6.26			1.74			4.2		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO071			PRWP-SO072			PRWP-SO073			PRWP-SO073			PRWP-SO073		
		Sample No.:	PR0234			PR0235			PR0236			PR0237			PR0238		
		Sample Date:	12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1-10 ft		
		Sample Purpose:	REG			REG			REG			FD			FS		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	1.25			0.258			-	-		-	-		-	-	
Dinitrotoluene, 2,4-	mg/kg	5.6	7.3		X	0.638			-	-		-	-		-	-	
Dinitrotoluene, 2,6-	mg/kg	1.2	1.44		X	-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	8.27			1.1			0.231			0.334			-	-	
Trinitrotoluene, 2,4,6-	mg/kg	36	0.317			-	-		-	-		-	-		-	-	

Table E-1

Comparison of Delineation Sample Results to Remedial Goals
June and November 2010 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PRWP-SO074			PRWP-SO075			PRWP-SO076			PRWP-SO077			PRWP-SO078		
		Sample No.:	PR0239			PR0240			PR0241			PR0242			PR0243		
		Sample Date:	12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10			12-Nov-10		
		Sample Depth:	1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft			1 - 10 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		1.78	J		-	-		-	-		1.03	J	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		4.83			5.37			3.87			1.79		
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		10.5		X	11.1		X	4.33			3.88		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		1.1			1.25		X	0.511	J		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	1.54			22.1			27.2			12.3			7.58		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

VQ = validation qualifier; mg/kg = milligrams per kilogram; NA = not applicable; J = estimated concentration.

RG = remedial goal

Notes:

1. Sample purpose "REG" is the regular sample, "FD" is the field duplicate, and "FS" is the field split. For REG and FD, the sample with the higher concentrations is shown. The FS samples are shown independently.

2. "-" indicates that the analyte was not detected in this sample.

3. RDX is shown as detected in several samples at concentrations less than the reporting limits. Because RDX has no association with Plum Brook Ordnance Works and is a common false positive in samples from collected from non-PBOW sites, RDX was not regarded as site-related and no RG was derived.

4. An "X" indicates that reported concentration exceeds the RG.

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-00502			PR-00503			PR-00504			PR-00505			PR-00506		
		Sample No.:	PR0050			PR0051			PR0052			PR0054			PR0056		
		Sample Date:	18-Aug-09			18-Aug-09			18-Aug-09			18-Aug-09			18-Aug-09		
		Sample Depth:	0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft		
		Sample Purpose:	REG			REG			REG			FD			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		0.102	J	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	0.167	J		-	-		-	-		0.413			0.102	J	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.0959	J		7.36		X	5.97			0.995	J		0.0904	J	
Dinitrotoluene, 2,4-	mg/kg	5.6	2.06			12.9		X	13.1		X	6.75	J	X	0.827		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		1.12	J		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.75			23.5			32			1.53	J		0.16	J	
Trinitrotoluene, 2,4,6-	mg/kg	36	0.0602	J		-	-		-	-		-	-		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-00507			PR-00508			PR-00509			PR-00510			PR-00511		
		Sample No.:	PR-00507			PR-00508			PR-00509			PR-00510			PR-00511		
		Sample Date:	21-Oct-09			21-Oct-09			21-Oct-09			21-Oct-09			21-Oct-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		1.4			-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	1.09			6.09			5.32			2.78			1.25		
Dinitrotoluene, 2,4-	mg/kg	5.6	4.09	J		15.2		X	11.6		X	4.4			4.41		
Dinitrotoluene, 2,6-	mg/kg	1.2	0.24			0.973			-	-		0.308			0.562		
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	2.54			18.1			16.9			4.12			3.67		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		0.3			-	-		-	-		0.0613	J	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-00512			PR-00513			PR-00514			PR-00515			PR-00516		
		Sample No.:	PR-00512			PR-00513			PR-00514			PR-00515			PR-00516		
		Sample Date:	21-Oct-09			19-Nov-09			19-Nov-09			19-Nov-09			19-Nov-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.572			9.62	J	X	6.86	J	X	6.62	J	X	0.919		
Dinitrotoluene, 2,4-	mg/kg	5.6	0.538			22.5	J	X	13.5	J	X	16.5	J	X	2.33		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		8.1	J		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.717			40.4	J		31.2	J		30.2	J		3.29		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-10035			PR-10036			PR-10037			PR-10040			PR-10060		
		Sample No.:	PR0025			PR0028			PR0030			PR0068			PR0017		
		Sample Date:	24-Jul-09			24-Jul-09			24-Jul-09			19-Aug-09			24-Jul-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			2 - 12 Ft			0 - 0 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		0.385			0.0577	J		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		0.33			-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.362			-	-		-	-		-	-		-	-	
Dinitrotoluene, 2,4-	mg/kg	5.6	0.298			-	-		0.364			-	-		0.121	J	
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	1.47			1.66			0.628			-	-		0.235		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		1.99			0.167			-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-10125			PR-10126			PR-10127			PR-10132			PR-10133		
		Sample No.:	PR0026			PR0027			PR0029			PR0060			PR0060		
		Sample Date:	24-Jul-09			23-Jul-09			24-Jul-09			19-Aug-09			19-Aug-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			1 - 11 Ft			1 - 11 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		0.0503	J		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		-	-		-	-		-	-		-	-	
Dinitrotoluene, 2,4-	mg/kg	5.6	0.363			0.159	J		0.0675	J		-	-		-	-	
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.236			-	-		0.19			-	-		-	-	
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		0.888			0.185		

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-10136			PR-10138			PR-10139			PR-10140			PR-10149		
		Sample No.:	PR0072			PR0057			PR0058			PR0059			PR0016		
		Sample Date:	19-Aug-09			19-Aug-09			19-Aug-09			19-Aug-09			22-Jul-09		
		Sample Depth:	0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 10 Ft			0 - 0 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?		VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	0.112	J		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		0.35			-	-		-	-		0.0923	J	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		1.93			4.07			-	-		0.813		
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		5.44			9.65		X	3.89			2.02		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.0508	J		3.58			9.16			3.58			1.47		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-10158			PR-10161			PR-10163			PR-10164			PR-10176		
		Sample No.:	PR0034			PR0021			PR0023			PR0024			PR0006		
		Sample Date:	24-Jul-09			24-Jul-09			24-Jul-09			24-Jul-09			23-Jul-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	FD			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		0.116	J		0.322			0.197		
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		0.214			0.345		
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		-	-		-	-		0.241			-	-	
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		-	-		0.0737	J		0.802			0.218		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.0583	J		0.138	J		0.345			0.468			0.0457	J	
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		0.0459	J		1.75		

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-10178A			PR-10183			PR-10184			PR-477			PR-478		
		Sample No.:	PR0073			PR0066			PR0007			PR0011			PR0010		
		Sample Date:	19-Aug-09			19-Aug-09			23-Jul-09			22-Jul-09			22-Jul-09		
		Sample Depth:	0 - 10 Ft			0 - 10 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			FD			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	0.0569	J		-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		0.182			0.229			9.04	J		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		2.54	J		4.38			8.45	J	X	0.822		
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		10.6	J	X	8.77		X	16.7	J	X	0.677		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		1.56	J	X	-	-		-	-		0.425		
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	-	-		4.39	J		9.07			6.68	J		3.62		
Trinitrotoluene, 2,4,6-	mg/kg	36	0.0692	J		-	-		-	-		0.121	J		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-479			PR-480			PR-481			PR-482			PR-486		
		Sample No.:	PR0008			PR0003			PR0009			PR0012			PR0013		
		Sample Date:	22-Jul-09			22-Jul-09			22-Jul-09			22-Jul-09			23-Jul-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			FS			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		0.32	J		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		0.203			0.411			0.246			0.0953	J	
Dinitrobenzene, 1,3-	mg/kg	6.1	0.0594	J		4.8			9.33		X	2.07			5.1		
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		10		X	16.8		X	6.29		X	3.84		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		1			-	-		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.324			14			11.4			6.64			6.72		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		0.0608	J		-	-		-	-		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-487			PR-488			PR-492			PR-493			PR-494		
		Sample No.:	PR0014			PR0015			PR0036			PR0037			PR0040		
		Sample Date:	23-Jul-09			23-Jul-09			24-Jul-09			24-Jul-09			27-Jul-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		0.0677	J		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		0.0981	J		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		0.0836	J		1.6			0.324			0.981		
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		0.348			2.15			1.39			1.43		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		-	-		0.89			0.453			0.496		
RDX	mg/kg	NA	-	-		-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.212			0.844			3.76			1.19			1.58		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-495			PR-496			PR-497			PR-498		
		Sample No.:	PR0041			PR0042			PR0043			PR0044		
		Sample Date:	27-Jul-09			27-Jul-09			27-Jul-09			27-Jul-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			REG			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES														
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		-	-		-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		-	-		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	-	-		-	-		0.225			0.102	J	
Dinitrotoluene, 2,4-	mg/kg	5.6	-	-		0.262			0.31			0.151	J	
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		0.0599	J		-	-		-	-	
RDX	mg/kg	NA	-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	0.25			0.391			0.991			0.641		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-	

Table E-2

Comparison of Delineation Sample Results to Remedial Goals
July Through November 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Location:	PR-499			PR-499			PR-500			PR-501		
		Sample No.:	PR0045			PR-0047			PR0038			PR0039		
		Sample Date:	27-Jul-09			27-Jul-09			24-Jul-09			24-Jul-09		
		Sample Depth:	0 - 0 Ft			0 - 0 Ft			0 - 0 Ft			0 - 0 Ft		
		Sample Purpose:	REG			FS			REG			REG		
Parameter	Units	Remedial Goal (RG)	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?	Result	VQ	Exceeds RG?
EXPLOSIVES														
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	-	-		0.24			-	-		-	-	
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	-	-		0.26	J		-	-		-	-	
Dinitrobenzene, 1,3-	mg/kg	6.1	4.27			5.5			-	-		0.323		
Dinitrotoluene, 2,4-	mg/kg	5.6	11.1		X	17		X	-	-		0.349		
Dinitrotoluene, 2,6-	mg/kg	1.2	-	-		1.3		X	-	-		0.194		
RDX	mg/kg	NA	-	-		-	-		-	-		-	-	
Trinitrobenzene, 1,3,5-	mg/kg	220	14.5			18			0.858			1.28		
Trinitrotoluene, 2,4,6-	mg/kg	36	-	-		-	-		-	-		-	-	

VQ = validation qualifier; mg/kg = milligrams per kilogram; NA = not applicable; J = estimated concentration.
RG = remedial goal

Notes:

1. Sample purpose "REG" is the regular sample, "FD" is the field duplicate, and "FS" is the field split. For REG and FD, the sample with the higher concentrations is shown. The FS samples are shown independently.

2. "-" indicates that the analyte was not detected in this sample.

3. RDX is shown as detected in several samples at concentrations less than the reporting limits. Because RDX has no association with Plum Brook Ordnance Works and is a common false positive in samples from collected from non-PBOW sites, RDX was not regarded as site-related and no RG was derived.

4. An "X" indicates that reported concentration exceeds the RG.

Table E-3

Comparison of Delineation Sample Results to Remedial Goals
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT	
May 2009 Sample Identification	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**
Rows North and South of NTCRA Excavation														
393	1.4		0.51		0		0.37		0		0.084		0	
394	7.0	X	1.2		0		5.4		0.56		0.38		0	
395	3.6		0.58		0		2.9		0.28		0.36		0	
396	7.8		2.4		0.26		5.5		0.6		0.77		0	
397	5.6		1.6		0.52		5.8	X	0.75		0.76		0	
398	7.0	X	0		4.5		19	X	2.4	X	0		0	
399	3.2		2.2		0		4.1		0.58		0.37		0	
400	0.39		0		0		2.1		0.23		0		0	
401	18		5.4		0		17	X	1.9	X	1.6		0	
402	9.9		3.4		0		9.6	X	1.2		0.74		0	
403	0.099		0.058		0		0.8		0		0.098		0.11	
404	2.2		1.4		0		2.6		0.33		0.39		0	
405	28		12	X	0.1		33	X	3.6	X	2.0	X	0	
405dup	27		0		0		30	X	0		0		0	
406	18		7.6	X	0		18	X	1.8	X	0.98		0	
407	0.39		0.29		0.074		0.88		0		0.21		0	
408	2.3		1.3		0		2.8		0.39		0.38		0	
409	0.92		0.62		0.1		1.5		0.19		0		0	
410	8.3		3.6		0		8.7	X	0.89		0		0	
411	9.8		3.6		0		6	X	0.8		0		0	
412	9.1		3.3		0		5.7	X	0.67		0		0	
413	12		4.9		0		5.7	X	0.95		1.1		0	
414	1.8		0.46		0		1.3		0.23		0		0	
415	3.2		1.0	X	0		4		0.61		0		0	
416	19		0		0		16	X	2.6	X	0		0	
417	7.2		3.0	X	0		7.5	X	1.1		0		0	
418	22		7.8	X	0		19	X	3.1	X	2.0	X	0	
419	3.9		2.4		0		4.6		0.85		0		0	
420	10		4.1		0		10	X	1.4		0		0	
421	10		3.7		0		9.7	X	1.2		0		0	
422	14		6		0.054		16	X	2.5	X	0		0	
423	31		15	X	0.13		27	X	3.4	X	1.9		0	
423dil	29		0		0		26	X	0		0		0	
424	1.5		0.77		0.04		2.9		0.46		0		0	
425	2.4		0.44		0		1.8		0.36		0.19		0	
426	0		0.086		0.71		0.21		0.036		0.23		0	
427	0		0.011		0.31		0.12		0.031		0.25		0.22	
428	0.32		0.033		0.16		0.14		0.038		0.25		0.31	
429	0.86		0		0		0.062		0		39	X	0.088	
430	4.5		2.2		0		8.9	X	1.3		0		0	

Table E-3

Comparison of Delineation Sample Results to Remedial Goals
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT	
May 2009 Sample Identification	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**
431	1.9		0		0		4.1		0.66		0.49		0	
432	0.067		0		0		0.16		0		0		0	
433	0		0		0		0		0		0		0	
434	0		0		0		0		0		0		0	
435	0		0		0		0		0		0		0	
436	0		0		0		0		0		0		0	
437	0		0		0		0		0		0		0	
438	0		0		0		0		0		0		0	
439	0		0		0		0		0		0		0	
440	0		0		0		0		0		0		0	
441	0		0		0		0		0		0		0	
442	0		0		0		0		0		0		0	
443	0		0		0		0		0		0		0	
444	0		0		0		0		0		0		0	
445	0		0		0		0.052		0		0		0	
446	6.7		0		0		1.3		0.26		0.4		0	
447	0.3		0		0		0		0		0.063		0.082	
448	0.078		0.019		0.49		0.067		0		0.046		0.46	
449	0		0.036		0		0.16		0		0.038		0	
450	0.071		0		0		0.11		0		0.075		0.12	
451	0		0		0		0		0		0		0	
452	0		0		0		0		0		0		0	
453	0		0		0		0		0		0		0	
454	0		0		0		0		0		0		0	
455	0		0		0		0		0		0		0	
456	0		0		0		0		0		0		0	
457	0		0		0		0		0		0		0	
458	0		0		0		0		0		0		0	
459	0		0		0		0		0		0		0	
460	0		0		0		0		0		0		0.060	X
461	0		0		0		0		0		0		0	
462	0		0		0		0		0		0		0	
463	0		0		0		0		0		0		0	
30-Foot Step-Out														
10001	1800		50	X	0		43	X	0		99	X	0	
10002	1200		77	X	0		1400	X	280	X	260	X	0	
10003	660		0		0		150	X	89	X	160	X	240	X
10004	0		0		0		0		0		0		0	
10006	0		31	X	38	X	42	X	0		0		0	
10014	20000	X	5900	X	560	X	22000	X	3000	X	0		0	
10015	16		0		0		7.8	X	0.52		0		0	
10021	1.3		0.88		0		2.1		0.3		0		0	

Table E-3

Comparison of Delineation Sample Results to Remedial Goals
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT	
May 2009 Sample Identification	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**
10022	17		3.6		0		8.2	X	1.2		0.56		0	
10023	14		4.5		0.27		8.5	X	1.1		0		0	
10025	12		3.3		0		5.7	X	0.44		0		0	
10026	2.5		0.46		0		1.5		0		0		0	
10027	200		0		0		85	X	0		160	X	0	
10096	560		530	X	0		1500	X	240	X	170	X	0	
10097	600		64	X	170	X	94	X	0		120	X	240	X
10098	0		0		0		0		0		0		0	
10099	0		0		77	X	0		0		32	X	0	
10100	0		0		0		0		0		0		0	
10101	140		0		230	X	58	X	0		260	X	300	X
10102	700		430	X	26000	X	480	X	96	X	6400	X	2900	X
10102dup	0		0		26000	X	0		0		0		0	
10103	340		310	X	0		1300	X	160	X	0		0	
10104	15000	X	0		380	X	14000	X	2000	X	0		0	
10105	0		440	X	0		1900	X	220	X	270	X	380	X
10106	27000	X	4700	X	280	X	15000	X	2000	X	0		0	
10106dup	27000	X	0		0		0		0		0		0	
10107	5900	X	0		0		7600	X	1100	X	0		0	
10108	9100	X	3400	X	0		7400	X	1200	X	0		0	
10109	0		0		0		0		0		0		0	
10110	1.2		0		1.5		1.5		0.26		0.68		0	
10111	12		5.4		0		14	X	1.9	X	2.3		0	
10112	2.2		0		0		9.8	X	1.0	X	0		0	
10113	0.88		0.41		0		1.3		0.26		0.27		0.25	
10114	7.7		2		0		4.7		0.46		0		0	
10115	10		2.0	X	0		4.0	X	0.48		0.42		0	
10116	7.7		2.1		0		2.7		0.21		0.03	X	0	
10117	400		0		0		0		0		0		0	
10118	82		0		0		79	X	0		0		0	
10119	530		0		0		0		0		0		0	
10120	420		0		0		270	X	71	X	81	X	0	
10121	620		0		0		50	X	0		59	X	0	
10122	400		79	X	0		82	X	0		83	X	100	X
10123	1400		130	X	0		310	X	110	X	200	X	220	X
10124	1700		460	X	63	X	420	X	0		380	X	480	X
60-Foot Step-Out														
10137	0		0		0		0		0		0		0	
10129	0.21		0		0.76		0.32		0.32		0.45		0.66	
10157	2.2		0.026		0		0		0		0		0	
90-Foot Step-Out														
10182	3.2		1.2		10		1.6		0.46		1.1		1.2	

Table E-3

Comparison of Delineation Sample Results to Remedial Goals
May and June 2009 Samples
Pentolite Road Red Water Pond Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

	1,3,5-Trinitrobenzene		1,3-Dinitrobenzene		2,4,6-Trinitrotoluene		2,4-Dinitrotoluene		2,6-Dinitrotoluene		2-ADNT		4-ADNT	
May 2009 Sample Identification	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**	**(mg/kg)**	**Exceeds RG?**
10069	0		0		0		0		0		0		0	
10089	0		0		0		0		0		0		0	
10196	1.5		0.42		0.14		1.6		0.21		0.30	X	0	
MAXIMUM	27000	X	5900	X	26000	X	22000	X	3000	X	6400	X	2900	X
Remedial Goal (RG)	2200		6.1		36		5.6		1.6		15		15	

RG = remedial goal; 2-ADNT = 2-amino-4,6-dinitrotoluene; 4-ADNT = 4-amino-2,6-dinitrotoluene; mg/kg = concentration in milligrams per kilogram;
NA = not applicable; dup = duplicate sample; dil = sample run as a dilution; "0" = analyte was not detected in associated sample.

Source of Analytical Data: McTech Corp, 2009, Non-Time Critical Removal Action Report, Soil Excavation, Composting, and Disposal, Pentolite Road Red Water Ponds, Plum Brook Ordnance Works, Sandusky, Ohio, April.

RESPONSE TO COMMENTS

Responses to External Comments on the
Draft Addendum for Red Water Pond Areas Feasibility Study for Soil
Plum Brook Ordnance Works, Sandusky, Ohio,
Dated October 19, 2012
FUDS Project No. G05OH001820

Comments from Dr. Janusz Byczkowski, Toxicologist, Ohio Environmental Protection Agency, *Division of Emergency and Remedial Response, received November 29, 2012.*

Comment 1: **Section 2.4.2, Page 2-5, Line 6, and Tables D-1 and D-2. This document states: "*…non-cancer-based RSL (corrected to an HQ of 0.1) for 2,4-DNT (6,1 mg/kg) or 2,6-DNT (12 mg/kg) Therefore, cancer effects are clearly the risk –driving effects for 2,4-DNT and 2,6-DNT*..." also, in Tables D-1 and -2: "*…Noncancer-based RSL … mg/kg…Trinitrotoluene, 2,4,6 …36…*"**

In U.S. EPA (2011) table there are neither, formally calculated carcinogenicity slope factor or regional screening level (RSL) for 2,6-DNT isomer, nor non-cancer RSL for 2,4-DNT.
While cancer-based RSL for mixture of technical dinitrotoluenes (2,4-DNT/2,6-DNT mixture) is indeed listed as 7.2 mg/kg soil, the cancer-based RSL for 2,4-DNT isomer is 1.6 mg/kg soil, rather than 5.6 mg/kg. The RSL listed by U.S. EPA (2011) for 2,4,6-TNT is 19 mg/kg soil.

Reference:
U.S. EPA (2011): Master_SL_table_run_JUN2011. xls accessed on line: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Please correct the RSL values throughout the document.

Response 1: It is agreed that the residential soil RSL listed for cancer effects associated with 2,4-DNT is 1.6 mg/kg, based on a cancer risk of 1E-6 to the resident. Both 2,4-DNT and 2,6-DNT are present in soils at PBOW various sites, including the PRRWP Area. Therefore, the PBOW Project Delivery Team has opted to use the more stringent RSL for mixed dinitrotoluene isomers of 0.72 mg/kg to screen both 2,4-DNT and 2,6-DNT all PBOW sites. The associated cancer slope factor for mixed dinitrotoluene isomers has also been conservatively applied as the basis to derive cleanup goals.

With respect to the noncancer RSL for 2,4-DNT and the noncancer RSL for TNT, these values can be found in the RSL Residential Soil Table at the URL referenced by the reviewer, under "Residential Soil Supporting." Each of these RSL values mentioned in the referenced text or tables can be found at this web location. As a clarification, the reference for the November 2011 RSL will be revised in Section 6.0 to specifically include the RSL Residential Soil Table.

Comment 2: **Table 2-1. There is no footnote "g" below the table 2-1. Please change superscript in the second "f" footnote to " ^{g} ".**

Response 2: The error in this footnote designation will be corrected.