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October 03, 2014

U.S. Army Engineer District, Nashville
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Subject: ***Submittal of the Final Remedial Investigation Report for the Garage Maintenance Area (including the Locomotive Shop/Railcar Wash Area, Former Sellite Area, and Unloading Area) Former Plum Brook Ordnance Works, Sandusky, Ohio Contract No. W912P5-12-D-0001: Shaw Project Number 146394***

Dear Ms. Coleman:

In accordance with the requirements of Delivery Order No. DO-0002 of Contract No. W912P5-12D-0001 awarded to CB&I Federal Services LLC, we are pleased to submit the Final Remedial Investigation Report for the Garage Maintenance Area (including the Locomotive Shop/Railcar Wash Area, Former Sellite Area, and Unloading Area) at the Former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio. This report represents the full compilation and summary for the Remedial Investigation for the Garage Maintenance Area (DERP-FUDS Project No. G05OH001825). This report was prepared consistent with the following: the site characterization reports (SCR), baseline human health risk assessments (BHHRA), and screening-level ecological risk assessments (SLERA) prepared for the Locomotive Shop/Railcar Wash Area, Former Sellite Area, and Unloading Area; the agreements among the PBOW project delivery team members; and communications with the U.S. Army Corps of Engineers regarding the scope of this report.

This Final RI report incorporates the comments of the Corps on the previously submitted May 22, 2014 internal draft.

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

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

Sincerely,

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Shaw Environmental & Infrastructure, Inc.

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

Project Description: Remedial Investigation for Garage Maintenance Area (Locomotive Shop/Railcar Wash Area, Former Sellite Area, and Unloading Area)
Former Plum Brook Ordnance Works, Sandusky, Ohio

Contract No. W912P5-12-D-0001 Delivery Order No. DO02

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Final

Remedial Investigation Report
Garage Maintenance Area
(Including Locomotive Shop/Railcar Wash Area, Former Sellite Area, and Unloading Area)

FUDS Project No. G05OH001825

Former Plum Brook Ordnance Works, Sandusky, Ohio

Prepared for:

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October 2014

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List of Acronyms

amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BHHRA	baseline human health risk assessment
BSC	background screening concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
COPEC	chemicals of potential ecological concern
CSEM	conceptual site exposure model
D&M	Dames & Moore, Inc.
DERP	Defense Environmental Restoration Program
DNT	dinitrotoluene
DoD	U.S. Department of Defense
DQO	data quality objective
EHQ	ecological hazard quotient
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ES	EnviroScience, Inc.
FS	feasibility study
FUDS	Formerly Used Defense Sites
GHS	Globally Harmonized System
GMA	Garage Maintenance Area
HI	hazard index
HQ	hazard quotient
ICI	International Consultants Incorporated
ILCR	incremental lifetime cancer risk
IT	IT Corporation
LBA	Locomotive Building Area
LOAEL	lowest-observed-adverse-effects level
LS	Locomotive Shop
LRD	Great Lakes and Rivers Division
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MDC	maximum detected concentration
mg/kg	milligrams per kilogram

List of Acronyms (Continued)

mg/L	milligrams per liter
MK	Morrison Knudsen Corporation
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	no-observed-adverse-effects level
NT	nitrotoluene
NWI	National Wetland Inventory
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl
ppb	parts per billion
ppm	parts per million
PRG	preliminary remediation goal
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RBRC	risk-based remediation criteria
RCA	Railcar Wash Area
RBSC	risk-based screening concentration
RfD	reference dose
RI	remedial investigation
RSL	regional screening level
S.U.	standard unit
SCR	site characterization report
SDWR	Secondary Drinking Water Regulations
Shaw	Shaw Environmental, Inc.
SI	site inspection
SLERA	screening-level ecological risk assessment
SVOC	semivolatile organic compound
TAL	target analyte list

TDS	total dissolved solids
TNT	trinitrotoluene
TNTA	TNT Area A
TNTC	TNT Area C
TOC	total organic carbon
TRV	toxicity reference values
ULA	Unloading Area
USACE	U.S. Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound
WAA	War Assets Administration

Executive Summary

Remedial investigations (RI) were conducted on the eastern and western portions of the Garage Maintenance Area (GMA). The eastern portion of the GMA includes the Locomotive Building Area (LBA), composed of the Locomotive Shop with its surrounding area and the Railcar Wash Area (RCA). The western portion of the GMA includes the Former Sellite Area and the Unloading Area (ULA), each of which was investigated separately. Investigations of these areas are administered under the Defense Environmental Restoration Program (DERP) Formerly Used Defense Sites (FUDS) Project No. G05OH001825. The results of the RI have been previously reported in the following finalized documents:

Locomotive Building Area

Shaw Environmental (Shaw), 2010a, ***Final, Garage Maintenance Area (Locomotive Building Area), Site Characterization Report, Former Plum Brook Ordnance Works, Sandusky, Ohio, Revision 1,*** September.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2011a, ***Final, Baseline Human Health Risk Assessment, Garage Maintenance Area (Locomotive Building Area), Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2011b, ***Final, Screening Level Ecological Risk Assessment, Garage Maintenance Area (Locomotive Building Area), Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Former Sellite Area

Shaw Environmental, Inc. (Shaw), 2013a, ***Final, Garage Maintenance Area (Former Sellite Area), Site Characterization Report, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** April.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014a, ***Final, Baseline Human Health Risk Assessment, Garage Maintenance Area (Former Sellite Area), FUDS No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014b, ***Final, Screening-Level Ecological Risk Assessment, Garage Maintenance Area (Former Sellite Area), FUDS No. G05OH001825, Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Unloading Area

Shaw Environmental, Inc. (Shaw), 2013b, ***Final, Garage Maintenance Area (Unloading Area), Site Characterization Report, FUDS Number G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** May.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014c, ***Final, Garage Maintenance Area (Unloading Area), Baseline Human Health Risk Assessment, FUDS Project No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014d, ***Final, Screening-Level Ecological Risk Assessment, Garage Maintenance Area (Unloading Area), FUDS Project No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

This RI summarizes the findings of these nine reports. No additional investigation results, evaluation, or information concerning these sites is provided in this RI report that was not previously provided in the nine reports listed above. Recommendations are also provided based on this previously provided information. Thus, the purposes of this RI report are to 1) place all RI-related reports under a single cover, and 2) record a recommendation as to whether or not performance of a feasibility study is warranted.

The overall findings from the studies conducted for the three areas indicate that exposure to environmental media associated with the LBA and the ULA sites poses no unacceptable human health risks/hazards or ecological hazards that are attributable to past Department of Defense practices. Exposure to environmental media at the Former Sellite Area resulted in elevated risks and hazards for both human and ecological receptors, primarily due to the presence of polychlorinated biphenyls in site soil. Also, aberrantly low pH levels were identified in the soil in bare areas devoid of vegetation. Acidity levels in the range identified in these denuded areas are capable of resulting in skin and eye irritation and damage and are also known to cause conditions that are toxic to plants.

Recommendations. Based on the RI results, the U.S. Army Corps of Engineers recommends no further action with respect to the LBA and the ULA sites. For the Former Sellite Area, the U.S. Army Corps of Engineers recommends further evaluation in a feasibility study for potential remediation or action on contamination (low pH soils and polychlorinated biphenyls) identified in the Former Sellite Area soil. Therefore, a feasibility study is warranted for DERP-FUDS Project No. G05OH001825.

1.0 Introduction

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

Remedial investigations (RI) were conducted on the eastern and western portions of the Garage Maintenance Area (GMA). The eastern portion of the GMA includes the Locomotive Building Area (LBA), composed of the Locomotive Shop (LS) with its surrounding area and the Railcar Wash Area (RCA). The western portion of the GMA includes the Former Sellite Area and the Unloading Area (ULA), each of which was investigated separately. Investigations of these areas are administered under DERP FUDS Project No. G05OH001825.

The goal of the investigations performed as part of the GMA RI was to determine if there have been any environmental impacts associated with DoD use of the GMA sites. The RI activities were conducted by CB&I Federal Services LLC (formerly Shaw Environmental, Inc. [Shaw]). Activities related to the LBA were performed under Delivery Order No. DX06 of Contract No. W912QR-08-D-0013 and activities for the Former Sellite Area and ULA were conducted under DX01 of Contract No. W91278-10-D-0094. This report, submitted under Task Order DO-02 of Contract No. W912P5-12-D-0001, summarizes the information presented previously in the following reports:

Locomotive Shop and Railcar Wash Area

Shaw Environmental (Shaw), 2010a, ***Final, Garage Maintenance Area (Locomotive Building Area), Site Characterization Report, Former Plum Brook Ordnance Works, Sandusky, Ohio, Revision 1,*** September.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2011a, ***Final, Baseline Human Health Risk Assessment, Garage Maintenance Area (Locomotive Building Area), Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2011b, ***Final, Screening Level Ecological Risk Assessment, Garage Maintenance Area (Locomotive Building Area), Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Former Sellite Area

Shaw Environmental, Inc. (Shaw), 2013a, ***Final, Garage Maintenance Area (Former Sellite Area), Site Characterization Report, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** April.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014a, ***Final, Baseline Human Health Risk Assessment, Garage Maintenance Area (Former Sellite Area), FUDS No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014b, ***Final, Screening-Level Ecological Risk Assessment, Garage Maintenance Area (Former Sellite Area), FUDS No. G05OH001825, Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Unloading Area

Shaw Environmental, Inc. (Shaw), 2013b, ***Final, Garage Maintenance Area (Unloading Area), Site Characterization Report, FUDS Number G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** May.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014c, ***Final, Garage Maintenance Area (Unloading Area), Baseline Human Health Risk Assessment, FUDS Project No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

Shaw Environmental & Infrastructure, Inc. (Shaw), 2014d, ***Final, Screening-Level Ecological Risk Assessment, Garage Maintenance Area (Unloading Area), FUDS Project No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

It should be noted that this RI report generally presents and summarizes information directly as it was conveyed in these final approved reports. With two exceptions, no new data are presented in this RI report: Section 2.4 includes an updated evaluation of groundwater quality in the vicinity of PBOW based on other PBOW documents (Shaw, 2008a; 2012a), and Section 3.5 presents an additional summary of an investigation performed at the Maintenance Pit in the LS.

1.1 Report Organization

As part of the RI effort, environmental media (i.e. soil, groundwater, surface water, and sediment) from the GMA sites were previously investigated and evaluated in site characterization reports (SCR), baseline human health risk assessments (BHHRA), and screening-level ecological risk assessments (SLERA). This RI report summarizes these reports and presents recommendations based on their

findings. The SCRs, BHHRAs, and SLERAs are appended to this report in their entirety (Appendices A through I) in electronic format on compact disc.

The remainder of this chapter provides a description and history of the PBOW facility as well as the history and current conditions of the LBA, Former Sellite Area, and ULA. More specific information on the three GMA sites is included in the respective SCRs, BHHRAs, and SLERAs that are appended to this RI report. Chapter 2.0 of this report summarizes the physical setting of PBOW and specifically addresses the sites currently being evaluated. This discussion of physical setting includes the physiography, topography, geology, hydrogeology and natural groundwater quality.

Chapter 3.0 summarizes the SCR, BHHRA, and SLERA for the LBA; summaries of the Former Sellite Area SCR, BHHRA, and SLERA are presented in Chapter 4.0; and Chapter 5.0 presents summaries of the SCR, BHHRA, and SLERA for the ULA. Chapter 6.0 presents site-specific recommendations for site management decisions. These recommendations primarily discuss whether or not a remedial action is warranted. These recommendations do not identify a specific technological approach but are provided to help site managers form a basis for determining whether a feasibility study (FS) is required or if proceeding to a no-action proposed plan is the appropriate course for a given site. References used in the RI are provided in Chapter 7.0.

1.2 Facility Location and Description

The former 9,000-acre PBOW facility was used for the manufacture of nitroaromatics during World War II. NASA operates and maintains the site as the Plum Brook Station, which is a satellite of the John H. Glenn Research Center, located at Lewis Field in Cleveland, Ohio. PBOW is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland. Although primarily in Perkins and Oxford Townships, the eastern edge of PBOW extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by Patten Tract Road, and on the east by U.S Highway 250. The areas surrounding PBOW are primarily agricultural and residential. Public access is prohibited at PBOW except during the annual deer hunting season, which is by permit only. Figure 1-1 shows the geographical location of the former PBOW facility.

1.3 Facility History and Background

The former PBOW was established by the War Department as a government-owned, contractor-operated facility for the production of 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT), and pentolite during World War II. The PBOW site originally consisted of approximately 9,100 acres, approximately 3,500 acres of which were used as a buffer area outside the facility fence line. The property was acquired in the name of the United States of America in 1941. The

government contractor, Trojan Powder Company, operated the production facility from December 1941 until 1945. It is estimated that more than 1 billion pounds of nitroaromatic explosives were manufactured during this period.

At the end of production in September 1945, PBOW was placed in standby operation status and the Army conducted decontamination and decommissioning activities. On December 17, 1945, the U.S. Army Ordnance Department (Ordnance Department) obtained physical control of the site. The Ordnance Department continued decontamination efforts until August 1946. In 1946, over 6,200 acres, 3,231 located within the fenced area, were transferred to the War Assets Administration (WAA), and approximately 2,800 acres were transferred to the Ravenna Arsenal. This 2,800-acre parcel, transferred to Ravenna Arsenal and referred to as the Magazine Area (and also the Plum Brook Depot), was transferred again in July 1947 to the Erie Ordnance Depot, LeCarne, Ohio (War Department, 1947). The Magazine Area included approximately 2,300 acres inside the fence line and 500 acres of the buffer area, outside of the fence line.

In 1949, the General Services Administration took control of WAA's portion of the PBOW property, which included an indeterminate amount of acreage outside of the fence line due to conveyances by WAA to private landowners during the late 1940s and early 1950s. It is believed that farmers were given the opportunity to buy back land in the buffer area, outside the fence line.

In June 1954, the Army reacquired the 3,231 acres within the PBOW fence line that was previously transferred to the WAA and subsequently to the General Services Administration. From August 1954 to sometime in 1958, further decontamination was performed by the Army. The decontamination included removal and disposal of contaminated surface and subsurface soil around the buildings and wooden and ceramic waste disposal lines containing TNT. This included thousands of pounds of TNT which were discovered in catch basins that were removed and incinerated at the burning grounds.

Two property use agreements were entered into by the Army and the National Advisory Committee of Aeronautics (NACA), the predecessor of NASA, in March 1956 and January 1958, respectively. The first agreement was for approximately 500 acres on which NACA built a nuclear reactor. The second agreement gave NACA (NASA as of October 1958) use of an additional 2,700 acres within the fenced area but outside the Magazine Area, for a total of 3,231 acres under the two use agreements. At this time, NASA had use of all property inside the PBOW fence except the 2,300 acres in the Magazine Area. The Army declared this 3,231-acre property as excess in October 1958.

In September 1961, the Army declared the Magazine Area as excess, and NASA formally requested custody of the property in October 1961 (NASA, 1961). On March 15, 1963, accountability and custody of the PBOW property (6,031 acres) were transferred from the Department of the Army to NASA.

However, prior to NASA's acceptance of the property in March 1963, Ravenna Arsenal performed additional decontamination and subsequently certified 500 acres of the former PBOW property as decontaminated and suitable for unrestricted future use. This decontamination certification was only for the 500 acres in the former pentolite manufacturing area (the area where NACA built the nuclear reactor) under the first use agreement. NASA identified additional DoD-related contamination in 1963, after transfer of the property. NASA performed further decontamination efforts and the removal of structures in 1964.

NASA has operated and maintained the property inside the fence line since 1963, and the facility currently located there is the NASA Glenn Research Center, Plum Brook Station. NASA operates the property as a space research facility in support of its John Glenn Research Center at Lewis Field, Cleveland, Ohio. Most of the aerospace testing facilities built in the 1960s at the site have been demolished or are currently on standby or inactive status. During 1967 through 1971, NASA purchased approximately 2,000 acres outside of the fence line from local farmers as "buffer." On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. This excess included approximately 1,500 acres of farmland outside the fence, including those acres purchased from farmers beginning in 1967, and was sold as farmland (NASA, 2013). Also, 46 acres outside of the fence in the northeast corner of the PBOW facility near the guard house was conveyed to the Perkins Township Board of Education and is used as a bus transportation area. In addition, the 2,152 acres of PBOW declared excess included a 604-acre parcel in the western part of the fenced area known as "Parcel 59." This area, although previously declared excess, was not transferred and remains under NASA control. According to a NASA newsletter, NASA presently controls approximately 6,432 acres (NASA, 2013); this includes approximately 5,500 acres within the fence line and 900 acres outside of the fence which have been leased for agriculture (NASA, 2012).

The former PBOW FUDS property includes the entire 9,100 acres, but the only project areas that have been approved (or proposed) for the property are located within the fenced area (currently controlled by NASA). The fence generally runs along the patrol road. The area outside the fence was used as a buffer zone during the PBOW manufacturing period, and there is no known or

suspected DoD-related contamination outside the fence line. The GMA site is within the former PBOW and current NASA fence line.

1.4 Site-Specific Description and History

During PBOW operation, the GMA included the LBA (which included the LS and RCA), Former Sellite Area, ULA, as well as other maintenance areas, storehouses, a vehicle maintenance garage, a fueling depot, and common areas (the maintenance areas, storehouses, maintenance garage, fueling depot, and common areas are not part of this RI). The GMA is located in the central portion of the PBOW facility (Figure 1-2).

Locomotive Shop. The LS (also referred to as the “Locomotive Building”) within the LBA is located on the north side of Maintenance Road in the eastern part of the GMA. The Locomotive Building is also the easternmost building of the GMA (Figure 1-2). The Locomotive Building was Building 718 on the facility buildings list. It was located south of a track known as "Z" track. "Z" track was labeled as being the track "to (the) caustic dock" (Shaw, 2010a). The Locomotive Building was used for the maintenance of equipment, vehicles, and railcars. A work pit was built within this building to allow maintenance personnel to work below the locomotives. The work pit is the primary area of concern within this building. The pit measures 60 feet long by 3 feet, 8 inches wide by 5 feet deep (USACE, 2000). An investigation of the maintenance pit following the SCR confirmed that the pit is lined with concrete underlain by gravel and clay. The pit is located beneath the northern set of railroad tracks that run through the building. NASA backfilled this pit with loose stone and currently uses this building as a storage garage. At the time PBOW was operational, the pit was used to work on the railcars and locomotives. The maintenance pit measures 60 feet long by 3 feet, 8 inches wide by 5 feet deep (USACE, 2000). The maintenance pit, which has drainage channels located around the perimeter, is sloped to a small diameter (approximately 12 inch) centrally located sump. The maintenance pit sump is connected by a steel waste line to a larger sump located on the south side of the building. The larger sump is approximately 9 feet, 2 inches deep by 2 feet, 6 inches in diameter. When the locomotive building was active during PBOW operations, waste within the maintenance pit would flow through the perimeter channels into the sump via gravity. The waste would then flow through the steel waste line to the larger sump located on the south side of the building. Accumulated waste within the larger sump was sent into the sewer system via a sump pump. During the investigation of the maintenance pit, the loose stone was removed and replaced with clean gravel.

Railcar Wash Area. The RCA is located approximately 260 feet east of the LS and across Maintenance Road from Ash Pit No. 1 (Figure 1-2). During PBOW operation, this area was used

as the site of a railcar cleaning operation that involved an acid. Because of this, the RCA is also referred to as the acid area. No aboveground structures were present during operations. It is located in the area surrounding the historical location of railroad tracks that exited the eastern end of the Locomotive Building. The actual wash pit was located 261 feet from the east wall of the LS. From historical information recovered by the USACE during preparation of the site inspection (SI) report, general notes on a historical drawing were found cautioning against installation of any underground piping through the area. The statement reportedly said, "Do not run 3 inch line through acid saturated earth. Should this be necessary, paint water line with black acid resisting paint." Also during the SI, three rubble piles were observed to the east of the LS; the exact contents of these piles were unknown, but visual examination indicated the presence of masonry materials (USACE, 2000).

Currently, the area is open land with moderate vegetative cover. Limestone blocks used as railroad track supports across the drainage ditch are still present and visible on the east side of the ditch. No man-made structures other than the Locomotive Building are located near the RCA. During the 2009 field activities, an approximate 3-inch-diameter clay pipe was discovered discharging water into the drainage ditch from the RCA (Shaw, 2010a).

Former Sellite Area. The Former Sellite Area is located on the north side of Maintenance Road, approximately 1,600 feet to the west of the LS. The ULA abuts the Former Sellite Area to the east (Figure 1-2). During PBOW operation, the Former Sellite Area was used for the production and storage of raw sellite which was used for the TNT washing process (Dames & Moore, Inc. [D&M], 1995).

Review of historical site photographs show that the Former Sellite Area consisted of one building approximately 60 feet by 70 feet, a sulfur storage bin (20 feet by 60 feet) along the east side of the building, and six aboveground storage tanks along the south side of the building. Sellite was produced by burning sulfur to produce sulfur dioxide followed by reaction with sodium carbonate. Extensive barren areas with pieces of sulfur and slag on the ground surface were observed at the Former Sellite Area during field reconnaissance by D&M (D&M, 1995) and again by Shaw in October 2010. A shallow surface ditch which receives runoff from the Sellite Area begins southeast of the site and traverses the east, north, and west sides of the site (D&M, 1995).

Unloading Area. The ULA is located on the north side of Maintenance Road, between Ransom Road and Taylor Road, and was used principally for unloading of toluene and possibly other chemicals from railcars (Figure 1-2). It is estimated that more than 400 million pounds of toluene

may have been unloaded at this site during the PBOW operational period (International Consultants Incorporated [ICI], 1995). The former ULA is estimated to have been approximately 550 feet wide by 175 feet in length (approximately 2.2 acres). The area consists primarily of a former rail line with open areas to the north and south of the former bed. The site is bounded to the west by a drainage ditch and the Former Sellite Area and to the east by NASA maintenance buildings (Shaw, 2013b).

In an area approximately 300 feet northeast of the ULA, eight underground storage tanks (UST) (#28, #29, #30, #31, #32, #33, #34, and #35) were installed as part of the GMA to support maintenance work. The USTs contained gasoline, solvents, and waste oil. Tanks #28, #32, #33, #34, and #35 were installed in 1942 by DoD and tanks #29, #30, and #31 were installed by NASA in 1964. All of the tanks except tank #32 were removed in 1989. In 1990, tank #32 was removed (Tetra Tech, Inc., 2001). Based on the findings of the SCR, the location of these former USTs are downgradient and/or crossgradient of the ULA relative to the overburden/shale groundwater flow direction (Shaw, 2013b).

2.0 Physical Setting

2.1 Physiography and Topography

PBOW is located within the Eastern Lake Region of the Central Lowland Province (Soil Conservation Service, 2006). The facility is on a plain with a slight slope to the north-northeast toward Lake Erie at approximately 25 feet per mile. Elevations across the PBOW facility range from 680 feet above mean sea level (amsl) at the intersection of Taylor Road and Patrol Road on the southwestern side of the site to 625 feet amsl 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).

Locomotive Shop. As noted by the SI, elevation of the LBA ranges from 636 to 637 feet amsl (USACE, 2000). The Locomotive Building is a large, brick structure oriented with its long dimension in the east-west direction. Three pairs of railroad tracks approach the building on the western end and two of the pairs historically entered the building. The third set of tracks ran parallel to the north wall of the Locomotive Building. There is also a square concrete slab on the southwest comer of the building for an unknown purpose. Between the LS and the RCA, an unnamed drainage ditch is present in a northeast-to-southwest orientation that typically contains water and drains to the northeast (Shaw, 2010a).

Railcar Waste Area. No aboveground structures were present during PBOW operations from 1942 to 1945. During the 2009 field investigation, the land was found to be open with moderate vegetative cover. Limestone blocks used as railroad track supports across the unnamed drainage ditch are still present and visible on the east side of the ditch. No man-made structures other than the Locomotive Building are located near the RCA. Field activities of 2009 also identified an approximate 3-inch-diameter clay pipe discharging water into the drainage ditch from the RCA subsurface (Shaw, 2010a).

Former Sellite Area. Surveyed ground surface elevations for the Former Sellite Area range from a low of 630.28 feet amsl to a high of 637.22 feet amsl. Portions of the Former Sellite Area not included in the site survey may exceed 638 feet amsl based on site topographic contours. Surface water for the Former Sellite Area drains into an unnamed ditch that begins southeast of the site. This ditch runs along the east and northern portions of the site, eventually turning west and draining into Ransom Brook which flows in a northerly direction (Shaw, 2013a).

ULA. Ground surface elevations at the Unloading Area range from approximately 633.2 feet amsl along the southern portion of the site to 637.2 feet amsl near the southeastern site area. Surface water for the ULA drains into an unnamed ditch west of the site that eventually drains into Ransom Brook. This unnamed ditch west of the site marks the boundary between the Former Sellite Area and ULA (Shaw, 2013b).

2.2 Geology

The bedrock in northern Ohio and found at PBOW consists of Devonian and Silurian carbonates (limestone and dolomite) and clastics (shale, siltstone, and sandstone). At the GMA, two bedrock units have been encountered during well installation: the Delaware Limestone and the Olentangy Shale. Further details of PBOW-specific geology are presented in the LBA, Former Sellite Area, and ULA SCRs (Appendices A, D, and G). Site-specific geology is summarized in Sections 3.2.2.2 (LBA), 4.2.2.2 (Former Sellite Area), and 5.2.2.2 (ULA). Bedrock monitoring wells were not installed in the Former Sellite Area or at the ULA, but the geologic interpretations for these areas are regarded as representative from the LBA.

2.3 Hydrogeology

Two groundwater aquifer systems are present in the region: a carbonate (limestone) aquifer to the west and a shale aquifer to the east (Shaw, 2005). PBOW is located within the transition of the two systems. Both aquifers are overlain by a veneer of glacial drift, generally less than 20 feet thick, generically referred to as the overburden. Groundwater in the overburden is in discontinuous pockets during dry periods and is considered a poor source of groundwater (Shaw, 2005; IT Corporation [IT], 1997a, 1999, 2001a). Groundwater in the overburden and groundwater in the shale unit exhibit similar water levels, suggesting substantial vertical communication, and are therefore considered one hydrogeologic unit (i.e., the overburden/shale). During periods of low precipitation, only limited vertical migration of contaminants would occur in the overburden/shale because of reduced infiltration. Flow in the overburden/shale is toward the local surface drainages, with a generally northerly trend. Because of the discontinuous nature of the overburden/shale, lateral migration is minimal. In general, the overburden/shale has a low permeability, yielding an insufficient volume of groundwater for potable use in many areas underlying PBOW.

Groundwater flow in the Delaware Limestone is generally toward the north but is influenced by major fracture zones (Shaw, 2005). The limestone bedrock water-bearing zone yields groundwater year-round, although specific groundwater yield from any bedrock monitoring well is dependent upon the bedrock fracture(s) encountered. The limestone unit typically yields an adequate volume of groundwater for a drinking water source but is regionally regarded by the

Ohio Department of Natural Resources (ODNR) as being of low quality because of high mineral content (ODNR, 1962). Limestone bedrock groundwater underlying most of PBOW is of poor natural quality largely due to naturally occurring petroleum hydrocarbons and hydrogen sulfide gas emissions. Emissions of hydrogen sulfide gas from wells may result in nuisance odors and, at elevated levels, potential health concerns. The presence of hydrogen sulfide gas, which has direct and indirect corrosive effects, results in the rapid deterioration of metal components of well materials, pumps, and plumbing.

Site-specific hydrogeology of groundwater underlying LBA, Former Sellite Area, and the ULA is summarized in Sections 3.2.2.3, 4.2.2.3, and 5.2.2.3, respectively.

2.4 Groundwater Quality and Use

2.4.1 Groundwater Quality

Three overburden/shale (LBA-MW01, LBA -MW02, and LBA -MW03) and two bedrock (LBA -BEDGW-001 and LBA -BEDGW-002) monitoring wells were installed at the LBA to measure the groundwater quality. One existing bedrock monitoring well at the LBA, IT-MNTA-BEDGW-001, was also used. Similarly, three overburden/shale (RCA-MW01, RCA-MW02, and RCA-MW03) and three bedrock (RCA-BEDGW-001, RCA-BEDGW-002, RCA-BEDGW-003) monitoring wells were installed at the RCA to measure the groundwater quality. To measure groundwater quality at the Former Sellite Area, three overburden/shale (FSB-MW01, FSB-MW02, and FSB-MW03) monitoring wells were installed, and three overburden/shale (ULA-MW01, ULA-MW02, and ULA-MW03) monitoring wells were also installed at the ULA. No bedrock groundwater monitoring wells were installed at the Former Sellite Area or the ULA. Overburden/shale and limestone bedrock groundwater quality at the four areas was evaluated in context of the regional characteristics of these aquifers and observations made with respect to findings concerning groundwater quality at other PBOW sites.

Overburden/Shale Groundwater. Groundwater in the overburden is in discontinuous pockets during dry time periods (Shaw, 2005; IT, 1997a, 1999, 2001a). Also, the overburden/shale generally has a low permeability, yielding an insufficient volume of groundwater for potable use in many areas underlying PBOW. Additionally, groundwater from background wells in competent shale bedrock was found to have elevated concentrations of chloride, sulfate, iron, manganese, and total dissolved solids (TDS) (Shaw, 2006). Some of these concentrations, especially those of sulfate and TDS, were found at levels that far exceed the respective U.S. Environmental Protection Agency (EPA) Office of Groundwater Secondary Drinking Water Regulations (SDWR) or health advisories (EPA, 2012a). The SDWRs are

nonenforceable levels that are based on aesthetic properties (e.g., taste, odor, and color) or cosmetic effects (e.g., skin or tooth discoloration). The following list compares concentrations of these analytes in samples from off-site upgradient background shale unit groundwater wells to the respective Office of Drinking Water SDWRs or health advisories.

- ***Chloride*** – Fifty percent of the background wells exceeded the chloride SDWR of 250 milligrams per liter (mg/L) or parts per million (ppm). The maximum background concentration (3,540 ppm) was 14 times higher than the SDWR.

- ***Sulfate*** – Eleven percent of the background wells exceeded the sulfate SDWR of 250 ppm. The maximum background concentration (514 ppm) was approximately twice the SDWR.

- ***Iron*** – Thirty-two percent of the background wells exceeded the iron SDWR of 0.3 ppm. The maximum background concentration (1.55 ppm) was approximately 5 times higher than the SDWR.

- ***Manganese*** – Sixty-one percent of the background wells exceeded the manganese SDWR of 0.05 ppm. The maximum background concentration (0.728 ppm) was over 14 times higher than the SDWR.

- ***Sodium*** – One hundred percent of the background wells exceeded the sodium health advisory level of 20 ppm. The maximum background concentration (1,390 ppm) was approximately 70 times higher than the sodium health advisory level. (Note that no SDWR exists for sodium.)

- ***TDS*** – Eighty-two percent of the background wells exceeded the TDS SDWR of 500 ppm. The maximum background concentration (6,850 ppm) was nearly 14 times higher than the SDWR.

Based on naturally occurring high TDS and other analytes as described above, this groundwater unit is consistent with the EPA guidelines for Class III nonpotable groundwater. Therefore, overburden/shale groundwater is not a suitable drinking water source based on both low yield and naturally poor quality.

The low yield in the overburden/shale groundwater that is characteristic under much of PBOW was observed in the vicinity of the GMA. At the LBA site, only two of the three overburden/ shale monitoring well samples could be collected using the low-flow sampling methodology during both the months of May (wet season) and November (dry season) due to insufficient water volume. At the RCA, of the four temporary piezometers installed, none exhibited a sufficient amount of groundwater for sample collection. In addition, the three overburden/shale monitoring well samples could not be collected using the low-flow sampling methodology

during both the months of May (wet season) and November (dry season) due to insufficient water volume and well RCA-MW01 did not even exhibit groundwater during the month of November for a sample to be collected. Based on these observations at the RCA, use of overburden/shale groundwater is regarded as highly unlikely in the vicinity of RCA.

On the western side of the GMA at the Former Sellite Area, one of the eight temporary piezometers installed did not present adequate groundwater volume for sample collection during the wet season month of June and of the remaining seven piezometers, only four could be sampled using the low-flow sampling methodology due to insufficient water volume. At the ULA, eight temporary piezometers were installed, but only one presented an adequate volume of groundwater for the sample to be collected using the low-flow sampling methodology.

Limestone Bedrock Groundwater. The limestone bedrock water-bearing zone yields groundwater year-round, although specific groundwater yield from any bedrock monitoring well is dependent upon the bedrock fracture(s) encountered. During periods of low precipitation, only limited migration of contaminants would occur in the overburden/shale due to reduced infiltration. Of the six bedrock monitoring wells, three at the LBA and three at the RCA, only three provided a sufficient volume of groundwater for sample collection. Three samples were collected during the month of May (wet season) and only two samples were collected during the month of November (dry season). In addition, groundwater recharge in the three bedrock wells during sample collection was also low, which prevented any of the samples to be collected using the desired low-flow sampling technology. Therefore, during both the wet and dry season sampling events, the bedrock monitoring wells were purged dry one day and sampled with a bailer the following day.

As previously noted, the limestone bedrock underlying most of PBOW is of poor natural quality, largely due to naturally occurring petroleum hydrocarbons and hydrogen sulfide gas emissions. Hydrogen sulfide was not noted on the boring logs from the LBA and RCA newly installed bedrock monitoring wells although existing monitoring well MNTA-BEDGW-001, used as the upgradient well for LBA, has exhibited hydrogen sulfide measurements during borehole drilling and groundwater sampling events with readings greater than 50 ppm.

Natural petroleum-derived hydrocarbon seeps are common along the walls of area quarries (Shaw, 2005). Petroleum hydrocarbons were observed at depth during the drilling of LBA bedrock well LBA-BEDGW-002. Well LBA-BEDGW-002 had petroleum hydrocarbon seeping from fractures between the depths of 49.6 to 56.4 feet below ground surface (bgs). Also, a

distinct hydrocarbon odor was detected and a hydrocarbon sheen was noticed during the development of bedrock well LBA-BEDGW-002.

At the RCA, hydrocarbon staining was noted in the boring log of well RCA-BEDGW-001 at depths of 53.6 to 63.0 feet bgs and petroleum hydrocarbon seepage from a depth of 68.9 to 70.2 feet bgs. Hydrocarbon seepage was found in well RCA-BEDGW-002 at a depth of 57.0 to 57.2 and 58.1 to 58.2 feet bgs and in well RCA-BEDGW-003, hydrocarbon seepage was noted to be from depths of 62.4 to 63.7 and 65.5 to 65.8 feet bgs and petroleum staining was noted to be at depths of 64.7 to 66.7 and 67.6 to 80.2 feet bgs. During development of well RCA-BEDGW-002, instantaneous and periodic readings of hydrogen sulfide were measured to be 102 ppm and photoionization detector meter measurements were as great as 56 ppm.

No bedrock monitoring wells were installed at the Former Sellite Area or the ULA. However, the LBA and RCA project sites are located approximately 1,300 feet cross-gradient to the Former Sellite Area and ULA so bedrock similarities would be expected. At bedrock limestone upgradient location Acid Area 1, petroleum hydrocarbon was encountered in one of the four wells and hydrogen sulfide was noted to have been encountered while drilling in two of the four bedrock wells (Jacobs Engineering, 2009). With the petroleum hydrocarbon presence and excessive hydrogen sulfide measurements noted in nearby bedrock monitoring wells, indications suggest that bedrock groundwater in the vicinity of the Former Sellite Area and the ULA is of natural poor quality.

Consistent with the findings of naturally occurring petroleum hydrocarbons in the limestone wells, benzene was detected in the groundwater at concentrations above both the risk-based screening concentration (RBSC) and background screening concentration (BSC) in the three LBA and RCA bedrock wells sampled (LBA-BEDGW-002, MNTA-BEDGW-001, and RCA-BEDGW-002). Benzene concentrations in the groundwater samples ranged from nondetect to 1,680 micrograms per liter [µg/L], with three of the five analytical results exceeding the promulgated Safe Drinking Water Act maximum contaminant level for benzene of 5 µg/L (EPA, 2012a).

The TDS concentration of each limestone bedrock groundwater sample (3,320 to 7,970 mg/L) exceeded the SDWR for TDS of 500 mg/L. SDWRs are nonenforceable federal guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water that are used by public water authorities as guidance for acceptability of water as a potable source. The most common components of TDS are common salts; very small particulates; and ionic forms of common elements such as calcium, magnesium,

sodium, iron, sulfate, and strontium (Ohio Environmental Protection Agency [OEPA], 2009). The elevated TDS within the limestone bedrock that underlies PBOW likely results from the reducing conditions that mobilize metals.

In summary, the limestone unit underlying PBOW generally provides an adequate quantity of groundwater for hypothetical potable use. However, the yields in the vicinities of the GMA (LBA, Former Sellite, and ULA) sites appear to be insufficient to support potable use. Regardless of yield, the natural quality of limestone bedrock groundwater underlying PBOW would fail drinking water standards with respect to naturally occurring benzene that consistently exceeds the maximum contaminant level and the elevated TDS. The elevated benzene is related to naturally occurring petroleum hydrocarbons, and the high TDS is likely associated with naturally occurring reducing conditions.

2.4.2 Groundwater Use

Approximately 170 private drinking water wells permitted by the Erie County Health Department are located within 4 miles of PBOW. USACE conducted a private well survey for the area within 1 mile of the downgradient PBOW boundary. Only five private wells were identified within the 1-mile radius. Two of these were identified as being used for the irrigation of lawns and gardens and washing cars, and the other three were not used at all (Appendix A of Shaw [2006]). NASA does not currently use the groundwater for any purpose and has recently agreed to revise their Facility Master Plan to state that land use controls restricting groundwater use will be put in place if the property is excessed (PBOW Project Delivery Team, 2013).

2.5 Surface Water

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

Eleven streams pass through or originate within PBOW and are a part of four drainage areas: 1) Sawmill Creek (southern PBOW); 2) Plum Brook (central PBOW); 3) Pipe Creek (western PBOW); and 4) Storrs-Hemminger Ditch (northeast PBOW). All streams flow north or northeasterly into Sandusky Bay. Numerous ponds lie within and around PBOW. For the GMA, a tributary to Plum Brook flows in a northerly direction between the LBA and RCA project sites and a tributary to Ransom Brook is located west of the ULA and north of the Former Sellite Area. This tributary flows in a westerly direction to Ransom Brook which flows in a northerly direction away from PBOW property.

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

2.6 Wetlands

A wetland study performed at the PBOW facility in 2012 identified 10 upland and wetland vegetative communities at the installation (EnviroScience, Inc. [ES], 2012). Over 1,000 wetlands totaling over 400 acres were identified throughout PBOW during this study. The wetlands and their boundaries, as identified in the ES (2012) report, have not been verified by USACE; therefore, they are not considered jurisdictional wetlands. However, until such jurisdictional confirmation is obtained, the delineation in the ES (2012) report is assumed to be accurate, and any actions or use of these areas should be consistent with the protected status of wetlands under all applicable federal and state statutes.

3.0 Locomotive Building Area (Locomotive Shop and Railcar Wash Area)

This chapter provides a summary of the sampling, analyses, results, and evaluation of the environmental media associated with the LS and RCA within the LBA (i.e., soil, overburden/shale groundwater, limestone bedrock groundwater, surface water, and sediment) that have been presented in the LBA SCR (Appendix A), BHHRA (Appendix B), and SLERA (Appendix C). The reference for each of these documents is provided below:

- Shaw Environmental (Shaw), 2010a, ***Final, Garage Maintenance Area (Locomotive Building Area), Site Characterization Report, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** Revision 1, September.
- Shaw Environmental & Infrastructure, Inc. (Shaw), 2011a, ***Final, Baseline Human Health Risk Assessment, Garage Maintenance Area (Locomotive Building Area), Plum Brook Ordnance Works, Sandusky, Ohio,*** February.
- Shaw Environmental & Infrastructure, Inc. (Shaw), 2011b, ***Final, Screening Level Ecological Risk Assessment, Garage Maintenance Area (Locomotive Building Area), Plum Brook Ordnance Works, Sandusky, Ohio,*** February.

Results of the previous initial SI of the LBA (USACE, 2000) are briefly summarized in Section 3.1. Identification of the samples and the recommendations from the SI present a context for the performance of the RI and for some of the specific sampling locations and analyses performed in the RI.

After the SCR was finalized, an additional investigation of the maintenance pit (specifically the sump and pit material) within the Locomotive Building at the LS was performed. This investigation is summarized in Section 3.5, and the full memorandum drafted for the Army describing the investigation and its results is presented in Appendix J. Other than the summary of the maintenance pit investigation, this chapter provides no data or other information that has not been previously presented in the LBA SCR, BHHRA, or SLERA (Appendices A, B, and C).

3.1 Previous Investigation and Evaluation

Locomotive Shop. Prior to the RI, the following analytical samples were collected in 1999 as part of the SI for the LS (USACE, 2000):

- One (0 to 0.5 foot) surface soil sample
- Two subsurface soil samples (1 to 3 and 3 to 5 feet bgs) from boring SB01
- One subsurface soil sample from maintenance pit boring DP01 (6 to 7.5 feet bgs)
- Four surface water samples (includes one quality control [QC] field duplicate sample); one from the sump, one from the sewer (waste water junction box), and one from the drainage ditch located between the LS and RCA
- One collocated sediment sample with the surface water sample in the drainage ditch.

Soil samples were analyzed for semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), target analyte list (TAL) metals, and total organic carbon (TOC). The surface water and sediment samples were analyzed for SVOCs and Resource Conservation and Recovery Act metals (Shaw, 2010a).

In SI soil samples from the LS, no SVOCs were detected above preliminary remediation goals (PRG) derived by the EPA. According to the SI report, one PCB (Aroclor 1260) was detected above the PRG at a concentration of 450 ppm from the maintenance pit inside of the LS. During RI preparation, it was determined that this result was 450 parts per billion (ppb) or 0.45 milligrams per kilogram (mg/kg). This value still exceeded the PRG screening value of 0.2 mg/kg. In addition, metals (antimony, arsenic, chromium, iron, and lead) were found to be above PRG screening limits in some of the surface and subsurface soil samples. Analytical results from a water sample collected from the sump inside of the Locomotive Building indicated concentrations of lead and arsenic above PRGs. Also, the QC field duplicate sample exhibited concentrations of antimony and iron above the PRG. The PCB Aroclor 1260 was also detected in the water sample from the sump and exceeded screening levels. A surface water sample and a sediment sample were collected from the open ditch to the east of the LS; each was analyzed for SVOCs and metals. No SVOCs were detected in either the surface water or the sediment, and no metals were detected above PRGs in the water. Arsenic (41.5 ppm) and iron (80,900 ppm) were detected in the sediment sample above their PRG levels of 0.38 and 22,000 ppm, respectively. Water samples were collected from the sump just inside the southern wall of the LS and the sewage junction box just outside of the LS. The SI found the sump water sample to have concentrations of Aroclor 1260 (1.5 ppb) and arsenic (20.6 ppb) that exceeded the PRGs (Shaw, 2010a).

Based on the detections of arsenic and Aroclor 1260 in the sump water, the SI recommended removal and disposal of the sump water. The SI also recommended further consideration of removal of the sludge material from the maintenance pit (Shaw, 2010a).

Railcar Wash Area. Prior to the RI, the following analytical samples were collected in 1999 as part of the SI for the RCA (USACE, 2000):

- One (0 to 2 feet) surface soil sample in DP002
- Six subsurface soil samples (three at 2 to 4 and three at 4 to 6 feet bgs) from borings DP001, DP002, and DP003
- One QC field duplicate subsurface soil sample at 4 to 6 feet bgs from boring DP004 (a duplicate location of DP003).

Soil samples were analyzed for SVOCs, PCBs, TAL metals, and select samples were analyzed for TOC (Shaw, 2010a).

Results from the SI concluded arsenic (7.3 ppm), was above the PRG screening level of 0.38 ppm in surface soil. No PCBs or SVOCs were detected above PRG screening levels in surface or subsurface samples. Including the quality assurance (QA) sample, arsenic and iron were above the PRG screening levels in all subsurface soil samples except in boring DP00l (2 to 4 feet). The maximum concentration of arsenic was 17.7 ppm in DP002 (2 to 4 feet), and iron was detected at 46,400 ppm in the same subsurface sample (Shaw, 2010a).

The SI reported that 2,4-DNT and naphthalene concentrations in RCA soil exceeded PRGs. However, review of the SI data during the RI preparation indicated the concentrations were incorrectly shown in ppm rather than ppb. Thus, instead of 4,000 ppm and 3,400 ppm for 2,4-DNT and naphthalene, the actual concentrations were 4.0 ppm and 3.4 ppm, respectively. The SI recommended additional assessment activities at the RCA in part based on the misinterpretation of the 2,4-DNT and naphthalene concentrations. However, other SI analytical results (arsenic and iron) above PRGs also support the SI recommendation for further investigation of the RCA (Shaw, 2010a).

This RI report addresses the concerns raised in the SI evaluation. The SI results are summarized in the SCR (Appendix A) and were further evaluated in the BHHRA (Appendix B) and SLERA (Appendix C), together with the analytical results obtained from samples collected as part of the RI.

3.2 Site Characterization and Evaluation

This section summarizes the RI sampling of environmental media at the LBA, the analytical results, and an evaluation of these results. Additional details are provided in the SCR (Appendix A).

3.2.1 Samples and Analyses

The RI samples were collected consistent with the site-specific quality assurance project plan (QAPP) (Shaw, 2008b) and work plan for the LBA (Shaw, 2009). Soil, groundwater, surface water, and sediment sampling locations for the LS and the RCA are shown on Figure 3-1.

A geophysical survey was conducted around the Locomotive Building to confirm or deny the presence of a UST, as similar USTs have been associated with locomotive building structures at other federal facilities (e.g., West Virginia Ordnance Works). The geophysical survey was performed using a Geonics Limited EM31-MKl1 ground conductivity meter (EM31) and a SIR3000 ground-penetrating radar. Where possible, the survey was conducted between 5 and 65 feet beyond the four locomotive building walls.

Surface and subsurface soil samples at the LBA were collected as part of the RI from a total of 12 soil borings, 8 at the LS (including 3 in the maintenance pit) and 4 at the RCA. Generally, surface soil is defined as samples collected from within the interval of 0 to 1 foot bgs, and subsurface soil is defined as samples collected from depths greater than 1 foot bgs per the RI work plan (Shaw, 2009). It was also determined during the direct-push soil sampling that fill material was present at the LBA with variable thicknesses. The work plan called for surface soil sample collection at a depth of 0 to 1 foot within the native soil followed by the 3- to 5-foot subsurface soil sample. The 8- to 10-foot soil sample was collected from a depth of 8 to 10 feet below the existing ground surface.

Nine temporary piezometers were installed at the LBA, five at the LS and four at the RCA, as described in the work plan. However, only the five temporary piezometers at the LS (LBA-PZ01, LBA-PZ02, LBA-PZ03, LBA-PZ04, and LBA-PZ05) yielded adequate groundwater volume for sampling.

Three overburden/shale groundwater monitoring wells (LBA-MW01, LBA-MW02, and LBA-MW03) and two limestone bedrock monitoring wells (LBA-BEDGW-001 and LBA-BEDGW-002) were installed in the LS area as directed by the work plan. At the RCA, three overburden/shale groundwater monitoring wells (RCA-MW01, RCA-MW02, and

RCA-MW03) and three limestone bedrock monitoring wells (RCA-BEDGW-001, RCA-BEDGW-002, and RCA-BEDGW-003) were installed. The work plan was designed to include upgradient, source area, and downgradient groundwater locations for both the overburden/shale wells and limestone bedrock monitoring wells. Placement of overburden/shale monitoring wells was based on groundwater flow directions determined from newly installed piezometers. Existing sitewide limestone bedrock groundwater flow maps were used to place the new bedrock monitoring wells. Only two limestone bedrock monitoring wells were necessary at the LS. Based upon the 2004 groundwater level data, groundwater flow is in a northwest direction so existing monitoring well MNTA-BEDGW-001 could be used as the upgradient monitoring well.

Surface water and sediment samples were also collected from the unnamed tributary to Plum Brook located between the LS and the RCA. Six surface water and sediment samples were collected in collocated locations from the unnamed drainage ditch and a tributary to the ditch. In addition, one surface water sample was collected from drainage water flowing from a clay pipe from the possible railcar wash sump.

The following list summarizes the samples and analyses collected for the LBA RI:

- ***Surface Soil*** – Thirteen samples, seven from the LS (including one QC field duplicate sample and one QA field split sample) and six from the RCA (including one QC field duplicate sample and one QA field split sample) were collected and analyzed for nitroaromatics, volatile organic compounds (VOC), SVOCs, TAL metals, and PCBs, and one sample was analyzed for TOC.

- ***Subsurface Soil*** – Nine samples, five from the LS and four samples from the RCA (including one QC field duplicate and one QA field split sample) from within an overall depth interval of 3 to 5 feet bgs were analyzed for nitroaromatics, TAL metals, PCBs, and SVOCs. Eleven samples, including five from the LS and six from the RCA (which includes one QC field duplicate sample and one QA field split sample) from within a depth interval of 8 to 10 feet were analyzed for nitroaromatics, VOCs, TAL metals, and SVOCs.

  Additionally, three samples from three borings were collected from the maintenance pit within the LS. Each sample was collected near the bottom of the boring (pit bottom) and analyzed for nitroaromatics, target compound list SVOCs, and TAL metals.

- ***Overburden/Shale Piezometers*** – Seven groundwater samples from the LS, including one QC field duplicate sample and one QA field split sample, were analyzed for nitroaromatics, VOCs, SVOCs, TAL metals (filtered and unfiltered), hardness, cyanide, and general chemistry parameters; field tests were also conducted.

Due to groundwater recharge less than 50 milliliters per minute, temporary piezometers from the RCA were not sampled.

- ***Overburden/Shale Monitoring Wells*** – A total of eight groundwater samples were collected during the wet season of May 2009 (five from the LS, including one QC field duplicate sample and one QA field split sample, and three from the RCA). Seven groundwater samples were collected during the dry season of November 2009 (five from the LS, including one QC field duplicate sample and one QA field split sample, and two from the RCA). Groundwater samples were analyzed for nitroaromatics, VOCs, SVOCs, TAL metals (filtered and unfiltered), and general chemistry parameters; field tests were also conducted. Due to lack of water volume in well RCA-MW01 during the month of November, no groundwater sample was collected.

- ***Limestone Bedrock Monitoring Wells*** – Due to lack of water volume, groundwater could not be collected from all the LS and RCA monitoring wells. A total of three groundwater samples were collected during the wet season of May 2009 (two from the LS and one from the RCA). Two groundwater samples were collected during the dry season of November 2009 (one from the LS and one from the RCA). Groundwater samples were analyzed for nitroaromatics, VOCs, SVOCs, TAL metals (filtered and unfiltered), and general chemistry parameters; field tests were also conducted.

- ***Surface Water*** – A total of nine samples were collected from the water in the drainage ditch located between the LS and RCA. Seven samples, including one QC field duplicate sample and one QA field split sample, were collected from the unnamed tributary to Plum Brook, one sample from the drainage ditch to the tributary, and one sample was collected from drainage water flowing from a clay pipe which may have possibly been from the railcar wash sump. Samples were analyzed for nitroaromatics, VOCs, TAL metals, SVOCs, PCBs, and water quality parameters. In addition, one sample was analyzed for hardness.

- ***Sediment*** – A total of eight collocated samples were collected below the surface water in the area between the LS and RCA. Five of the samples were collected from the unnamed tributary to Plum Brook and one regular sample along with a QC field duplicate and a QA field split were collected from the drainage ditch to the tributary. Samples were analyzed for nitroaromatics, VOCs, TAL metals, SVOCs, PCBs, and water quality parameters.

All analytical data from these samples were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the EPA *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA, 2008) and 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

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 3 Modifications to National 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). Additional information on data evaluation, data validation, and data quality are provided in the SCR and information attached therein (Appendix A).

3.2.2 Physical Characteristics

3.2.2.1 Local Soils

At the LS, fill material is interpreted to have been encountered in 13 of the 15 piezometer, soil boring, and monitoring well boring locations. Depths of fill material in the land surface ranged from 0.9 foot (SB-04) to possibly 9.2 feet (LBA-MW02/LBA-BEDGW-002) and consisted of a dark to yellowish brown, fine-grain sand with gravel. Within the LS in the maintenance pit, a coarse-grained, gravel limestone fill was encountered.

Below the LS fill material, native soil consisted of a glacial till, glacial outwash, or glacial lacustrine (lake) deposit. In general, lithology of the monitoring well borings first encountered a brown, fine-grain sand with thicknesses ranging from 0.1 foot (LBA-BEDGW-002) to 4.4 feet (LBA-BEDGW-001). Below the sand, lithology changed to a brownish-colored, stiff, silty clay that continued to the top of bedrock (shale) that was encountered at approximately 26 feet bgs. The Olentangy Shale was the bedrock formation that was encountered.

In the RCA located across the unnamed tributary, fill material was interpreted to have been encountered in 6 of the 14 boring locations. Depths of fill ranged from 0.9 foot (SB-11) to 4 feet (RCA-MW03). At well RCA-MW03, fill material consisted of a yellowish-brown, fine-grain sand overlying a black clay with silt and sand. At PZ-10 a black, loose ash was encountered to a depth of 1.0 foot, and in well PZ-08, fill consisted of a mottled, yellowish brown silt to a depth of 1.5 feet overlying a fine grain, yellowish-brown sand to a depth of 2.8 feet.

Below the fill material at the RCA, native soil also consisted of a glacial till, glacial outwash, or glacial lacustrine (lake) deposit. Lithology typically consisted of a black or dark brown, silt or clay with organics followed by a gray or brownish-colored, stiff, silty clay or clayey silt that continued to the top of bedrock (shale) that was encountered at an average depth of 23 feet bgs. As the LS, the Olentangy Shale was the bedrock formation encountered.

3.2.2.2 Local Geology

Bedrock units encountered at the LBA are of Devonian age and consist of the Plum Brook Shale (member of the Olentangy Shale) and the underlying Delaware Limestone. Nine piezometers advanced to refusal at the LS and RCA are believed to have encountered the Olentangy Shale at depths ranging from 17.9 to 22.9 feet bgs, but could not be confirmed because no refusal material was recovered. Monitoring wells RCA-BEDGW-001 and LBA-BEDGW-002 encountered the shale at respective depths of 23.2 to 27 feet bgs (shale elevations of 615.3 and 609.3 feet amsl, respectively). The Delaware Limestone was encountered in well RCA-BEDGW-003 at a depth of 35.5 feet (598.8 feet amsl) and in well RCA-BEDGW-001 at a depth of 41.2 feet (597.3 feet amsl).

As determined by rock core recovery during borehole drilling for bedrock monitoring wells, the Olentangy Shale at the LBA was found to typically be gray in color, highly weathered near the soil bedrock interface, thinly laminated, and friable. Competency of the shale increased with depth. The Olentangy Shale at the LBA was not encountered in borings LBA-MW01, LBA-MW02, LBA-MW03, RCA-MW01, and RCA-MW02 completed for the overburden/shale wells, because they were not advanced to refusal. The Delaware Limestone below the shale was typically found to be dark gray in color, hard, slightly weathered, and fossiliferous (including brachiopods and corals), and to exhibit massive bedding. Pyrite crystals were found in several cores. In addition, petroleum hydrocarbon was found seeping from sections of the rock core during lithologic review at monitoring wells LBA-BEDGW-002, RCA-BEDGW-001, RCA-BEDGW-002, and RCA-BEDGW-003. Naturally occurring petroleum hydrocarbons are common regionally in the Delaware Limestone.

3.2.2.3 Local Hydrogeology

Overburden/shale groundwater in the LS area was encountered at depths ranging from 1 foot bgs (SB01/PZ05) to 10 feet bgs (PZ01 and SB03/PZ04) in January 2009 (wet season) during soil boring drilling/piezometer installation. Groundwater was not encountered in soil boring SB05. During monitoring well installation conducted in March and April 2009 (wet season), overburden/shale groundwater was encountered at depths ranging from 6.4 feet bgs (LBA-BEDGW-001) to 9.5 feet bgs (LBA-BEDGW-002). Overburden/shale groundwater in the RCA on the other side of the drainage ditch was encountered during the temporary piezometer and well installation in only 6 of the 14 borings. Overburden/shale groundwater depths ranged from 3.3 feet bgs (RCA-BEDGW-002) to 23 feet bgs (RCA-MW02 and RCA-MW03). Overburden/shale groundwater is suspected not to have been encountered in this area, possibly due to the presence of an agricultural drainage line or from the line that ran from the former catch sump (previously used to catch the waste acid rinse water from the former railcar washing)

that is currently draining overburden/shale groundwater. The drainage line is below grade and discharges on the bank of the unnamed ditch. Groundwater is currently discharging from the drainage line. As shown by the May 26, 2009 overburden/shale groundwater elevation contour map (Figure 3-2), which includes water level measurements from both the temporary piezometers and permanent monitoring wells, overburden/shale groundwater of the LS flows in an east-northeast direction and groundwater from the RCA flows in a west-northwest direction toward the adjacent unnamed drainage ditch. Figure 3-3 presents an overburden/shale groundwater potentiometric map of water level measurements taken on October 27, 2009 (dry season) from the overburden/shale monitoring wells (piezometers were abandoned in July). The groundwater flow direction based on October 2009 measurements is the same as depicted in May 2009. Overburden/shale groundwater flow from both contour maps mimics the surface topography.

Two bedrock monitoring wells were installed at the LS and three were installed at the RCA during the RI. Based on 2004 groundwater flow data, existing bedrock well IT-MNTA-BEDGW-001 was used as an upgradient well; well LBA-BEDGW-002 was installed as a source well near the southeast corner of the building; and well LBA BEDGW-001 was installed in a downgradient position, northwest of the Locomotive Building. Groundwater from these bedrock wells was encountered at varying depths. Bedrock groundwater was encountered in fractures during March 2009 drilling at depths of 90.8 to 91.1 feet bgs (LBA-BEDGW-001) and 61 feet bgs (LBA-BEDGW-002).

Bedrock wells installed in the RCA include RCA-BEDGW-001, installed in an upgradient location southeast of the area; well RCA-BEDGW-002, installed as a source well within the RCA (western side); and well RCA-BEDGW-003, installed as the downgradient well, across the drainage ditch northwest of the RCA. Bedrock groundwater from these wells was also encountered at variable depths. The depth at which groundwater was encountered ranged from 53.8 feet bgs in well RCA-BEDGW-002 to 91.1 feet in well RCA-BEDGW-003. The screened intervals of all bedrock wells are within the Delaware Limestone.

Groundwater level measurements from bedrock wells associated with nearby Ash Pit 1 and Waste Water Treatment Plant 1 were combined with the LBA bedrock groundwater level measurements. Groundwater flow diagrams indicate bedrock groundwater flows in a northwest direction at the LBA. Figures 3-4 and 3-5 show the bedrock groundwater flow on May 26 (wet season) and October 27, 2009 (dry season). Bedrock groundwater elevations from wells LBA-BEDGW-001, LBA-BEDGW-002, RCA-BEDGW-001, RCA-BEDGW-003, and AP 1 -BEDGW-001 were not used in the contouring of the May 26, 2009 groundwater flow map and

elevations from wells LBA-BEDGW-001, LBA-BEDGW-002, RCA-BEDGW-001, and RCA-BEDGW-003 were not used in the October 27, 2009 bedrock groundwater flow map. The groundwater elevations were not used because the well screens are set in possibly low-producing fractures or within a different bedrock fracture network compared to the other bedrock well screens. In either case, bedrock groundwater elevations were variable with elevation changes as much as 69 feet in wells spaced only 130 feet apart (MNTA-BEDGW-001 and RCA-BEDGW-003) (Figure 3-4). The reason for the difference in water level elevations from wells located fairly close to each other is unknown.

3.2.2.4 Local Surface Water

Two surface water features are associated with the LBA (Figure 3-1). One is a large, unnamed tributary which bisects the LS and RCA. Water flow is in a northeastern direction into another unnamed tributary within Pentolite Ditch which drains into Plum Brook. The second feature is a smaller tributary located north of Maintenance Road (approximately 50 feet north of Ash Pit No. 1) and drains in a northwest direction into the larger unnamed tributary. As shown on Figure 3-1, the smaller tributary is a northwest-southeast-oriented drainage feature in the southwest corner of the RCA that drains from the Ash Pit No. 1 site south of Maintenance Road via a culvert. The larger unnamed tributary typically contains water, and the smaller tributary is ephemeral.

One stream level staff gauge (SG05) was placed in the larger unnamed tributary between the LS and RCA (Figure 3-1). Elevations of the staff gauge were recorded at the top and base of the rod. Water level measurements from the drainage ditch were collected from the staff gauge. When elevations are plotted in correlation with groundwater level measurements from overburden/shale monitoring wells, the drainage ditch meets the definition of a "gaining" stream during both the wet and dry season months of May and October (Figures 3-2 and 3-3). Both figures show groundwater elevations in the LBA adjacent to the drainage ditch are greater than the water level elevation of the ditch, indicating groundwater is discharging into the creek.

3.2.3 Summary of Geophysical and Analytical Results

The geophysical and analytical results of the RI samples described in Section 3.2.1 are summarized in this section. As part of this evaluation, analytes detected in the respective environmental media were compared to RBSCs (Oak Ridge National Laboratory-EPA, 2009) and BSCs as points of reference only. Concentrations of analytes that exceed the RBSCs are highlighted in Tables 3-1 through 3-6 for the various environmental media. The derivations of RBSCs and BSCs are described in the LBA BHHRA (Appendix B). RBSCs do not infer a regulatory limit or mandated cleanup level, nor is the identification of an exceedance intended to indicate an unacceptable human health risk or a need for remedial action. Formal evaluation of

human health risks was performed in the BHHRA. Concentrations in individual samples that exceed the respective BSCs are identified by bold text in Tables 3-1 through 3-6. Sampling locations where RBSCs and/or BSCs were exceeded are shown on Figures 3-6 through 3-9.

Geophysical Summary. The geophysical findings from the LS are summarized as follows:

Locomotive Shop:

- The geophysical survey concluded that there is/are no buried UST(s) within a perimeter of 65 feet surrounding the LS.

Surface and Subsurface Soil Analytical Summary. The findings from the LS (including maintenance pit) and RCA surface and subsurface soil are summarized as follows:

Locomotive Shop:

- Three nitroaromatics and six VOCs were detected in surface soil (0 to 1 foot) samples, but none were above their respective RBSC concentrations.

- Seven nitroaromatics were detected in the subsurface soil samples; however, only 2,4-DNT and 2,6-DNT exceeded their RBSCs in boring LBA-SB02 at 8 to 10 feet bgs.

- One PCB (Aroclor 1260) was detected in the surface soil in one sample at a concentration of 0.24 ppm, only marginally above the RBSC of 0.22 ppm. No PCBs were detected in 3 to 5 feet subsurface soil samples.

- Twelve VOCs were detected in subsurface soil samples at the LS; however, none of the detected compounds exceeded their RBSCs.

- SVOCs were detected in surface soil, but only benzo(a)pyrene exceeded its RBSC in only one location (LBA-SB03).

- SVOCs exceeding RBSCs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, 2,4-DNT, and 2,6-DNT, were detected in several subsurface samples.

- No metals were detected above both RBSC and BSC values. Six metals (aluminum, arsenic, chromium, cobalt, iron, and manganese) were detected above RBSCs and five metals (beryllium, calcium, lead, magnesium, and mercury) were detected above BSCs. Beryllium is not a metal associated with either the TNT manufacturing process or typical maintenance activities. In addition, beryllium appears to be elevated relative to BSCs throughout this area and likely represents the upper range of its concentration in natural soil. In addition, the essential nutrients calcium and

magnesium were detected above BSC levels (as nutritionally essential elements, calcium and magnesium lack RBSC values).

Based on the presence of nitroaromatics, SVOCs, and PCBs in surface and subsurface soil at concentrations above RBSCs and metals detected above RBSCs or BSCs, former DoD operations have impacted the soil at the LS.

Maintenance Pit:

- A weathered petroleum odor was encountered in boring SB09, which was drilled within 5 feet of 1999 SI boring DP-01. Elevated petroleum-contaminated material found in DP01 was not observed in borings SB07, SB08, or SB09 or reflected in the analytical results. Therefore, the heavy petroleum-related contamination encountered during the 1999 SI appears to be limited to the sump and does not appear throughout the maintenance pit.

- Nitroaromatics and PCBs were not detected in any of the subsurface soil samples.

- Three SVOCs (benzo[a]anthracene, benzo[a]pyrene, and benzo[b]fluoranthene) were detected above RBSCs.

- No metals were detected above both RBSC and BSC values. Five metals (aluminum, arsenic, chromium, iron, and manganese) were detected above RBSCs and three metals (beryllium, calcium, and magnesium) were detected above BSCs. Beryllium is not a metal associated either with the TNT manufacturing process or typical maintenance activities. In addition, beryllium appears to be elevated relative to BSCs throughout this area and likely represents the upper range of its concentration in natural soil. In addition, the nutritionally essential calcium and magnesium were detected above BSC levels (as nutritionally essential elements, they lack RBSC values).

Former DoD activities may have impacted the maintenance pit within the LS, as evidenced by SVOCs above RBSCs and metals detected above RBSCs or BSCs. Possible petroleum contamination was investigated more fully in a subsequent investigation summarized in Section 3.5.

Railcar Wash Area:

- Only one nitroaromatic (2,4-DNT at 0.71 ppm) exceeded its RBSC in surface soil (LBA-SB 11).

- Four nitroaromatics (2,4-DNT, 2,6-DNT, 2-nitrotoluene [NT], and 3-NT) were detected above the RBSCs in subsurface soil (boring LBA-SB11).

- VOCs were detected in the surface and subsurface soil samples; however, none exceeded an RBSC.

- Two SVOCs were detected in the subsurface soil samples, and 2,4-DNT and 2,6-DNT were both detected in LBA-SB11 above the RBSCs.

- The PCB Aroclor 1221 exceeded the RBSC in one surface soil sample (boring LBA-SB12), while no PCBs exceeded their RBSCs in the subsurface soil.

- No metals were detected above both RBSC and BSC values. Six metals (aluminum, arsenic, chromium, cobalt, iron, and manganese) were detected above RBSCs and two (beryllium and magnesium) were detected above BSCs. Beryllium is not a metal associated either with the TNT manufacturing process or typical maintenance activities. In addition, beryllium appears to be elevated relative to BSCs throughout this area and likely represents the upper range of its concentration in natural soil.

Based on the presence of nitroaromatics in surface and subsurface soil, SVOCs found in subsurface soil, and one PCB in surface soil, all above RBSCs and/or BSCs, former DoD operations have impacted the soil at the RCA.

Piezometer Overburden/Shale Groundwater Sample Summary. The major findings from LS piezometer groundwater are summarized as follows (due to groundwater recharge rates less than 50 milliliters per minute, no groundwater samples were collected from the RCA):

Locomotive Shop:

- Seven nitroaromatics were detected in piezometer groundwater samples at the LS and four (2,4-DNT, 2,6-DNT, 2-NT, and 3-NT) were above its RBSC. All exceedances were from the sample from piezometer LBA-PZ03.

- Twelve VOCs were detected in piezometer groundwater and three (1,1-dichoroethane [LBA-PZ01 and LBA-PZ04], naphthalene [LBA-PZ03], and trichloroethene [LBA-PZ03]) were above their RBSCs in several of the piezometers.

- Two nitroaromatics (2,4-DNT and 2,6-DNT) were detected as SVOCs in the groundwater sample from LBA-PZ03 and were above their RBSC of 0.099 ppb.

- Nineteen unfiltered metals were detected and five (aluminum, arsenic, cobalt, iron, and manganese) exceeded both the RBSC and BSC.

- Only arsenic exceeded both the RBSC and BSC in the filtered samples.

Monitoring Well Overburden/Shale Groundwater Sample Summary. Five groundwater samples (QC field duplicate and QA field split samples included in total) were

collected from newly installed wells during the wet season month of May 2009, and five samples were collected during the dry season month of November 2009. The findings are summarized as follows:

Locomotive Shop:

Upgradient (LBA-MW01)

- Manganese was the only compound that exceeded the RBSC screening level in upgradient monitoring well LBA-MW01. It was detected in both the filtered and unfiltered groundwater samples during both the wet (May 2009) and dry (November 2009) season sampling events.

Source Area (LBA-MW02)

- Nitroaromatics were detected in well LBA-MW02 during both the wet (May 2009) and dry (November 2009) season sampling events. Five compounds above RBSCs included 2,4-DNT, 2,6-DNT, 2-NT, 3-NT, and 4-NT.

- One VOC (trichloroethene) was detected above the RBSC during both the wet and dry sampling events.

- Nitroaromatics 2,4-DNT and 2,6-DNT, detected as SVOCs, were above RBSCs during both the wet and dry season sampling events.

- Only manganese was detected above the RBSC during the dry season sampling event and it was detected in the unfiltered groundwater sample.

Downgradient (LBA-MW03)

- One VOC (carbon tetrachloride) was detected above the RBSC in downgradient well LBA-MW03 during the dry season sampling, and one VOC (1,l-dichloroethane) was detected above the RBSC during both sampling events.

- Only manganese was detected above the RBSC during the dry season (November 2009) sampling event in both the unfiltered and filtered groundwater sample. Aluminum was also detected above the BSC during the dry season sampling.

Based on the presence of nitroaromatics, VOCs, SVOCs, and metals above RBSCs and/or BSCs in the overburden/shale groundwater, former DoD operations have impacted the groundwater at the LS.

Railcar Wash Area:

Upgradient (RCA-MW01):

- Aluminum was the only metal detected above RBSCs in the groundwater in upgradient monitoring well RCA-MW01, and it was detected above the BSC in only the unfiltered groundwater sample during the wet (May 2009) season sampling season.

- No groundwater samples were collected during the dry sampling season due to insufficient groundwater.

Source Area (RCA-MW02)

- Nitroaromatics 2,4-DNT, 2,6-DNT, and 2-NT were detected above RBSCs during the wet (May 2009) season sampling event, while 2-NT was the only nitroaromatic detected above the RBSC during the dry season.

- Four metals were detected above the RBSCs and two were detected above the BSCs in the unfiltered groundwater sample from well RCA-MW02. Cobalt and manganese were above the RBSCs in the wet season and nickel was detected above the BSC. Chromium, cobalt, iron, and manganese were above the RBSC during the dry season and aluminum, iron, and nickel were above the BSC. Filtered metals cobalt and manganese were above the RBSC during both sampling events while only nickel was above the BSC during the wet sampling season. Iron was the only metal to exceed both the RBSC and BSC, and it was detected in the filtered sample during the dry season.

Downgradient (RCA-MW03)

- One VOC (dibromochloromethane) was detected above the RBSC in downgradient well RCA-MW03 during the wet season sampling event.

- Three metals (chromium, cobalt and nickel) were detected above the RBSC and three metals (aluminum, iron, and nickel) were detected above the BSC in the unfiltered groundwater sample during the dry sampling season (November 2009).

Based on the presence of nitroaromatics, VOCs, and metals above RBSCs and/or BSCs in the overburden/shale groundwater, former DoD operations have impacted the groundwater at the RCA.

Limestone Bedrock Groundwater Sample Summary. Three groundwater samples were collected during the wet season month of May 2009, and two groundwater samples were collected during the dry season month of November 2009. The findings are summarized as follows:

Locomotive Shop:

Upgradient Well (IT-MNTA-BEDGW-001)

- Six VOCs exceeded RBSCs and four exceeded BSCs during the wet and dry season sampling events from upgradient bedrock well IT-MNTA-BEDGW-001. Petroleum hydrocarbon-related compounds ethylbenzene and total xylenes were above RBSCs and BSCs during both sampling events. Also, benzene was above the RBSC and BSC during the dry season sampling, and toluene was above the BSC during both sampling events. Chloroform and methylene chloride were above the RBSCs during the wet season, and 1,1,2,2-tetrachloroethane was above the RBSC during the dry season.

- Two petroleum hydrocarbon-related SVOCs were detected above RBSCs during both sampling events: 2-methylnaphthalene and naphthalene.

- Manganese was the only metal compound that exceeded the RBSC screening level in upgradient monitoring well MNTA-BEDGW-001. It was detected in the unfiltered groundwater sample during the wet (May) season sampling event. Magnesium and potassium (essential human macronutrients) were detected above BSC screening levels during both sampling events.

Source Area (LBA-BEDGW-002)

- Six VOCs (benzene, ethylbenzene, toluene, tota1 xylenes, chloroform, and chloromethane) exceeded RBSCs and four VOCs (benzene, ethylbenzene, toluene, and tota1 xylenes) exceeded BSCs during the wet season sampling event from bedrock well LBA-BEDGW-002.

- Two petroleum hydrocarbon-related SVOCs were detected above RBSCs during both sampling events: 2-methylnaphthalene and naphthalene.

- Seven metal compounds were detected above RBSCs and nine were detected above BSCs during the wet season sampling event. Metals above both the RBSC and BSC in both the unfiltered and filtered sample included arsenic and manganese. Barium was above the RBSC in both groundwater samples, while only iron was above the RBSC in only the unfiltered groundwater. Essential human macronutrients calcium and magnesium exceeded BSCs in both the unfiltered and filtered groundwater samples.

- No groundwater sample could be collected from the source area well LBA-BEDGW-002 during the dry sampling season due to insufficient groundwater.

Downgradient (LBA-BEDGW-001)

- No groundwater samples could be collected from the downgradient bedrock well LBA-BEDGW-001 during either the wet or dry season due to insufficient groundwater.

Petroleum-related organics (VOCs and SVOCs) and metals above the RBSCs and/or BSCs naturally occur in the Delaware Limestone groundwater and are attributed to petroleum hydrocarbons and reducing conditions present in this hydrogeologic unit (Section 2.4.1). The presence of these compounds at the LBA is interpreted to be related to the naturally occurring petroleum hydrocarbons and reducing conditions and not related to former DoD operations at the site.

Railcar Wash Area:

Upgradient (RCA-BEDGW-001):

- No groundwater samples could be collected from the upgradient bedrock well during either the wet or dry season due to insufficient groundwater.

Source Area (RCA-BEDGW-002)

- Four VOCs exceeded RBSCs and four exceeded BSCs in source area well RCA-BEDGW-002. The petroleum hydrocarbon-related compounds benzene, ethylbenzene, and total xylenes were above RBSCs and BSCs and toluene exceeded only the BSC during both the wet and dry season sampling events. The VOC 1,1,2,2-tetrachloroethane was also above the RBSC during the wet season.

- The petroleum hydrocarbon-related SVOC naphthalene was above RBSCs during both season sampling events.

- Four metal compounds were detected above RBSCs and six were detected above BSCs during the wet and dry season sampling events from source area well RCA-BEDGW-002. Arsenic was above both the RBSC and BSC in both the unfiltered and filtered samples, and manganese was above only the RBSC in both samples during both sampling events. The essential human macronutrient magnesium exceeded BSCs in both the unfiltered and filtered groundwater samples during both events, while calcium exceeded the BSC in the unfiltered samples and the filtered sample only during the dry season sampling.

- Total cyanide was detected above the RBSC during the wet season (May 2009) sampling.

Downgradient (RCA-BEDGW-003)

- No groundwater samples could be collected from the downgradient bedrock well RCA-BEDGW-003 during either the wet or dry season due to insufficient groundwater.

Petroleum-related organics (VOCs and SVOCs) and metals above the RBSCs and/or BSCs naturally occur in the Delaware Limestone groundwater and are attributed to petroleum hydrocarbons and reducing conditions present in this hydrogeologic unit (Section 2.4.1). The presence of these compounds at the LBA is interpreted to be related to the naturally occurring petroleum hydrocarbons and reducing conditions and not related to former DoD operations at the site.

Surface Water Summary. A total of nine surface water samples were collected from the LBA. These include seven surface water samples (two of the seven are a QC field duplicate and QA field split sample) collected from the drainage ditch between the LS and RCA, one surface water sample from the incoming, small drainage ditch, and one sample from a clay tile possibly draining the sump of the former RCA. The findings from LBA surface water are summarized as follows:

- No nitroaromatics, SVOCs, or PCBs were detected in any of the surface water samples.
- No VOCs were detected above RBSC values.
- Metals detected above the RBSC values include the following six analytes (number of RBSC exceedance in parentheses): arsenic (one), chromium (seven), cobalt (one), iron (one), lead (one), and manganese (six). The elevated metals are likely in part the result of degradation of culverts beneath Maintenance Road. This is suspected because with the exception of manganese, the maximum detected concentration (MDC) of metals was detected in swales found below the culvert outfall for Maintenance Road.
- Hardness was measured at a concentration of 464,000 ppb.

Based upon minimal to no chemical detections, the surface water appears not to have been impacted by former DoD activities.

Sediment Summary. A total of eight sediment samples were collocated with eight surface water sample locations at the LBA (no sediment sample was collected below the clay drainage tile where surface water sample LBA-SW07 was collected). This includes five sediment samples collected from the drainage ditch between the LS and RCA and three samples (two are a QC

field duplicate and QA field split sample) from the incoming, small drainage ditch. The findings from LBA sediment are summarized as follows:

- No nitroaromatics or PCBs were detected in any of the sediment samples.
- No VOCs or SVOCs were detected above RBSC values in the sediment samples from the drainage ditch between the LS and RCA.
- Metals detected above the RBSCs include the following four analytes (number of RBSC exceedance in parenthesis): arsenic (eight), chromium (eight), cobalt (three), and manganese (two). These elevated concentrations of metals can be attributed to degradation of the culverts and are probably not related to former DoD activities at the site.
- TOC was found to be 15,000 ppm.

Based upon minimal to no chemical detections, the sediment appears not to have been impacted by former DoD activities.

3.3 Baseline Human Health Risk Assessment

This section provides a summary of the LS and RCA evaluation in the GMA (LBA) BHHRA report (Shaw, 2011a), which is included as Appendix B. Analytical data from samples collected in LS and RCA media were grouped together and evaluated as a single LBA exposure unit for the BHHRA. It is important to note that this site-specific risk assessment, including the evaluation of future land use and groundwater use, was performed to satisfy administrative requirements. All data and other information presented in this section have been previously presented in the full BHHRA and/or SCR (Appendix A) reports. This BHHRA is consistent with EPA guidance and the procedures established in the BHHRA for TNT Area A (TNTA) and TNT Area C (TNTC) soil (IT, 2001b), the BHHRA for groundwater at PBOW (Shaw, 2006), and the GMA (LBA) work plan (Shaw, 2010b).

3.3.1 Identification of Chemicals of Potential Concern

A screening process is used to identify chemicals of potential concern (COPC), which are the detected chemical analytes carried through the full risk assessment process. The objectives of COPC screening are to focus the risk assessment on those chemicals that may contribute significantly to overall risk and to remove from quantification those chemicals whose contribution is clearly inconsequential. COPC screening includes a risk-based screen which also considers status as a human nutrient, a frequency-of-detection evaluation, and a background screen (Appendix B). EPA 2010 Regional Screening Levels (RSL) (EPA, 2010) were used for the risk-based screen.

The COPCs for each of the LBA media are identified as follows:

- ***Surface Soil*** – Chromium, Aroclor 1221, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and 2,4-DNT
- ***Subsurface Soil*** –Aluminum, vanadium, 2,4-DNT, 2,6-DNT, 2-NT, and 3-NT
- ***Total Soil*** **–** Aluminum, chromium, vanadium, Aroclor 1221, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, 2,4-DNT, 2,6-DNT, 2-NT, and 3-NT
- ***Maintenance Pit Material*** – Benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene
- ***Bedrock Groundwater*** – Arsenic, iron, manganese, thallium, 2-methylnapthalene, naphthalene, benzene, chloroform, chloromethane, ethylbenzene, methylene chloride, 1,2,2,2-tetrachloroethane, toluene, xylenes, and cyanide
- ***Overburden Groundwater*** – Chromium, cobalt, iron, manganese, sulfate, 2,4-DNT, 2,6-DNT, 2-NT, 3-NT, 4-NT, carbon tetrachloride, dibromochloromethane, 1,1-dichloroethane, and trichloroethene
- ***Sediment*** – Arsenic, chromium, cobalt, manganese, and thallium
- ***Surface Water*** – Arsenic, chromium, cobalt, iron, lead, and manganese.

Summaries of the COPC screening process and identification are shown in Tables 3-7 through 3-14 for surface soil, subsurface soil, total soil, maintenance pit material, bedrock groundwater, overburden/shale groundwater, sediment, and surface water, respectively. As discussed in Appendix B, the total soil COPCs include all surface soil and subsurface soil COPCs. Maintenance pit material refers to backfill material and associated fines collected from the bottom of the maintenance pit within the Locomotive Building.

3.3.2 Exposure Assessment

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

The CSEM provides the basis for identifying and evaluating the potential risks to human health in the BHHRA. The CSEM (Figure 3-10) includes the receptors appropriate to all plausible site-use scenarios and the potential exposure pathways.

The receptors and pathways on Figure 3-10 reflect scenarios developed from information regarding site background and history, topography, climate, and demographics as presented by D&M (1997) and the sitewide groundwater investigation (IT, 1997b).

No current or future exposure to off-site residents is evaluated because off-site residents are serviced by municipal water from surface water sources. Although there are numerous private groundwater wells in the vicinity, including several within 1 mile of the facility boundary, none of these are used as a potable source.

Based on the investigations of other PBOW sites, natural hydrocarbons and hydrogen sulfide are known to be present within the bedrock limestone, and shale formation groundwater generally provides low yields and is of low quality. Consistent with these observations, the groundwater underlying the LBA provides low yield and is of naturally low quality (Section 2.4.1). However, the groundwater underlying the LBA was not summarily excluded for consideration as a tap water source because OEPA has maintained that an assumption of potable use should initially be made under baseline conditions where no prior use restrictions are in place. Therefore, the development of groundwater for hypothetical on-site residential and on-site worker use as tap water was evaluated for purposes of this BHHRA at the request of OEPA. Groundwater quality and use are discussed in greater detail in Section 2.4.1.

Exposure associated with the COPCs was evaluated using the following receptors. Each medium that is quantitatively evaluated for each receptor (provided that COPCs are identified for that medium) is listed in parentheses:

- Current groundskeeper (surface soil)
- Future groundskeeper (total soil, bedrock groundwater, and overburden groundwater)
- Future indoor worker (surface soil, subsurface soil [inhalation pathway only], bedrock groundwater, and overburden groundwater)
- Future/current construction worker (total soil, surface water, sediment, and maintenance pit material)

- Future on-site resident (total soil, surface water, sediment, bedrock groundwater, and overburden groundwater)
- Future hunter (surface soil)
- Future hunter's child (surface soil [venison pathway only]).

The resident was evaluated for noncancer hazards separately for the young child (ages 1 through 6 years) and adult life stages, and the noncancer hazard results are presented separately for the child and adult residents. Cancer risk results for the child and adult resident were evaluated based on a 30-year combined child/adult exposure duration and are presented as combined child/adult cancer risks.

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

3.3.3 Risk Characterization

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

3.3.3.1 Cancer Risk

The risk from exposure to potential chemical carcinogens is estimated as the probability of an individual developing cancer over a lifetime and is called the incremental lifetime cancer risk (ILCR). Total ILCRs in the range of 1E-6 to 1E-4 are regarded as acceptable (EPA, 1990); this range is referred to as the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) risk management range. Risks less than this range are regarded as negligible. A target cancer risk goal of 1E-5 was selected by the PBOW Project Delivery Team as a basis to consider remedial action. Use of this 1E-5 goal represents a departure from the Army's practice of generally using a cancer risk exceeding a value of 1E-4 (the upper end of the NCP risk management range) to trigger remedial action considerations.

3.3.3.2 Noncancer Effects of Chemicals

The hazards associated with noncancer effects of chemicals are evaluated by comparing an exposure level or intake with a chemical-specific chronic reference dose (RfD) as described in

the BHHRA (Appendix B). A hazard quotient (HQ) of 1 indicates that the estimated intake equals the RfD. If the HQ is greater than 1, there may be concern for potential adverse health effects. In the case of simultaneous exposure of a receptor to multiple chemicals, a hazard index (HI) is calculated as the sum of the HQs.

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

3.3.3.3 Risk Characterization Results

Cancer and noncancer risk characterization results were evaluated in the BHHRA for each LBA environmental medium and each receptor scenario using the methods summarized in Sections 3.3.3.1 and 3.3.3.2 and described in Appendix B.

Risk characterization for each receptor scenario that includes groundwater exposure was run separately for overburden/shale groundwater and limestone bedrock groundwater. The cancer risks and noncancer hazards for each receptor exposed to LBA media are shown in Table 3-15.

The overall HI and ILCR values are summarized in the following bullets; exceedances of PBOW cancer risk criteria (ILCR more than 1E-5) are shown as bold and exceedances of the noncancer hazard criterion (HI more than 1) or the NCP risk management range (1E-6 to 1E-4) are shown as bold italics:

- Current groundskeeper: ILCR = 9E-6; HI = 0.007
- Future groundskeeper – all pathways including bedrock groundwater use: ***ILCR = 1E-3; HI = 11***
- Future groundskeeper – all pathways including overburden groundwater use: **ILCR = 6E-5**; HI = 0.9
- Future groundskeeper – all pathways excluding groundwater use: ILCR = 8E-6; HI = 0.2
- Future indoor worker – all pathways including bedrock groundwater use: ***ILCR = 1E-3; HI = 11***

- Future indoor worker – all pathways including overburden groundwater use: **ILCR = 5E-5**; HI = 0.7

- Future indoor worker – all pathways excluding groundwater use: ILCR = 8E-7; HI = 0.002

- Current/future construction worker: ILCR = 1E-6; HI = 0.9

- Current/future construction worker – exposed to maintenance pit material: ILCR= 2E-7 ; HI= (NA; no noncarcinogenic COPCs identified)

- Hypothetical future resident – all pathways including bedrock groundwater use: ***ILCR = 8E-3***; ***child HI = 167***; ***adult HI = 72***

- Hypothetical future resident – all pathways including overburden groundwater use: ***ILCR = 2E-4***; ***child HI = 6***; ***adult HI = 2***

- Hypothetical future resident – all pathways excluding groundwater use: ILCR = 1E-5; child HI = 0.7; adult HI = 0.1

- Future hunter: ILCR = 2E-7; HI = 0.0003

- Future hunter's child: ILCR = 3E-12; HI = 0.0000003.

Further evaluation in the BHHRA uncertainty analysis (Appendix B) identified the concentrations of chromium present in soil as unrelated to former site operations. The total ILCR for the current and future groundskeeper would be 3E-06 for both scenarios if chromium were appropriately excluded.

3.3.4 BHHRA Conclusions

The ILCR of the LBA future groundskeeper, indoor worker, and resident that is hypothetically assumed to use bedrock groundwater as household tap water exceeds the NCP risk management range as well as the PBOW target cancer risk criterion. The HI values of these receptors, if assumed to use the bedrock groundwater as a potable source, also exceed the target criterion of 1, indicating that adverse human health risks cannot be regarded as unlikely to occur under these hypothetical scenarios. If overburden/shale groundwater is assumed to be the tap water source, the future groundskeeper and indoor worker have ILCR values that exceed the PBOW target cancer risk criterion, but not the NCP risk management range. The future resident exposed to overburden/shale groundwater has an ILCR that exceeds both the NCP risk management range as well as the PBOW target cancer risk criterion, and HI values that exceed the target criterion of 1. Cancer risks and noncancer hazards to all other potential LBA receptors evaluated under current or future land use are within or less than the NCP risk management range, less than the

target HI criterion, and less than the PBOW cancer risk criterion, indicating that cancer risks are at acceptable levels and adverse noncancer effects are unlikely to occur under potential current scenarios. These conclusions also apply to the future groundskeeper, indoor worker, and resident not assumed to use bedrock or overburden/shale groundwater. Note that even though the current groundskeeper is used to represent a maximum exposure under current potential land use (i.e., NASA control), only limited groundskeeping activities (mostly mowing around the Locomotive Building) are apparent in this area.

The risks associated with overburden and bedrock groundwater differ with respect to one another in that the overburden risks/hazards are mostly associated with apparent PBOW-related nitroaromatics compounds, whereas the bedrock groundwater risks/hazards are associated almost entirely with naturally occurring arsenic and petroleum-related compounds. Use of either the overburden/shale or bedrock groundwater is regarded as implausible because of insufficient yield. Additionally, the naturally poor quality of the bedrock groundwater and associated hydrogen sulfide off-gassing make it unsuitable as a potable source. Also, as discussed in Section 2.4.2, NASA has recently expressed intentions of placing institutional controls on the Plum Brook Station property that would prohibit the use of on-site groundwater in perpetuity.

In summary, exposure to LBA groundwater is regarded as implausible, but even if exposure to groundwater was a plausible scenario, the analytes driving the elevated risk and hazard are not related to former site activities.

3.4 Screening-Level Ecological Risk Assessment

This section provides a summary of the SLERA report for the LBA (Shaw, 2011b), which is included as Appendix C. As with the BHHRA (Section 3.3), analytical data from samples collected in LS and RCA media were grouped together and evaluated as a single LBA exposure unit for the SLERA. The SLERA was performed to satisfy project administrative requirements, including those described by FUDS regulations (USACE, 2004). All data and other information presented herein have been previously presented in the full LBA SLERA and/or SCR reports (Appendices C and A, respectively).

The goal of the SLERA was to evaluate and provide an estimate of current and future ecological hazard associated with exposure to potential releases to soil, surface water, and sediment from LBA. This summary provides an ecological site description, identifies chemicals of potential ecological concern (COPEC), identifies ecological receptors, characterizes exposure, characterizes ecological risks, and presents the conclusions of the SLERA.

The LBA SLERA is consistent with EPA guidance and with the procedures established in previous risk assessments performed at PBOW (e.g., the SLERA for TNTA and TNTC [IT, 2001c]) as well as the Garage Maintenance Area (Locomotive Building Area) work plan (Shaw, 2010c).

3.4.1 Ecological Site Description

This section summarizes the general discussion of site background and the area of concern, surface water resources, wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area was based on a compilation of existing ecological information and site reconnaissance activities discussed in Sections 3.4.1.1 and 3.4.1.2. Additional ecological site description is provided in Appendix C.

3.4.1.1 Site Background

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

The LBA is approximately 4 acres in size. The site exhibits very little topography and is nearly flat, with the only significant drop-off occurring at the banks of the unnamed ditch that separates the LS from the RCA.

3.4.1.2 Site Reconnaissance

Ecologists performed site visits to LBA on April 27, June 2, and September 9, 2009. These visits were performed at different times of year to identify early- and late-blooming plant species (especially any threatened or endangered species) and to identify migrating and nesting bird species. These site visits were also used to compile lists of other fauna observed at the site. No federally or state-listed species were observed. A full species list is presented in the SLERA (Appendix C).

Prior to arrival at PBOW, site personnel obtained maps and other relevant site information and determined the locations of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. The locations of known or potential contaminant sources

affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visit to evaluate the site for more subtle clues of potential effects from contaminant release. Information obtained during the reconnaissance trips was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area.

3.4.1.3 Surface Water

The unnamed ditch that is located between the LS and the RCA is the only water body present at the site (Figure 3-1). Water associated with precipitation events tends to pool throughout the site in localized shallow depressions and drains towards this ditch. This ditch is approximately 10 feet wide at the top, narrowing slightly towards the bottom of the ditch. When the ditch was observed during ecological site reconnaissance visits, less than 2 feet of water was present and no flow was observed.

3.4.1.4 Wetlands

According to the National Wetland Inventory (NWI) maps for the area (U.S. Fish and Wildlife Service, 2013), there are no designated wetlands at the LBA site. It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes (such as those present at PBOW), because minor depressions often contain isolated wetlands not easily identified through interpretation of aerial photographs (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps). It should also be noted that the NWI map classification may have been based on previous anthropogenic conditions.

In the period of time since the SLERA for this site was finalized, a wetland delineation effort at PBOW has been performed. This wetland study identified the surface ditch at the LBA as a perennial waterway and a Palustrine Scrub-Shrub linear wetland (ES, 2012). These wetlands are depicted on Figure 3-1. Although these wetlands do not currently have jurisdictional standing, they are considered sensitive habitats that are likely subject to the protection of applicable state and federal wetland regulations and statutes.

3.4.1.5 Vegetative Communities

Vegetative communities at the LBA were classified during the site reconnaissance trips (Figure 2-2 of Appendix C). The LBA contains primarily upland old field and shrub thickets. Small disturbed areas occur around the Locomotive Building and driveway. There is limited semiaquatic vegetation around the edges of the unnamed ditch. Small areas within the shrub thicket in the vicinity of the historical RCA have been cleared and disturbed for the installation

of monitoring wells. The majority of the area adjacent to the LS is mowed grass and upland field, and the area where the RCA was located consists primarily of upland old field/shrub thicket habitat. Denser shrub thickets are located adjacent to the unnamed ditch and in the southeast of the RCA. Vegetative stress attributable to chemicals was not observed at the LBA, and there was no evidence that significant ecological threats exist at the site. Based on site reconnaissance information, the LBA represents a small parcel of upland old field and shrub-thicket habitat that is capable of supporting ecological receptors.

3.4.1.6 Species Inventory

A total of 102 plant species were documented at the LBA during the early summer and fall vegetation surveys. Signs of 4 mammal species (opossum, cottontail rabbit, raccoon, and white-tailed deer) and 15 bird species were observed during spring and fall field reconnaissance. Thirteen of the 15 observed bird species were present during the breeding season and are presumed to be nesting at the site. No amphibian or reptile species were observed during the site reconnaissance. Although no fish were visually observed in the unnamed ditch at the LBA during the site reconnaissance, some of the smaller fish species are expected to be present.

No threatened or endangered species were identified at the LBA during the site reconnaissance visits. Also, a review of information on sensitive species at the PBOW facility provided by ODNR and from other wildlife inventories available for the installation did not indicate that threatened or endangered species are present at the site or likely to utilize the habitat at the LBA on a regular basis.

3.4.2 Identification of Chemicals of Potential Ecological Concern

A screening process was performed on the analytical data from the RI and SI to identify COPECs that may pose a threat to ecological receptors. These data include all soil samples collected to a depth of 6 feet, surface water samples, and sediment samples. Groundwater was excluded because exposure to this LBA medium is considered to be an incomplete pathway for ecological receptors. All sample locations evaluated in the SLERA are presented on Figure 3-1.

The COPEC selection process was performed to develop a subset of chemicals detected at the site that are not naturally occurring or associated with non-site-related sources. These chemicals may also be present at sufficient frequency, concentration, and location to pose a potential risk to ecological receptors. This selection process and the screening values used for COPEC selection are described in the SLERA (Appendix C). The results of the COPEC screening are presented in Tables 3-16 through 3-18 for soil, surface water, and sediment at the LBA. Ten chemicals were

identified as COPECs in soil, 11 were selected in surface water, and 5 were selected in sediment at the LBA.

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

3.4.3 Selection of Ecological Assessment Receptors

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

As part of this receptor selection process, site biota were organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds. Seven representative terrestrial receptor species are expected or possible in the area of the LBA based on the habitat present at the site and were selected as indicator species for the potential effects of COPECs. These indicator species represent two classes of vertebrate wildlife (mammals and birds); include a range of both body size and food habits; and include herbivores, omnivores, and carnivores. The seven terrestrial species selected include the deer mouse (small omnivorous mammal), short-tailed shrew (small insectivorous mammal), Eastern cottontail rabbit (medium-sized terrestrial herbivorous mammal), marsh wren (small insectivorous bird), raccoon (medium-sized omnivorous mammal), white-tailed deer (large herbivorous mammal), and red-tailed hawk (large carnivorous bird).

Exposure to aquatic organisms in the ditch is assumed to occur via direct exposure to contaminants in the water column and via prey exposed to contaminants in surface water and sediment. Potential uptake through the aquatic food chain is evaluated for the raccoon (also considered as a terrestrial receptor) and muskrat (medium-sized aquatic herbivorous mammal).

A terrestrial food web is presented on Figure 3-11, and an aquatic food web is presented on Figure 3-12. Many of the species evaluated, particularly the deer mouse, cottontail rabbit, short-tailed shrew, and marsh wren, have limited home ranges that make them particularly vulnerable to exposure from site contaminants. Further discussion of the selection of ecological receptors is provided in Appendix C.

3.4.4 Exposure Characterization

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Exposure to soil, surface water, and sediment was evaluated for the pertinent representative terrestrial and aquatic assessment receptors, as described in Appendix C. Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Further discussion of exposure routes is provided in Appendix C.

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

3.4.5 Risk Characterization

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

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

- EHQs are not measures of risk.
- EHQs are not population based.
- EHQs are not linearly scaled.
- EHQs are often produced that are unrealistically high and toxicologically impossible (e.g., estimated EHQs greater than 1,000).

- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to EHQ threshold exceedances.

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

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

Therefore, it should be understood that EHQs greater than 1 do not necessarily indicate that adverse ecological effects are occurring at the site or may occur in the future. Table 3-19 summarizes the EHQs for the seven evaluated terrestrial assessment receptors and two aquatic receptors, as presented in Section 5.1 of the SLERA (Appendix C). Only aluminum for the deer mouse and short-tailed shrew receptors and selenium for the muskrat receptor had EHQs greater than 1, when rounded. Aluminum was identified as a COPEC only in surface water, and selenium was identified as a COPEC in both surface water and sediment. The EHQs were very low; none of the NOAEL-based EHQs exceeded 2, and no LOAEL-based EHQs exceeded 1. Due to the conservative nature of the food chain evaluation, these EHQ exceedances are considered minor, and aluminum and selenium are considered to have a low potential for adverse effects. Also, as discussed in the SLERA (Appendix C), both aluminum and selenium are likely naturally occurring and/or associated with turbidity in the samples.

3.4.6 SLERA Conclusions

Only two COPECs (aluminum in surface water and selenium in surface water and sediment) had EHQs greater than 1, but all EHQs were below 5, and neither chemical had an EHQ exceeding 1 when the more realistic LOAEL TRV was used to calculate hazards. Aluminum in surface water appears to be associated with naturally occurring aluminum in soil and sediment that is suspended in particulates in the water column. Selenium was detected in sediment samples at concentrations that were only slightly higher than naturally occurring concentrations in soil. Therefore, the potential for adverse ecological impacts is considered to be very low at this site, and no chemicals are identified for further evaluation for protection of the environment at the LBA.

3.5 Maintenance Pit Investigation

A supplemental investigation was performed on the maintenance pit in the Locomotive Building to address concerns regarding contamination in the sump of the pit identified during the SI and RI activities. One of the soil samples collected during the 1999 SI (DP-01) consisted of crushed limestone and associated fines from the sump in the bottom of the maintenance pit in the Locomotive Building. The borehole from this sample was reported to have a strong petroleum odor, and the sample itself had high organic carbon content and exhibited strong matrix interference during analysis. A weathered petroleum odor was also encountered in soil boring SB-09, which was collected within 5 feet of DP-01from the maintenance pit during the 2009 RI activities. However, the sample results did not indicate the presence of elevated petroleum-related contamination. Therefore, it was assumed that the petroleum contamination is likely limited to the immediate vicinity of the sump itself, where SI sample DP-01 was collected. An additional investigation was performed in 2011 to determine the contents of the sump. The results of this investigation were presented in a memorandum to the USACE titled *Locomotive Building Area, Discussion of Maintenance Pit and Sump Analytical Results*. The memorandum is presented in full in Appendix J, and summarized in this subsection.

The maintenance pit in the Locomotive Building was built to allow maintenance personnel to work below locomotives and railcars during the operation of PBOW. The pit measures 60 feet long by 3 feet 8 inches wide and is 5 feet deep with a sump located in the center of the pit. NASA had previously backfilled the pit with loose stone and currently uses the building as a storage garage. To access the sample locations, the gravel was excavated and four samples were collected from within and beneath the maintenance pit. After sampling was performed, the pit and sump were cleaned and backfilled with clean gravel.

Two samples were collected from residual sludge within the pit (SB-01 and SB-02), one sample was collected from sludge within the sump (SB-03), and one sample was collected from a clay layer underneath the pit (SB-04). The following were observed based on the analytical results:

- Relatively high concentrations of polycyclic aromatic hydrocarbons (PAH) (more than 50 mg/kg combined PAHs) were detected in SB 01, and SB-03 (more than 80 mg/kg combined PAHs). PAHs were not detected in SB-04, which indicates that the PAHs did not migrate vertically downward.

- High PCB concentrations were detected in sump sample SB-03 (approximately 12 mg/kg combined PCBs). PCBs were not detected in SB-4, indicating that the PCBs did not migrate vertically downward.

- No nitroaromatics were detected in any of the samples, indicating that TNT-production-related wastes did not impact the maintenance pit materials.

- Metals in the three sludge samples were elevated as compared to background soils, but the metals concentrations of the SB-04 clay materials were generally consistent with those of PBOW background soil. This indicates that the metals did not migrate vertically downward through the clay.

- Several VOCs were detected in the sump sample SB-03, but all were less than residential soil screening concentrations. Three VOCs were present in SB-01 and one in SB-02. None were detected in the clay sample SB-04.

The presence of PAHs and PCBs is expected due to previous maintenance pit uses and activities. A gravel layer underlies the maintenance pit, and lateral migration of contamination could have occurred within this layer. However, this layer underlying the pit is very limited spatially (approximately 300 square feet). Analytical data from the clay layer sample (SB-04) indicate that no impacts have occurred under the gravel layer. Also, no exposure pathways to the material underlying the pit are present. The memorandum concluded that few, if any, risks are associated with the maintenance pit material due to the “non-soil” nature of the matrix, the lack of vertical migration to (or through) the clay layer, and the lack of VOCs at concentrations that could contribute to vapor intrusion concerns. Further, in subsequent discussions, NASA stated that closure sampling of site media is required for all building demolitions at PBOW and agreed to address any possible remaining contamination when the building is demolished to support an alternative use of the land (USACE, 2011). Therefore, no further investigation of the maintenance pit in the Locomotive Building to address human health or ecological risk concerns are necessary.

4.0 Former Sellite Area

This chapter provides a summary of the sampling, analyses, results, and evaluation of the environmental media associated with the Former Sellite Area (i.e., soil, overburden/shale groundwater, surface water, and sediment) that have been presented in the Former Sellite Area SCR (Appendix D), BHHRA (Appendix E), and SLERA (Appendix F). The reference for each of these documents is provided below:

- Shaw Environmental, Inc. (Shaw), 2013a, ***Final, Garage Maintenance Area (Former Sellite Area), Site Characterization Report, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** April.

- Shaw Environmental & Infrastructure, Inc. (Shaw), 2014a, ***Final, Baseline Human Health Risk Assessment, Garage Maintenance Area (Former Sellite Area), FUDS No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

- Shaw Environmental & Infrastructure, Inc. (Shaw), 2014b, ***Final, Screening-Level Ecological Risk Assessment, Garage Maintenance Area (Former Sellite Area), FUDS No. G05OH001825, Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

Please note that this chapter provides no data or other information that has not been previously presented in the SCR, BHHRA, or SLERA (Appendices D, E, and F, respectively).

4.1 Previous Investigation and Evaluation

In 1993, an investigation was conducted by the Morrison Knudsen Corporation (MK) covering a number of areas of concern, including the Former Sellite Area (MK, 1994). During this investigation, three surface soil samples (MK-SS-34, MK-SS-35, and MK-SS-36) were collected. The report states that “SS34, SS35, and SS36 were obtained from an area void of vegetation and covered with lumps of sulfur and coke just west of the intersection of Maintenance Road and the rail spur. Broken timbers were found that indicate that a wooden structure of some sort used to exist in this area” (MK, 1994).

Surface soil samples were analyzed for nitroaromatics, VOCs, SVOCs, and TAL metals. Two of these soil samples (MK-SS-34 and MK-SS-35) contained a total of six PAH compounds that exceeded their RSL (EPA, 2010). The detected PAH concentrations were:

- MK-SS-34: benzo(a)anthracene (220 ppb), benzo(b)pyrene (130 ppb), and benzo(b)fluoranthene (310 ppb)

- MK-SS-35: benzo(a)anthracene (920 ppb), benzo(b)pyrene (680 ppb), benzo(b)fluoranthene (2,400 ppb), chrysene (1,500 ppb), dibenzo(a,h)anthracene (91 ppb), and indeno(1,2,3-cd)pyrene (430 ppb).

No other analytes exceeded RSLs, and TAL metals did not exceed BSC values.

4.2 Site Characterization and Evaluation

This section summarizes the RI sampling of environmental media at the Former Sellite Area, the analytical results, and an evaluation of these results. Additional details are provided in the SCR (Appendix D).

4.2.1 Samples and Analyses

The RI samples were collected consistent with the site-specific QAPP (Shaw, 2008b) and site-specific sampling and analysis plan (Shaw, 2011c). Surface and subsurface soil samples at the Former Sellite Area were collected as part of the RI to identify any soil contamination related to operation of sellite manufacturing. Surface and subsurface soil sampling locations are shown on Figure 4-1.

Soil boring drilling included 27 surface borings and 15 subsurface borings. Generally, surface soil is defined as samples collected from within the interval of 0 to 1 foot bgs and subsurface soil is defined as samples collected from depths greater than 1 foot bgs per the RI work plan (Shaw, 2011c). No fill material was encountered during drilling, so all analytical surface soil samples were collected from a depth of 0 to 1 foot bgs followed by subsurface soil samples collected from 3 to 5 feet and 8 to 10 feet bgs.

Eight temporary piezometers were installed at the Former Sellite Area as described in the work plan. However, only seven temporary piezometers (FSB- PZ01, FSB-PZ02, FSB-PZ03, FSB-PZ04, FSB-PZ05, FSB-PZ06, and FSB-PZ07) yielded adequate groundwater volume for sampling (piezometer FSB-PZ07 did not produced enough water for the entire intended analysis).

Three overburden/shale groundwater monitoring wells (FSB-MW01, FSB -MW02, and FSB -MW03) were installed in the Former Sellite Area as directed by the work plan. The work plan was designed to install the overburden/shale wells in upgradient, source area, and downgradient groundwater locations. Placement of overburden/shale monitoring wells was based

on groundwater flow directions determined from newly installed piezometers. Limestone bedrock monitoring wells were not installed at the Former Sellite Area due to the limited detections of leachable/mobile constituents in the soil and overburden groundwater at the site and the anticipated excessive production of hydrogen sulfide during well installation, which would result in unsafe drilling and sampling conditions.

An unnamed drainage ditch, which originates southeast of the site, extends along the east, north, and west sides of the Former Sellite Area. Six surface water and sediment samples were collected in collocated locations from the unnamed drainage ditch.

During the initial RI activities at the Former Sellite Area three surface soil samples (FSB-SS11, FSB-SS12, and FSB-SS13) were collected from three barren areas and analyzed for TOC and pH. The results of the pH analysis identified soil pH values of 2.46, 2.40, and 2.28 standard units. Low soil pH levels may cause metals to mobilize in soil resulting in enhanced vertical migration through the soil column to groundwater. Low soil pH may also result in increased toxicity of metals to human and ecological receptors. To address potential concerns over these possible scenarios, a pH delineation of acidic soil was performed at the Former Sellite Area. Field activities were conducted based on a letter work plan prepared by Shaw (Shaw, 2012b).

Delineation of soil pH began with the collection of background soil samples from locations with similar soils, topography, and drainage to the Former Sellite Area. This included drainages west of the Sellite Area as well as locations in the vicinity of two former buildings at Waste Water Treatment Plant No. 1 and Waste Water Treatment Plant No. 2 that had surface soils that were previously disturbed by construction activities, similar to the Former Sellite Area. Figure 4-2 shows the locations of the background pH sampling. A total of 32 background samples were collected. Background pH readings were taken only from surface soil (0 to 0.5 foot bgs).

The pH delineation at the Former Sellite Area was done in two phases. Phase I consisted of sampling a 40-foot by 40-foot grid across the entire site to determine the initial areas of low soil pH (Figure 4-3). A total of 117 surface soil samples (0 to 0.5 foot bgs) were collected at the grid nodes with a clean hand trowel. After interpreting the Phase I data, Phase II soil pH readings were taken from areas that showed pH values below the expected background pH. Phase II readings were taken on a finer (10-foot by 10-foot or 20-foot by 20-foot) grid scale and included more locations within the barren areas and provided greater definition of the extent of low-pH soil. Sixty-nine soil samples were collected for pH analysis (Figure 4-4). In addition, soil borings were completed at selected locations to determine the vertical extent of impacted soil and the potential for vertical leaching to groundwater. Eight hand auger borings were completed, with

pH measured at 1-foot intervals. The soil borings were advanced to 10 feet, auger refusal, or groundwater, whichever was encountered first. Subsurface pH sample locations are shown on Figure 4-5.

The following list summarizes the samples and analyses collected for the Former Sellite Area RI:

- ***Surface Soil*** – Seventeen samples, including 1 QC field duplicate and 1 QA field split sample, were analyzed for nitroaromatics, VOCs, SVOCs, PCBs, and TAL metals, and one sample was analyzed for TOC. Three surface soil samples were also analyzed only for TOC while 28 additional samples were collected, including 2 QC field duplicate and 2 QA field split samples, which were analyzed for PCBs only.

- ***Subsurface Soil*** – Thirty-six samples, including three QC field duplicate and three QA field split samples, from within depth intervals of 3 to 5 and 8 to 10 feet were analyzed for nitroaromatics, VOCs, SVOCs, TAL metals, and PCBs. Due to the low mobility of PCBs in soil, samples collected from the 8 to 10 feet bgs interval were not analyzed for PCBs.

- ***Overburden/Shale Piezometers*** – Nine groundwater samples, including one QC field duplicate sample and one QA field split sample, were analyzed for nitroaromatics, SVOCs, TAL metals (filtered and unfiltered), hardness, cyanide, and general chemistry parameters; field tests were also conducted. Insufficient water volume in piezometer FSB-PZ07 allowed only the analysis of nitroaromatics and SVOCs. Groundwater yield from piezometer FSB-PZ08 was insufficient for sample collection.

- ***Overburden/Shale Monitoring Wells*** – A total of five groundwater samples (including one QC field duplicate and one QA field split sample) were collected during each of the December 2011 (dry season) and April 2012 (wet season) sampling events from monitoring wells FSB-MW01, FSB-MW02 and FSB-MW03. Groundwater samples were analyzed for nitroaromatics, VOCs, SVOCs, TAL metals (filtered and unfiltered), and general chemistry parameters; field tests were also conducted.

- ***Surface Water*** – Six samples were collocated with the sediment samples in the unnamed drainage ditch which begins southeast of the site and traverses the east, north, and west sides of the Former Sellite Area. Samples were analyzed for nitroaromatics, SVOCs, and TAL metals. In addition, one sample was analyzed for hardness.

- ***Sediment –*** Six samples were collocated with the surface water samples in the unnamed drainage ditch. Sediment samples were analyzed for nitroaromatics, SVOCs, PCBs, and TAL metals. One selected sample was also analyzed for TOC.

pH Delineation

- ***Surface Soil*** – Including the 32 background soil samples, a total of 186 surface soil samples were collected and measured in the field for pH. Upon completion, 20 surface soil samples were submitted to the laboratory for analysis of pH.

- ***Subsurface Soil*** – pH data were collected from a total of 46 subsurface soil samples. These samples were collected at 1-foot intervals from eight hand auger borings that were completed to depths ranging from 4 to 10 feet bgs.

All analytical data from these samples were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the EPA *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA, 2008) and 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 the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project DQOs. The criteria for blank evaluation were based on those detailed in *Region 3 Modifications to National Functional Guidelines for Evaluating Organic Analyses* (EPA, 1994) and *Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, 1993). Additional information on data evaluation, data validation, and data quality are provided in the SCR and information attached therein (Appendix D).

4.2.2 Physical Characteristics

4.2.2.1 Local Soils

At the Former Sellite Area, no fill sand was encountered during drilling of any of the soil borings, and the topography and surface debris (slag and sulfur) suggest the area has remained relatively unchanged since the demolition of the surface structures (Shaw, 2012b).

Surface soil within the area of the Former Sellite building bounded by the perimeter access road was typical of other former sites at PBOW (e.g., Waste Water Treatment Plant No. 1, etc.). Surface soil found outside the perimeter road in the barren areas consisted of a dark brown to very dark grayish-brown silt with clay or sand that was moist and generally soft and contained organics. One small area along the east side of the site in the location of the sulfur storage bin contained a 0.5-foot-thick layer of slag, likely the remnants of site operations. In northern and eastern perimeter site areas, relatively large barren areas exist, with the surface soil consisting of

very dark grayish-brown silt with clay along with pieces of elemental sulfur present on the ground surface (Shaw, 2012b).

Native subsurface soil at the Former Sellite Area as determined by drilled borings was predominantly derived from glacial deposits (till, outwash, or glacial lacustrine [lake] deposits). In general, lithology of the upper 8 feet bgs of soil was yellowish-brown or dark grayish-brown silt with clay and sand. From approximately 8 to 23 feet bgs, soils generally consisted of gray, soft to medium-stiff clay with silt. Below approximately 23 feet bgs until refusal, soils were a stiff, dark gray clay with silt, sand, gravel, and shale fragments. Shale was encountered at an average depth of 26 feet bgs. Refusal was encountered in nine of the soil borings at an approximate average depth of 28 feet bgs (Shaw, 2012b).

4.2.2.2 Local Geology

Bedrock units encountered at the Former Sellite Area are of Devonian age and consist of the Plum Brook Shale (member of the Olentangy Shale) and the underlying Delaware Limestone. Shale was encountered during drilling of seven borings at an average depth of 26 feet. An average of 3 feet of weathered shale could be drilled prior to refusal by the Plum Brook Shale in seven of the nine borings (the refusal material was unknown in two of the borings). The average refusal depth within the shale was 28 feet bgs. The average elevation of the shale encountered equates to approximately 608 feet amsl. Seven borings, including the temporary piezometers and monitoring well borings, that were advanced into the shale bedrock recovered shale that was gray in color, hard, and highly weathered. No bedrock wells were drilled for this investigation, although three bedrock monitoring wells located approximately 530 feet east, 670 feet southeast, and 930 feet southeast of the Former Sellite Area did penetrate the Plum Brook Shale (monitoring wells GW-MW-13, AA1-BEDGW-004, and AA1-BEDGW-001, respectively). The average shale thickness encountered in those bedrock wells was approximately 12.5 feet. The shale thickness at the Former Sellite Area is anticipated to be somewhat thinner than in other areas because the shale thins and eventually pinches out approximately 3,200 feet to the northwest. The estimated elevation of the top of the underlying Delaware Limestone in this area is between 605 and 610 feet amsl, based on a top-of-limestone bedrock contour map presented in a previous study (Shaw, 2005). However, there is some uncertainty in this interpreted elevation given the lack of bedrock wells in the vicinity of the Former Sellite Area. Regardless, the data suggest that while present, the shale is relatively thin (less than approximately 12 feet) in this area.

4.2.2.3 Local Hydrogeology

Overburden/shale groundwater at the Former Sellite Area was encountered at depths ranging from 8 feet bgs (FSB-SB01/PZ01) to 24 feet bgs (FSB-SB14/PZ06) in May 2011 (wet season) during soil boring drilling/piezometer installation. Groundwater flow for July 2011 based on results from the piezometers was generally to the north but is influenced locally by topography and surface water discharge to the unnamed drainage ditch (Figure 4-6). Note that due to close proximity to the Former Sellite Area, groundwater elevation data for the Unloading Area piezometers are included on Figure 4-6 and pertinent water quality data are also discussed in this report as needed.

Three monitoring wells were installed in July based on July 2011 groundwater flow data collected from temporary piezometers. Monitoring well FSB-MW01 was installed upgradient (south) of the Former Sellite building. Monitoring well FSB-MW02 was installed within the source area based on highest detected concentrations of contamination in soil (primarily PCBs and lead). Note that potential contamination was not detected in appreciable concentrations in piezometer groundwater samples with the exception of FSB-PZ01, which had elevated concentrations of manganese greater than two times the BSC. Source area monitoring well FSB-MW02 is collocated with FSB-PZ01. Selection of the location for downgradient well FSB-MW03 was somewhat problematic in that groundwater flow away from the Former Sellite building occurs in a semiradial pattern to the west, north, and east. The location for FSB-MW03 was selected based on its relative position, not only to the Former Sellite building where elevated concentrations of PCBs were detected, but also a large barren area along the drainage ditch on the north side of the site. In addition, the downgradient well for the Unloading Area (ULA-MW03) was located based on apparent convergent flow, allowing it to monitor both the western portion of the Unloading Area and groundwater emanating from additional barren areas on the east side of the Former Sellite Area.

During monitoring well installation conducted in July 2011 (dry season), overburden/shale groundwater was encountered at depths of 10 (FSB-MW01) to 22 feet bgs (FSB-MW03). Figure 4-7 presents an overburden/shale groundwater potentiometric map of water levels taken October 11, 2011 (dry season) from both piezometers and overburden/shale monitoring wells. Groundwater flow during October 2011 was generally to the north. Figure 4-8 presents an overburden/shale groundwater potentiometric map of water level measurements taken March 14, 2012 (wet season) from the overburden/shale monitoring wells (piezometers were abandoned January 2012). The groundwater flow direction based on March 2012 measurements was also generally to the north. Overburden/shale groundwater flow from both contour maps indicates that it mimics the surface topography.

The installation of bedrock monitoring wells was contingent on analytical results from temporary piezometers and overburden/shale monitoring wells. Because of the limited detections of leachable/mobile constituents in the soil and groundwater at the site, no Delaware Limestone bedrock monitoring wells were installed at the Former Sellite Area. Review of both May 2010 (wet season) and August 2010 (dry season) regional bedrock groundwater flow maps were performed. Bedrock groundwater flow directions of both maps were in a north-northeast direction.

4.2.2.4 Local Surface Water

Surface water for the Former Sellite Area specifically drains into an unnamed ditch that begins in an area located southeast of the site. This ditch runs along the eastern and northern portions of the site, eventually traveling west and draining into Ransom Brook (Figure 4-1). Surface water from the site drains in a radial direction into the unnamed creek. Surface water in the unnamed ditch flows in a western direction following a precipitation event.

4.2.3 Summary of Analytical Results

The analytical results of the Former Sellite Area RI samples along with pH delineation data as described in Section 4.2.1 are summarized in this section. As part of this evaluation, analytes detected in the respective environmental media were compared to RBSCs and BSCs as points of reference only. Concentrations of analytes that exceed the RBSCs are highlighted in Tables 4-1 through 4-6 for the various environmental media. The derivation of RBSCs and BSCs is described in the Former Sellite Area BHHRA (Appendix E). RBSCs do not infer a regulatory limit or mandated cleanup level, nor is the identification of an exceedance intended to indicate an unacceptable human health risk or a need for remedial action. Formal evaluation of human health risks was performed in the Former Sellite Area BHHRA. Concentrations in individual samples that exceed the respective BSCs are identified by bold text in Tables 4-1 through 4-6. Sampling locations where RBSCs and/or BSC were exceeded are shown on Figures 4-9 through 4-11. Summaries of pH results in background, surface and subsurface field screening, and confirmation soil samples are shown in Tables 4-7 through 4-10.

The evaluation of the analytical results of the samples and analyses as well as a summary of the pH delineation as presented in the SCR is summarized below.

Surface and Subsurface Soil Summary. The findings from the Former Sellite Area surface and subsurface soil along with the pH measurement results are summarized as follows:

- No nitroaromatics were detected in any surface or subsurface soils.

- Three PCBs (Aroclor 1254, Aroclor 1260, and Aroclor 1268) were detected above their RBSCs in the surface soil (0 to 1 foot bgs): Aroclor 1254 detected in 25 samples, Aroclor 1260 detected in 25 samples, and Aroclor 1268 detected in 21 samples.

- One PCB (Aroclor 1254) was detected above the RBSC in the subsurface soil (3 to 5 feet bgs) sample from boring FSB-SB06 (sample FSB0024).

- No VOCs were detected above RBSCs in any surface or subsurface soil samples.

- One SVOC (benzo(a)pyrene) was detected above its RBSC in five surface soil samples.

- Five SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1, 2, 3-cd]pyrene) were detected above RBSCs in one subsurface soil (3 to 5 feet bgs) sample from boring FSB-SB06 (sample FSB0024).

- Five TAL metals (antimony, chromium, lead, mercury, and vanadium) were detected above both RBSC and BSC levels in surface soil samples: vanadium in sample FSB0010 (FSB-SB08) and antimony, chromium, lead, and mercury in sample FSB0011 (FSB-SB09).

- One TAL metal (aluminum) was detected above both RBSC and BSC levels in one subsurface soil sample (FSB0049) from soil boring FSB-SB13.

- TOC was measured at 0.81 ppm in the surface soil sample from FSB-SB01. In addition, TOC was also measured in surface soil samples FSB-SS11, FSB-SS12, and FSB-SS13, collected from barren areas within the Former Sellite Area, with concentrations of 2,310, 3,660, and 3,920 ppm, respectively. The TOC results for the barren area appear to be anomalous based on the general appearance of the soil (very dark grayish-brown silt with clay). Relative to other sitewide TOC data from similar industrial type settings (i.e., process buildings), the data appear to be above the expected range for TOC. It is noted that elevated TOC (up to 93,400 ppm) has been measured at the site, but these soils primarily are associated with organic soils at the red water ponds. It is suspected the acidic soil and/or high sulfur content may have interfered with the TOC sample analysis for the Former Sellite Area.

- Based on published data for Erie County soils and background data collected as part of this investigation, the surface soil pH readings were consistent (5.6 to 7.8 standard units [S.U.]) across much of the Former Sellite Area with those data. The exception to this was the barren area soils and soils within close proximity to the barren areas. Areas in close proximity to the barren areas had low pH readings (less than 5.6 S.U.). Typically, the lowest pH readings (1.13 to 2.5 S.U.) were identified near the center of each of the barren areas, with pH values trending upward moving toward the

perimeter of the barren areas. The vertical extent of low pH concentrations (less than 5.6 S.U.) in the barren areas ranged from 1 to 5 feet bgs, with an average depth of 3.5 feet bgs across all the borings. Soil pH values appear to have had no impact to the surface water as pH values were measured to be neutral and ranged from 7.18 to 7.63 S.U.

Based on the presence of PCBs and TAL metals in the soil, it is determined that former operations may have impacted the surface soil at the Former Sellite Area. In addition, the soil within the barren areas appears to have been impacted based on the pH delineation. The barren area soils appear to be residual material from burning of sulfur during sellite production. This residual material is likely from inorganic impurities entrained in the elemental sulfur.

Piezometer Overburden/Shale Groundwater Sample Summary. A total of nine groundwater samples were collected from seven of the eight temporary piezometers (total includes one QC field duplicate and one QA field split sample). Due to a groundwater recharge rate less than 50 milliliters per minute, no groundwater sample was collected from piezometer FSB-PZ08, and due to insufficient water volume in piezometer FSB-PZ07, only nitroaromatics and SVOCs could be analyzed. The major findings from the Former Sellite Area temporary piezometer groundwater samples are summarized as follows:

- No nitroaromatics, PCBs, VOCs, or SVOCs were detected in groundwater collected from temporary piezometers.
- Eighteen unfiltered metals were detected, but only four (aluminum, arsenic, iron, and manganese) exceeded both RBSCs and BSCs.
- Eleven filtered metals were detected, but only arsenic and manganese exceeded both their RBSCs and BSCs.
- Groundwater pH does not indicate appreciable impact from overlying acidic surface soils.

Based on the negative oxidation-reduction potential (ORP) measurements recorded at each of the seven temporary piezometers during groundwater sampling, groundwater reducing conditions are present. The reducing conditions may have resulted in dissolution of metals such as iron and manganese naturally present in the aquifer matrix.

Monitoring Well Overburden/Shale Groundwater Sample Summary. Five groundwater samples, including one QC field duplicate and one QA field split sample, were collected during the dry season month of December 2011, and five groundwater samples, including one QC field duplicate and QA field split sample, were collected during the wet season

month of April 2012. All samples collected in December 2011 and April 2012 were collected using the low-flow groundwater sample methodology. The major findings are summarized as follows:

Upgradient (FSB-MW01)

- One unfiltered metal (iron) was detected above both its RBSC and BSC during the April 2012 (wet season) sampling event.

Source Area (FSB -MW02)

- Manganese was detected above its RBSC and BSC in both the unfiltered and filtered metal samples during both the December 2011 (dry season) and April 2012 (wet season) sampling events.

Downgradient (FSB -MW03)

- One SVOC (bis[2-ethylhexyl]phthalate) exceeded its RBSC during both the December 2011 and April 2012 sampling events. However, the December 2011 result was "B" qualified, which indicates the chemical was also detected in the laboratory blank, and is unlikely to be site-related.

- Iron exceeded its RBSC and BSC in both the unfiltered and filtered metal samples during both the December 2011 and April 2012 sampling events. Arsenic and cobalt were detected above their RBSCs and BSCs in the April 2012 unfiltered metals sample.

- Groundwater pH does not indicate appreciable impact from overlying acidic surface soils.

Based on the negative ORP readings recorded at each of the monitoring wells during both the dry season (December 2011) and wet season (April 2012) sampling, groundwater reducing conditions are present in the overburden/shale water-bearing zone. The reducing conditions may have resulted in dissolution of metals such as iron and manganese naturally present in the aquifer matrix.

In addition, based on the few exceedances of RBSCs and/or BSCs, it appears that overburden/shale groundwater has been minimally impacted. The pH range of overburden/shale groundwater was within the normal range of 6.0 to 8.5 S.U. (Ohio Department of Health, 2012), with the exception of 8.72 S.U. in monitoring well FSB-MW03 during the December 2011 sampling event. Despite the low pH levels detected in and around the barren areas, only a few metals were detected in overburden/shale groundwater. The lack of many metals (filtered and unfiltered) in groundwater collected from piezometers and monitoring wells is likely due to the

fact that the low soil pH is only an issue in surface and shallow subsurface (less than 5 feet bgs) soils. Thus, leaching of metals due to the low soil pH levels was only possible in the surface and shallow subsurface soils and did not allow the metals to reach the groundwater.

Surface Water Summary. Eight surface water samples, including one QC field duplicate and one QA field split sample, were collected from the Former Sellite Area on January 9, 2012 from the unnamed drainage ditches located west, north, east, and southeast of the site. The findings of the surface water sampling are as follows:

- No nitroaromatics were detected in any surface water samples.
- One SVOC (bis[2-ethylhexyl]phthalate) was detected and exceeded its RBSC in FSB-SW01 and FSB-SW02 samples.
- Nineteen TAL metals were detected, but only six (aluminum, arsenic, cobalt, iron, lead, and manganese) exceeded RBSCs.
- Surface water pH values ranged from 7.18 to 7.63 S.U. and do not indicate an appreciable impact from nearby acidic soils.

Based on the few exceedances of RBSCs and/or BSCs, it appears that surface water has been minimally impacted. The pH range of surface water was within the normal range of 6.5 to 8.5 S.U. (Ohio Department of Health, 2012).

Sediment Summary. Eight sediment samples, including one QC field duplicate and one QA field split sample, were collected from the unnamed drainage ditches located west, north, east, and southeast of the Former Sellite Area. The findings of the sediment sampling are as follows:

- Nitroaromatics were not detected in any of the sediment samples.
- Two PCBs (Aroclor 1260 and Aroclor 1268) were detected in seven sediment samples, but one sample (FSB1008) exhibited Aroclor 1260 and Aroclor 1268 above RBSCs.
- Nineteen TAL metals were detected, but none exceeded both RBSCs and BSCs.
- Seventeen SVOCs were detected, with five SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1, 2, 3-cd]pyrene) exceeding RBSCs.
- TOC was detected at a concentration of 3.5 ppm.

Based on the few exceedances of RBSCs and/or BSCs, it appears that sediment has been minimally impacted. A small area of the ditch sediments appear to be minimally impacted by the acidic soils from the barren areas, with the soil pH being slightly depressed.

4.3 Baseline Human Health Risk Assessment

This section provides a summary of the Former Sellite Area BHHRA report (Shaw, 2014a), which is included as Appendix E. This site-specific risk assessment, including the evaluation of future land use and groundwater use, was performed to satisfy administrative requirements. All data and other information presented in this section have been previously presented in the full BHHRA and/or SCR (Appendix D) reports. This BHHRA is consistent with EPA guidance and with the procedures established in the BHHRA for TNTA and TNTC soil (IT, 2001b), the BHHRA for groundwater at PBOW (Shaw, 2006) and the Garage Maintenance Area work plan (Shaw, 2013c).

4.3.1 Identification of Chemicals of Potential Concern

A screening process is used to identify COPCs, which are the detected chemical analytes carried through the full risk assessment process. The objectives of COPC screening are to focus the risk assessment on those chemicals that may contribute significantly to overall risk and to remove from quantification those chemicals whose contribution is clearly inconsequential. COPC screening includes a risk-based screen which also considers status as a human nutrient, a frequency-of-detection evaluation, and a background screen (Appendix E). 2013 EPA RBSCs (EPA, 2013) were used for the risk-based screen.

The COPCs for each of the Former Sellite Area media are identified as follows:

- ***Surface Soil*** – Antimony, chromium, lead, vanadium, Aroclor 1254, Aroclor 1260, Aroclor 1268, and benzo(a)pyrene
- ***Subsurface Soil*** – Aluminum and Aroclor 1254
- ***Total Soil*** – Aluminum, antimony, chromium, vanadium, Aroclor 1254, Aroclor 1260, Aroclor 1268, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene
- ***Overburden Groundwater*** – Antimony, arsenic, cadmium, chromium, cobalt, iron, manganese, selenium, thallium, vanadium, and sulfate
- ***Sediment*** – Arsenic, chromium, Aroclor 1260, Aroclor 1268, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, carbazole, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene

- ***Surface Water*** – Arsenic, chromium, cobalt, iron, lead, and manganese.

A summary of the COPC screening process and identification is shown in Tables 4-11 through 4-16 for surface soil, subsurface soil, total soil, overburden/shale groundwater, sediment, and surface water. As discussed in Section 4.2.1, no bedrock monitoring wells were installed due to limited detections of leachable/mobile constituents detected in the soil and overburden groundwater at the site.

4.3.2 Exposure Assessment

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

The CSEM provides the basis for identifying and evaluating the potential risks to human health in the BHHRA. The CSEM (Figure 4-12) includes the receptors appropriate to all plausible site-use scenarios and the potential exposure pathways.

The receptors and pathways on Figure 4-12 reflect scenarios developed from information regarding site background and history, topography, climate, and demographics as presented by D&M (1997), and the sitewide groundwater investigation (IT, 1997b).

No current or future exposure to off-site residents is evaluated because off-site residents are serviced by municipal water from surface water sources. Although there are numerous private groundwater wells in the vicinity, including several within 1 mile of the facility boundary, none of these are used as a potable source.

Based on the investigations of other PBOW sites, natural hydrocarbons and hydrogen sulfide are known to be present within the bedrock limestone, and shale formation groundwater generally provides low yields and is of low quality. Consistent with these observations, the groundwater underlying the Former Sellite Area provides low yield and is of naturally low quality (Section 4.2.1). However, the groundwater underlying the Former Sellite Area was not summarily excluded for consideration as a tap water source because OEPA has maintained that an assumption of potable use should initially be made under baseline conditions where no prior use restrictions are in place. Therefore, the development of groundwater for hypothetical on-site residential and on-site worker use as tap water was evaluated for purposes of this BHHRA at the request of OEPA. Groundwater quality and use are discussed in greater detail in Section 2.4.1.

Exposure associated with the COPCs was evaluated using the following receptors. Each medium that is quantitatively evaluated for each receptor (provided that COPCs are identified for that medium) is listed in parentheses:

- Current groundskeeper (surface soil)
- Future groundskeeper (total soil and overburden groundwater)
- Indoor worker (surface soil and overburden groundwater)
- Current/future construction worker (total soil, surface water, and sediment)
- Hypothetical future site resident (total soil, surface water, sediment, and overburden groundwater)
- Future hunter (surface soil, including the venison pathway)
- Future hunter's child (surface soil [venison pathway only]).

The resident was evaluated for noncancer hazards separately for the young child (ages 1 through 6 years) and adult life stages, and the noncancer hazard results are presented separately for the child and adult residents. Cancer risk results for the child and adult resident were evaluated based on a 30-year combined child/adult exposure duration and are presented as combined child/adult cancer risks.

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

4.3.3 Risk Characterization

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

4.3.3.1 Cancer Risk

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

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

4.3.3.2 Noncancer Effects of Chemicals

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

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

4.3.3.3 Risk Characterization Results

Cancer and noncancer risk characterization results were evaluated in the BHHRA for each Former Sellite Area environmental medium and each receptor scenario using the methods summarized in Sections 4.3.3.1 and 4.3.3.2 and described in Appendix E.

Risk characterization for each receptor scenario that includes groundwater exposure was run separately for overburden/shale groundwater and limestone bedrock groundwater. The cancer risks and noncancer hazards for each receptor exposed to Former Sellite Area media are shown in Table 4-17.

The overall HI and ILCR values are summarized in the following bullets; exceedances of PBOW cancer risk criteria (ILCR more than 1E-5) are shown as bold and exceedances of the noncancer hazard criterion (HI more than 1) or the NCP risk management range (1E-6 to 1E-4) are shown as bold italics:

- Current groundskeeper: **ILCR = 6E-5** (attributed primarily to Aroclor 1260 and Aroclor 1268); HI = 0.3
- Future groundskeeper: ***ILCR = 2E-4***; ***HI = 6***
- Future groundskeeper excluding groundwater: **ILCR = 4E-5** (attributed to Aroclor 1254, Aroclor 1260 and Aroclor 1268); HI = 0.3
- Future indoor worker: ***ILCR = 2E-4; HI = 6***
- Future indoor worker excluding groundwater: ILCR = 1E-5; HI = 0.07
- Construction worker: ILCR = 3E-6; HI = 1
- Hypothetical future resident: ***ILCR = 8E-4***; ***child HI = 42; adult HI = 17***
- Hypothetical future resident excluding groundwater: **ILCR = 1E-4** (attributed to Aroclor 1254, Aroclor 1260 and Aroclor 1268 in total soil); ***child HI = 2*** (attributed to Aroclor 1254); adult HI = 0.3
- Future hunter: ILCR = 3E-6; HI = 0.01
- Future hunter's child: ILCR = 3E-09; HI = 0.0001.

The ILCR values that exceed the PBOW cancer risk and noncancer hazard criteria and are not associated with groundwater use are attributed to PCBs and benzo(a)pyrene.

4.3.4 BHHRA Conclusions

The ILCR value for the current and future groundskeeper exposure scenarios exceed the PBOW cancer risk goal. Note that no groundskeeping appears to have occurred at the Former Sellite Area in recent years, except occasional mowing. Thus, the current groundskeeper scenario, which assumes a full-time, 25-year employee who works exclusively at the Former Sellite Area for 8 hours per day, 250 days per year, appears to greatly overestimate the exposure levels of any current on-site worker or other current receptor.

The cancer risks associated with the following future receptors assumed to use overburden groundwater as a hypothetical source of tap water exceed the PBOW cancer risk goal and the upper value of the NCP risk management range: future groundskeeper, future indoor worker, and future resident. These receptors also exceed the target HI criterion of 1. However, the cancer risks and cancer hazards associated with overburden groundwater are nearly entirely attributable to natural arsenic, and the noncancer hazards are mostly due to metals that are consistent with natural background concentrations and do not appear to be related to former site activities. Further, use of the overburden groundwater is regarded as unlikely because of insufficient yield

of this hydrogeologic unit and also because of the readily available municipal water supply, which obviates the need for use of groundwater as a potential source of tap water in the general vicinity of PBOW. Also, as discussed in Section 2.4.2, NASA has recently expressed intentions of placing institutional controls on the Plum Brook Station property that would prohibit the use of on-site groundwater in perpetuity.

If the contributions of exposure to groundwater are appropriately excluded, only the ILCR for exposures to total soil in the future groundskeeper and hypothetical on-site resident scenario exceed the PBOW risk goal. These ILCRs are associated with potential ingestion and dermal contact with Aroclors and benzo(a)pyrene. The HI value for the on-site resident child exposure to total soil exceeds the PBOW HI goal and is associated with potential ingestion of Aroclors.

All cancer risk and noncancer hazard above PBOW criteria are associated with chemicals detected at the FSB-SB05, FSB-SS07, FSB-SB09, FSB-SB13, FSB-SS23, FSB-SS10, FSB-SS15, and FSB-MW03 locations, which are shown on Figure 4-1.

Risk-based remediation criteria (RBRC) were derived for Aroclors (PCBs) and benzo(a)pyrene in soil that may potentially warrant corrective action (Tables 4-18 through 4-20). Although an RBRC was also calculated for chromium in surface soil (Table 4-18), this metal was determined to be naturally occurring in the BHHRA (Appendix E). The RBRCs are not intended to serve as final cleanup criteria but represent a range of concentrations that are intended to support the development of remedial alternatives in the FS process.

4.4 Screening-Level Ecological Risk Assessment

This section provides a summary of the SLERA report for the Former Sellite Area (Shaw, 2014b), which is included as Appendix F. The SLERA was performed to satisfy project administrative requirements, including those described by FUDS regulations (USACE, 2004). All data and other information presented herein have been previously presented in the full Former Sellite Area SLERA and/or SCR reports (Appendices F and D, respectively).

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

The Former Sellite Area SLERA is consistent with EPA guidance and with the procedures established in previous risk assessments performed at PBOW (e.g., the SLERA for TNTA and TNTC [IT, 2001c]) as well as the Garage Maintenance Area work plan (Shaw, 2013c).

4.4.1 Ecological Site Description

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

4.4.1.1 Site Background

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

The Former Sellite Area is approximately 2 acres in size. The site exhibits very little topography and is nearly flat. Surface water from the Former Sellite Area drains into an unnamed ditch that begins southeast of the site and surrounds the site to the east, north, and west.

4.4.1.2 Site Reconnaissance

Ecologists performed site visits to Former Sellite Area on April 27, June 1, and September 1, 2011. These visits were performed at different times of year to identify early- and late-blooming plant species (especially any threatened or endangered species) and to identify migrating and nesting bird species. These site visits were also used to compile lists of other fauna observed at the site. No federally or state-listed species were observed. A full species list is presented in the SLERA (Appendix F).

Prior to arrival at PBOW, site personnel obtained maps and other relevant site information and determined the locations of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be

released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visit to evaluate the site for more subtle clues of potential effects from contaminant release. Information obtained during the reconnaissance trips was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area.

4.4.1.3 Surface Water

The unnamed ditch that borders the site to the east, north, and west contains water during and following rain events, but also is dry during dry weather patterns. This ditch is approximately 8 feet wide at the top and relatively shallow, with a maximum depth of approximately 3 feet below the bank elevation in the middle of the ditch. Surface water was present in the ditch during the RI sampling event, and surface water samples were collected. However, due to its ephemeral nature, the ditch does not have the habitat characteristics necessary for the establishment of permanent aquatic communities; therefore, it is considered a semiaquatic rather than aquatic habitat feature at the site.

4.4.1.4 Wetlands

According to the NWI maps for the area (U.S. Fish and Wildlife Service, 2013), there are no designated wetlands at the LBA site. It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes (such as those present at PBOW), because minor depressions often contain isolated wetlands not easily identified through interpretation of aerial photographs (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps). It should also be noted that the NWI map classification may have been based on previous anthropogenic conditions.

A wetland delineation effort recently performed at PBOW identified several wetlands at the Former Sellite Area. The study identified the surface ditch surrounding the Former Sellite Area as an ephemeral/intermittent waterway and a linear wetland. These wetlands are depicted on Figure 4-1. Two drainage areas north of the ditch were also identified as wetland areas (ES, 2012). Although these wetlands do not currently have jurisdictional standing, they are considered sensitive habitats that are likely subject to the protection of applicable state and federal wetland regulations and statutes.

4.4.1.5 Vegetative Communities

Vegetative communities at the Former Sellite Area were classified during the site reconnaissance trips (Figure 2-2 of Appendix F). The Former Sellite Area consists mostly of upland old field and shrub thicket habitat, with marsh and wet meadows present on either side of the ditch, and

upland old field habitat adjacent to Maintenance Road. During the site reconnaissance, the study area was examined for vegetative stress, which included looking for plants displaying stunted growth, poor foliage growth, tissue discoloration, and a loss of leaf coverage. Small, barren areas devoid of vegetation were observed that may be associated with former chemical contamination. These barren areas were approximately 110 to 2,410 square feet in size and partially covered by sand, ash, and/or slag. Sulfur was also often present in these barren areas. These barren areas were also observed in historical photographs of the Former Sellite Area and appear to be related to historical site operations.

4.4.1.6 Species Inventory

A total of 131 plant species were documented at the Former Sellite Area during the early summer and fall vegetation surveys. Signs of four mammal species (opossum, cottontail rabbit, raccoon, and white-tailed deer) and 18 bird species were observed during spring and fall field reconnaissance. Fifteen of the 18 observed bird species were present during the breeding season, and are presumed to be nesting at the site. No amphibian or reptile species were observed during the site reconnaissance. Due to the fact that the ditch at the Former Sellite Area only intermittently holds water, sustainable fish populations are unlikely to be present at the site.

No threatened or endangered species were identified at the Former Sellite Area during the site reconnaissance visits. Also, a review of information on sensitive species at the PBOW facility provided by ODNR and from other wildlife inventories available for the installation did not indicate that threatened or endangered species are present at the site, or likely to utilize the habitat at the Former Sellite Area on a regular basis.

4.4.2 Identification of Chemicals of Potential Ecological Concern

A screening process was performed on the analytical data from the RI and SI to identify COPECs that may pose a threat to ecological receptors. These data include all soil samples collected to a depth of 6 feet, surface water samples, and sediment samples. Groundwater was excluded because exposure to this Former Sellite Area medium is considered to be an incomplete pathway for ecological receptors. All sample locations evaluated in the SLERA are presented on Figure 4-1.

The COPEC selection process was performed to develop a subset of chemicals detected at the site that are not naturally occurring or associated with non-site-related sources. These chemicals may also be present at sufficient frequency, concentration, and location to pose a potential risk to ecological receptors. This selection process and the screening values used for COPEC selection are described in the SLERA (Appendix F). The results of the COPEC screening are presented in

Tables 4-21 through 4-23 for soil, surface water, and sediment at the Former Sellite Area. Nine COPECs were selected in total soil, 13 were selected in surface water, and 16 were selected in sediment at the Former Sellite Area.

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

4.4.3 Selection of Ecological Assessment Receptors

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

As part of this receptor selection process, site biota were organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds. Seven representative terrestrial receptor species that are expected or possible in the area of the Former Sellite Area based on the habitat present at the site, and were selected as indicator species for the potential effects of COPECs. These indicator species represent two classes of vertebrate wildlife (mammals and birds); include a range of both body size and food habits; and include herbivores, omnivores, and carnivores. The seven terrestrial species selected include the deer mouse (small omnivorous mammal), short-tailed shrew (small insectivorous mammal), Eastern cottontail rabbit (medium-sized terrestrial herbivorous mammal), marsh wren (small insectivorous bird), raccoon (medium-sized omnivorous mammal), white-tailed deer (large herbivorous mammal), and red-tailed hawk (large carnivorous bird). A terrestrial food web is presented on Figure 4-13. Many of the species evaluated, particularly the deer mouse, cottontail rabbit, short-tailed shrew, and marsh wren, have limited home ranges that make them particularly vulnerable to exposure from site contaminants. Further discussion of the selection of ecological receptors is provided in Appendix F.

Based on observations made during the site reconnaissance visits and using remote sensing technology, this ditch that traverses the perimeter of the area where the former sellite building stood appears to only be filled with water periodically, such as following significant rain events. Therefore, exposure pathways are not complete for aquatic receptors under normal conditions, and no aquatic receptors are selected for further evaluation. One semiaquatic species is evaluated (raccoon) because the raccoon would likely forage in the ditch surrounding the Former Sellite

Area. Although benthic organisms are unlikely to inhabit the soil/sediment within the ditch, this exposure route is assumed to be complete for the raccoon, and its ingestion of invertebrates inhabiting the soil/sediment is the primary reason for the inclusion of this receptor. A separate aquatic conceptual site model is not developed for this SLERA because true aquatic habitat does not exist at the site.

4.4.4 Exposure Characterization

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Exposure to soil, surface water, and sediment was evaluated for the pertinent representative terrestrial and semiaquatic assessment receptors, as described in Appendix F.

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

4.4.5 Risk Characterization

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

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

- EHQs are not measures of risk.
- EHQs are not population based.
- EHQs are not linearly scaled.

- EHQs are often produced that are unrealistically high and toxicologically impossible (e.g., estimated EHQs greater than 1,000).

- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to EHQ threshold exceedances.

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

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

Therefore, it should be understood that EHQs greater than 1 do not necessarily indicate that adverse ecological effects are occurring at the site or may occur in the future. Table 4-24 summarizes the EHQs for the seven evaluated terrestrial assessment receptors and one semi-aquatic receptor, as presented in Section 5.1 of the SLERA (Appendix F). Aluminum in surface water and cadmium in soil had EHQs that exceeded 1 for at least one receptor; however, their NOAEL-based EHQs did not exceed 10, and their LOAEL-based EHQs were all below 1. Therefore, these metals were assumed to have a low potential for toxicity. Lead in soil also contributed to EHQs that exceeded 1 for several receptors. The ingestion of terrestrial invertebrates that had bioaccumulated lead from soil was the most significant exposure pathway for these assessment receptors. Lead was detected in all 30 soil samples at concentrations ranging from 4.4 to 4,060 mg/kg (Table 4-21). The MDC of 4,060, detected in the 0 to 1 foot soil interval at location FSB-SB09, was more than an order of magnitude greater than the next highest concentration of 170 mg/kg at FSB-SB05. Aside from the MDC, only four other soil locations had lead concentrations that exceeded the BSC of 48.6 mg/kg: SB01 (57 mg/kg), SB04 (66.4 mg/kg), SB05 (170 mg/kg), and SB06 (63.4 mg/kg). All of these soil sample locations are within approximately 50 feet of SB09 (Figure 4-1). However, with the exception of the MDC at SB09, lead in the Former Sellite Area soil is not considered to be significantly elevated with respect to naturally occurring concentrations. If the SB09 hot spot is replaced with the BSC of 48.6 mg/kg, the resulting 95 percent upper confidence limit for lead in site soil is 48.8 mg/kg, which is essentially equal to the BSC. A revised EPC calculated using this replacement concentration for SB09 results in LOAEL-based HQs less than 1 for all receptors and NOAEL-based HQs less than 1 for all receptors except the marsh wren, which would have a NOAEL EHQ of 5.

Elevated PCBs in soil and sediment also resulted in EHQs greater than 1 for several receptors. For the Aroclor congeners, NOAEL-based HQs exceeding 1 ranged from 4.91 to 658, and LOAEL-based HQs exceeding 1 ranged from 4.35 to 58.6. Approximately 95 percent of the hazard for the deer mouse, short-tailed shrew, and marsh wren, the three terrestrial receptors that had HQs greater than 1 using both the NOAEL- and LOAEL-based TRVs, was associated with ingestion of PCBs in terrestrial invertebrate prey items that had bioaccumulated PCBs into their tissues. Uptake of PCBs into terrestrial invertebrates was not based on site-specific empirical data in this SLERA; rather, it was calculated using a model that estimates the partitioning of the chemical into the lipids of the invertebrates from the organic carbon fraction in the surrounding soil. The use of uptake factors that are not based on empirical and/or site-specific data results in substantial uncertainty in the food chain model results.

PCBs in soil were detected at multiple locations at concentrations exceeding their ecological screening values. The following table lists the soil sample locations where Aroclor 1254, Aroclor 1260, and Aroclor 1268 were identified at three different concentration ranges: 1) up to 10 times the ecological screening value of 0.37 mg/kg (i.e., from 0.37 to 3.7 mg/kg), 2) from 3.7 to 10 mg/kg, and 3) at concentrations greater than 10 mg/kg.

PCB	PCB Concentration (mg/kg)		
	0.37 to 3.7	**3.7 to 10**	**> 10**
Aroclor 1254	SS27, SB06, SS08, SS24, SS04, SS06, SS25, SS14, SS09, SS18, SS02	SS20, SB04, SS05, SB01, SB09, SB05, SS10, SS07	SS07
Aroclor 1260	SS08, SS27, SS24, SS09, SS06, SS25, SS04, SS03, SS15, SB04	SS18, SS20, SS01, SS14, SB05, SS02, SB01	SS10, SS23, SS05, SB09, SS07
Aroclor 1268	SB15, SS04, SS24, SB05, SB01	SS10, SS02, SS16, SS14, SS03, SS05	SS01, SS18, SS15, SB09, SS07, SS23

Sample location SS07 contained the MDCs for Aroclor 1254 (12.1 mg/kg) and Aroclor 1260 (41.1 mg/kg), and sample location SS23 contained the MDC for Aroclor 1268 of 95.85 mg/kg, which was nearly three times greater than the next highest concentration of this congener. These two sample locations are in close proximity to SB09, which was the soil sample location that had the hot spot for lead. SB09 also had PCB concentrations greater than 10 mg/kg for two of the three COPEC congeners (Aroclor 1260 and 1268). PCBs are bioaccumulative and highly toxic compounds, and their wide distribution at the Former Sellite Area is a concern for ecological receptors. PCBs are strongly lipophilic and tend to bind tightly to soil. The detection of several

of the congeners in sediment samples from the surrounding ditch suggest that soil-to-sediment transport pathways (e.g., overland runoff) may be occurring.

4.4.6 SLERA Conclusions

In general, concern regarding exposure to chemicals at the Former Sellite Area is relatively low for most ecological receptors because considerations such as the home range size and density characteristics of various species of concern make it unlikely that multiple individuals of a given species (i.e., local populations) would be exposed to media at the 2-acre Former Sellite Area site on a regular basis. However, the potential for adverse impacts to small-range receptors cannot be entirely discounted, as discussed in the following paragraphs.

The presence of lead and PCBs in soil (particularly in the vicinity of soil sample location SB09) at elevated concentrations does represent a potential threat to individual ecological receptors, and possibly to local populations of receptors with very small home ranges. The results of this SLERA indicate that localized impacts to terrestrial receptors that are nonmobile or have limited mobility (e.g., plants and terrestrial invertebrates) and to receptors with small home ranges (e.g., rodents and small songbirds) cannot be completely discounted. Further, there is potential for lipophilic contaminants that are present on site (i.e., PCBs) to accumulate in the tissues of small mammals and birds that may then be ingested as prey items by off-site predators. In other words, prey items may act as vectors for contamination to reach higher trophic level organisms off site. The small size of the site compared to the relatively large home range of most predatory organisms reduces the concern for potential impacts to upper trophic level organisms, however, as a vast majority of prey consumed by even a single predator would likely have had little or no exposure to the Former Sellite Area.

Acidic soil conditions were also observed at the site, and the lowest soil pH levels occurred at the barren areas, with pH levels of 1 to 2 S.U. occurring near the center of the bare patches of soil and gradually increasing to normal (i.e., background) conditions away from the barren areas (Figure 4-14). Low pH in soils can result in increased bioavailability, toxicity, and mobility of soil contaminants, particularly metals. Soil samples from the barren areas were also analyzed for chemical contaminants, and elevated concentrations of most COPECs did not coincide with the barren areas. In general, the elevated concentrations of significant COPECs (i.e., lead and PCBs) occurred within the boundary of the former perimeter road, and the barren/low-pH areas were along or just outside of the former perimeter road.

In summary, although the small size of the site precludes the potential for adverse effects to most ecological receptors, the presence of elevated concentrations of lead and PCBs in soil may

present a hazard to some small range ecological receptors. Additionally, the low soil pH increases the potential for contaminants to be mobilized off site, and also increases the potential for toxicity of contaminants present at the site due to increased bioavailability of contaminants. Phytotoxicity associated with the highly acidic conditions is a likely cause of the lack of vegetation at the barren areas observed at the site.

5.0 Unloading Area

This chapter provides a summary of the sampling, analyses, results, and evaluation of the environmental media associated with the ULA (i.e., soil, overburden/shale groundwater, surface water, and sediment) that have been presented in the ULA SCR (Appendix G), BHHRA (Appendix H), and SLERA (Appendix I). The reference for each of these documents is provided below:

- Shaw Environmental, Inc. (Shaw), 2013b, ***Final, Garage Maintenance Area (Unloading Area), Site Characterization Report, FUDS Number G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** May.

- Shaw Environmental & Infrastructure, Inc. (Shaw), 2014c, ***Final, Garage Maintenance Area (Unloading Area), Baseline Human Health Risk Assessment, FUDS Project No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

- Shaw Environmental & Infrastructure, Inc. (Shaw), 2014d, ***Final, Screening-Level Ecological Risk Assessment, Garage Maintenance Area (Unloading Area), FUDS Project No. G05OH001825, Former Plum Brook Ordnance Works, Sandusky, Ohio,*** January.

In addition, results of the previous initial investigation of the ULA (MK, 1994) are briefly summarized in Section 5.1. Identification of the samples and the recommendations from the report present a context for the performance of the RI and for some of the specific sampling locations and analyses performed in the RI.

Please note that this chapter provides no data or other information that has not been previously presented in the ULA SCR, BHHRA, or SLERA (Appendices G, H, and I).

5.1 Previous Investigation and Evaluation

Prior to the RI, the following analytical samples were collected in 1993 as part of an investigation for the ULA, referred to as the Rail Car Unloading Area by MK for their investigation (MK, 1994):

- Two surface soil samples (MK-SS-15 and MK-SS-16)
- One subsurface soil sample from boring SB11.

All of the samples were analyzed for VOCs, PAHs, pesticides, PCBs, nitroaromatics, and metals. Four PAH compounds exceeded their 2010 EPA RSL (EPA, 2010) in the subsurface soil sample

from SB11: benzo(a)anthracene (260 micrograms per kilogram [µg/kg]), benzo(a)pyrene (230 µg/kg), benzo(b)fluoranthene (340 µg/kg), and dibenzo(a,h)anthracene (27 µg/kg). Only low levels of PAHs were reported in the two surface soil samples MK-SS-15 and MK-SS-16.

In addition, two existing overburden/shale monitoring wells, EB-GM04 and MK-MW19, may be associated with the ULA. Figure 5-1 shows the locations of the existing monitoring wells. Monitoring well EB-GM04 was installed by Ebasco Environmental in 1990 on the northeastern side of the ULA in support of the UST removals. The VOCs 1,1-dichloroethane, 1,1-dichloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, chloroethane, cis-1,2-dichloroethene, tetracholorethene, and trichloroethene were the only compounds detected in the groundwater sample (ICI, 1995).

Monitoring well MK-MW19 was installed in 1993 on the northeast edge of the ULA, south of the railroad track line (Figure 5-1). A groundwater sample from this well was analyzed for VOCs, PAHs, nitroaromatics, and metals. Two compounds were found above the 2012 RSLs (EPA, 2012b) and maximum contaminant levels (EPA, 2012a); 1-dichloroethane (18 µg/L) and 1,1,1-trichloroethane (360 µg/L). Also, aluminum, cobalt, iron, lead, nickel, and vanadium exceeded both RSLs and background in one or more unfiltered groundwater samples. Since metals were not detected above RSLs and background in any of the filtered samples, the exceedances in the unfiltered samples were likely the result of elevated turbidity. It was concluded that since the use of 1,1,1-trichloroethane post-dates PBOW activities, the presence of 1,1,1-trichloroethane in the groundwater is likely associated with the UST installed in 1964, after PBOW closure (ICI, 1995).

Based on the findings of the SCR, groundwater flow in the ULA is to the north. Although overburden/shale well MK-MW19 is downgradient of the ULA, it is suspected that the groundwater contamination in well MK-MW19 is related to the former USTs or some other upgradient or crossgradient source (Shaw, 2013b).

This RI report addresses the concerns raised by the MK evaluation. The MK results are summarized in the SCR (Appendix G) and were further evaluated in the BHHRA (Appendix H) and SLERA (Appendix I) together with the RI analytical results.

5.2 Site Characterization and Evaluation

This section summarizes the RI sampling of environmental media at the ULA, the analytical results, and an evaluation of these results. Additional details are provided in the SCR (Appendix G).

5.2.1 Samples and Analyses

The RI samples were collected consistent with the site-specific QAPP (Shaw, 2008b) and work plan for the ULA (Shaw, 2011c). Soil, groundwater, surface water, and sediment sampling locations are shown on Figure 5-1.

Surface and subsurface soil samples at the ULA were collected as part of the RI from a total of 12 soil borings. Generally, surface soil is defined as samples collected from within the interval of 0 to 1 foot bgs, and subsurface soil is defined as samples collected from depths greater than 1 foot bgs per the RI work plan (Shaw, 2011c). At the ULA, no fill material was encountered at the surface, so soil samples were collected from 0 to 1, 3 to 5, and 8 to 10 feet bgs.

Eight temporary piezometers were installed at the ULA as described in the work plan. To aid in the placement of the overburden/shale monitoring wells and determine the quantity and quality of groundwater, samples were collected from all eight temporary piezometers (ULA-SB01/PZ01, ULA-SB04/PZ02, ULA-SB11/PZ03, ULA-SB02/PZ04, ULA-PZ05, ULA-PZ06, ULA-PZ07, and ULA-PZ08). However, only one piezometer (ULA-PZ04) yielded adequate groundwater for all intended analytical parameters.

Three overburden/shale groundwater monitoring wells (ULA-MW01, ULA-MW02, and ULA-MW03) were installed in the ULA as directed by the work plan. The approach described in the work plan included the installation of overburden/shale wells in upgradient, source area, and downgradient groundwater locations. Placement of overburden/shale monitoring wells was based primarily on groundwater flow directions determined from newly installed piezometers. In addition, since two other wells existed on the eastern portion of the site (EB-GM04 and MK-MW19) that showed some impact from non-DoD activities, locations were biased to the west-central portion of this site. The location of downgradient well (ULA-MW03) was selected in an area of groundwater convergence that receives groundwater flow from the ULA as well as barren areas in the eastern portion of the Former Sellite Area.

The following list summarizes the samples and analyses collected for the ULA RI:

- ***Surface Soil*** –Fourteen samples, including one QC field duplicate sample and one QA field split sample, were analyzed for nitroaromatics, VOCs, SVOCs, and TAL metals. In addition, soil samples from 0 to 1 and 3 to 5 feet bgs were analyzed for PCBs. One selected 0 to 1 foot bgs sample was also analyzed for TOC.

- ***Subsurface Soil*** – Fourteen samples, including one QC field duplicate and one QA field split sample, from within an overall depth interval of 3 to 5 feet bgs were analyzed for nitroaromatics, VOCs, SVOCs, PCBs, TAL metals. Sixteen samples, including two QC field duplicate sample and two QA field split samples from within a depth interval of 8 to 10 feet, were analyzed for nitroaromatics, VOCs, SVOCs, and TAL metals.

- ***Overburden/Shale Piezometers*** – Due to limited available water in the temporary piezometers, only piezometer ULA-PZ04 along with the associated matrix spike and matrix spike duplicate sample was able to be sampled for all the intended analytical parameters. The analytes included nitroaromatics, VOCs, SVOCs, PCBs, metals (unfiltered and filtered), and water quality parameters including alkalinity, chloride, cyanide, hardness, nitrate/nitrite, sulfate, total dissolved solids, total suspended solids, and turbidity. Piezometers ULA-PZ03, ULA-PZ07, and ULA-PZ08 samples were analyzed for only nitroaromatics, VOCs, and SVOCs. Piezometers ULA-PZ01 (sample ULA3000), ULA-PZ02, and ULA-PZ06 samples were analyzed for VOCs and SVOCs. Samples ULA3001 and ULA3002 from piezometer ULA-PZ01 were analyzed for only VOCs. Piezometer ULA-PZ05 (sample ULA3006) was analyzed for VOCs, SVOCs, filtered metals, total metals, and hardness.

- ***Overburden/Shale Monitoring Wells*** – A total of five groundwater samples, which includes one QC field duplicate and one QA field split sample, were collected during the dry season of December 2011. During the wet season of May 2012, five groundwater samples, which include one QC field duplicate and one QA field split sample, were again able to be collected. Overburden/shale monitoring well groundwater samples were analyzed for nitroaromatics, VOCs, SVOCs, metals (filtered and unfiltered), and water quality parameters (alkalinity, chloride, cyanide, hardness, nitrate/nitrite, sulfate, total dissolved solids, total suspended solids, turbidity, ferrous iron, and ORP).

All analytical data from these samples were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the EPA *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA, 2008) and 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 the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project DQOs. The criteria for blank evaluation were based on those detailed in *Region 3 Modifications to National Functional Guidelines for Evaluating Organic Analyses* (EPA, 1994) and *Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, 1993). Additional information on data evaluation, data validation, and data quality are provided in the SCR and information attached therein (Appendix G).

5.2.2 Physical Characteristics

5.2.2.1 Local Soils

At the ULA, no fill sand was encountered during drilling of the soil borings. The lack of fill sand was expected because a review of historical documentation indicated there were no former buildings in this area.

Native soil at the ULA as found in the 19 soil borings drilled (including soil borings, piezometers, and monitoring wells) consisted of a glacial till, glacial outwash, or glacial lacustrine (lake) deposit. In general, lithology of the upper 6 feet of the soil borings consisted of yellowish-brown, soft silt with clay and sand. From approximately 6 to 20 feet bgs, soils generally consisted of a gray, soft to medium stiff, clay with silt. Below approximately 20 feet bgs until refusal, stiff, dark gray clay with silt, sand, gravel, and shale fragments was encountered. Refusal was encountered in four of the soil borings at an approximate depth of 28 feet. Refusal was believed to be caused by competent shale based on weathered shale recovered in many of the deepest soil samples.

5.2.2.2 Local Geology

Bedrock units in the ULA consist of the Plum Brook Shale (member of the Olentangy Shale), and the underlying Delaware Limestone, both of Devonian age. As determined by cuttings recovered from four soil borings, weathered Plum Brook Shale was encountered during drilling at an average depth of 25 feet bgs. Four borings were advanced into the shale until refusal at an average depth of 28 feet. The elevation of the shale encountered equates to approximately 611 feet amsl. Four borings from the temporary piezometers and monitoring well borings that were advanced into the weathered bedrock found the shale gray in color, hard, and highly weathered. No bedrock wells were drilled for this investigation, although bedrock monitoring wells located approximately 530 feet east, 670 feet southeast, and 930 feet southeast of the ULA (monitoring wells GW-MW-13, AA1-BEDGW-004 and AA1-BEDGW-001, respectively) did penetrate the Plum Brook Shale. The average shale thickness encountered in those bedrock wells was approximately 12.5 feet. The shale thickness at the ULA is anticipated to be somewhat thinner than in these other areas since the shale thins and eventually pinches out approximately 3,200 feet to the northwest. The estimated elevation of the top of the underlying Delaware Limestone in this area is between 605 and 610 feet amsl based on a top of limestone bedrock contour map presented in a previous study (Shaw, 2005). However, there is some uncertainty in this interpreted elevation given the lack of bedrock wells in the vicinity of the ULA. Regardless, the

data suggest that where present, the shale is relatively thin (less than approximately 12 feet) in this area.

5.2.2.3 Local Hydrogeology

Overburden/shale groundwater at the ULA was encountered at depths ranging from 14.0 feet bgs (ULA-SB02/PZ04) to 22.3 feet bgs (ULA-PZ07) in May 2011 (wet season) during soil boring drilling/piezometer installation. Based on water level elevations from the temporary piezometers in July 2011, groundwater flow is generally to the north-northwest (Figure 5-2). During monitoring well installation conducted in July 2011 (dry season), overburden/shale groundwater was encountered at depths of 0.8 foot bgs (ULA-MW02) to 8.4 feet bgs (ULA-MW03). Figure 5-3 presents an overburden/shale groundwater potentiometric map of water level measurements taken on October 11, 2011 (dry season) from the piezometers and overburden/shale monitoring wells. Groundwater flow direction based on October 2011 measurements was generally to the northwest. Figure 5-4 presents an overburden/shale groundwater potentiometric map of water level measurements taken on March 14, 2012 (wet season) from the overburden/shale monitoring wells (piezometers were abandoned January 2012). In the ULA, the groundwater flow direction based on March 2012 measurements was to the northwest. Overburden/shale groundwater flow from all three contour maps indicates that it mimics the surface topography.

Since no bedrock wells were installed in the ULA, sitewide (regional) Delaware Limestone groundwater flow maps were constructed. Bedrock groundwater flow during the wet season (May 2010) and dry season (August 2010) both indicate flow to be in a north-northeast direction.

5.2.2.4 Local Surface Water

Surface water for the ULA drains into an unnamed ditch located southwest of the site. This ditch runs along the western portion of the site and flows in a westerly direction eventually into Ransom Brook (Figure 5-1). Surface water in the unnamed ditch flows in a western direction following a precipitation event.

5.2.3 Summary of Analytical Results

The analytical results of the ULA RI samples described in Section 5.2.1 are summarized in this section. As part of this evaluation, analytes detected in the respective environmental media were compared to RBSCs and BSCs as points of reference only. Concentrations of analytes that exceed the RBSCs are highlighted in Tables 5-1 through 5-4 for the various environmental media. The derivation of RBSCs and BSCs is described in the ULA BHHRA (Appendix H). RBSCs do not infer a regulatory limit or mandated cleanup level, nor is the identification of an exceedance intended to indicate an unacceptable human health risk or a need for remedial action.

Formal evaluation of human health risks was performed in the ULA BHHRA. Concentrations in individual samples that exceed the respective BSCs are identified by bold text in Tables 5-1 through 5-4. Sampling locations where RBSCs and/or BSC were exceeded are shown on Figures 5-5 and 5-6.

The evaluation of the analytical results of the samples and analyses as presented in the SCR is summarized below.

Surface and Subsurface Soil Summary. The findings from the ULA surface and subsurface soil analytical results are summarized as follows:

- No nitroaromatics were detected in any surface or subsurface soils.
- No VOCs or PCBs were detected above RBSCs in any surface or subsurface soil samples.
- One SVOC compound (benzo[a]pyrene) was detected above the RBSC of 0.015 ppm in surface soil samples from borings ULA-SB05, ULA-SB11, and ULA-SB12.
- No SVOCs were detected above RBSCs in subsurface soil samples.
- No TAL metals were detected in surface or subsurface soil samples above RBSC and BSC levels.
- TOC was measured at 0.053 ppm in the surface soil sample from ULA-SB01.

Soil at the ULA does not appear to be impacted by site activities. The detections of one SVOC compound (benzo[a]pyrene) above RBSCs in soil borings ULA-SB11 and ULA-SB12 are likely due to road runoff, while the detection in soil boring ULA-SB05 is likely due to surface water runoff from the nearby railroad tracks.

Piezometer Overburden/Shale Groundwater Sample Summary. A total of 10 groundwater samples were collected from the eight temporary piezometers (total includes one QC field duplicate and one QA field split sample). Due to limited groundwater recharge during sampling, only groundwater from ULA-PZ04 could be analyzed for the complete analytical set. The samples from the remaining piezometers were analyzed for VOCs (the main suspected chemical of concern at the site) and if possible, additional analyses. The major findings from the ULA temporary piezometer groundwater samples are summarized as follows:

- No nitroaromatics, PCBs, SVOCs were detected in groundwater collected from temporary piezometers.

- No VOCs were detected above RBSCs in piezometer overburden/shale groundwater samples.

- Unfiltered metals that exceeded both the RBSCs and BSCs included aluminum, arsenic, iron, and manganese in two piezometers (ULA-PZ04 and ULA-PZ05).

- Only manganese exceeded both the RBSC and BSC in filtered samples in one piezometer (ULA-PZ05).

Monitoring Well Overburden/Shale Groundwater Sample Summary. Five groundwater samples, including one QC field duplicate and one QA field split sample, were collected during the dry season month of December 2011, and five groundwater samples, including one QC field duplicate and QA field split sample, were collected during the wet season months of April and May 2012. All samples collected in December 2011 and April 2012 were collected using the low-flow groundwater sample methodology. The major findings are summarized as follows:

Upgradient (ULA-MW01)

- No nitroaromatics were detected during either groundwater sampling event.

- No VOCs or SVOCs were detected above RBSCs during either sampling event.

- No unfiltered or filtered metals were detected above RBSCs and BSCs during either sampling event.

Source Area (ULA-MW02)

- No nitroaromatics, VOCs, or SVOCs were detected during either groundwater sampling event.

- One metal (iron) among the unfiltered samples was found above both its RBSC and BSC during both the wet and dry season sampling events. Iron was found at a concentration of 1,710 ppb during December 2011 and at a concentration of 3,640 ppb during April and May 2012. Iron is also the only metal found in the filtered samples at a concentration exceeding both the RBSC and BSC during the April-May 2012 sampling event. Iron was detected at a concentration of 3,270 ppb. Iron did not exceed either the BSC or RBSC in the filtered samples collected in December 2011.

Downgradient (ULA-MW03)

- No nitroaromatics were detected during either groundwater sampling event.

- No VOCs or SVOCs were detected above RBSCs during either sampling event.

- No unfiltered or filtered metals were detected above RBSCs and BSCs during either sampling event.

Groundwater does not appear to be impacted by site activities at the ULA. The limited detection of metals are likely naturally occurring based on the fact that metals were not detected at appreciable concentrations in surface and/or subsurface soil.

The fact that COPCs were not detected at the ULA suggests that the site was not used extensively to unload chemicals directly from the tanker cars to the area adjacent to the tracks. Rather, the ULA may have been used as a staging area where individual tanker cars were disconnected and moved by rail to deliver their contents directly to the three toluene storage tanks.

5.3 Baseline Human Health Risk Assessment

This section provides a summary of the Unloading Area BHHRA report (Shaw, 2014c), which is included as Appendix H. This site-specific risk assessment, including the evaluation of future land use and groundwater use, was performed to satisfy administrative requirements. All data and other information presented in this section have been previously presented in the full BHHRA and/or SCR (Appendix G) reports. This BHHRA is consistent with EPA guidance and with the procedures established in the BHHRA for TNTA and TNTC soil (IT, 2001b), the BHHRA for groundwater at PBOW (Shaw, 2006) and the Garage Maintenance Area work plan (Shaw, 2013c).

5.3.1 Identification of Chemicals of Potential Concern

A screening process is used to identify COPCs, which are the detected chemical analytes carried through the full risk assessment process. The objectives of COPC screening are to focus the risk assessment on those chemicals that may contribute significantly to overall risk and to remove from quantification those chemicals whose contribution is clearly inconsequential. COPC screening includes a risk-based screen which also considers status as a human nutrient, a frequency-of-detection evaluation, and a background screen (Appendix H). 2013 EPA RBSCs (EPA, 2013) were used for the risk-based screen.

The COPCs for each of the ULA media are identified as follows:

- ***Surface Soil*** – Benzo(a)pyrene

- ***Subsurface Soil*** – No COPCs identified
- ***Overburden Groundwater*** – Antimony, arsenic, chromium, cobalt, iron, and manganese.

A summary of the COPC screening process and identification is shown in Tables 5-5 through 5-7 for surface soil, subsurface soil, and overburden/shale groundwater. As discussed in Appendix H, a total soil COPC table showing the combined COPCs from a mixture of surface and subsurface soil is not presented because COPCs were only detected in the surface soil. Also, no bedrock monitoring wells were installed at the ULA. No surface water or sediment were evaluated, as the only water body present at the site is the unnamed ditch that separates the ULA from the Former Sellite Area, and potential human health risks and hazards associated with exposure to this ditch were calculated under the Former Sellite Area investigation (Section 4.3).

5.3.2 Exposure Assessment

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

The CSEM provides the basis for identifying and evaluating the potential risks to human health in the BHHRA. The CSEM (Figure 5-7) includes the receptors appropriate to all plausible site-use scenarios and the potential exposure pathways.

The receptors and pathways on Figure 5-7 reflect scenarios developed from information regarding site background and history, topography, climate, and demographics as presented by D&M (1997) and the sitewide groundwater investigation (IT, 1997b).

No current or future exposure to off-site residents is evaluated because off-site residents are serviced by municipal water from surface water sources. Although there are numerous private groundwater wells in the vicinity, including several within 1 mile of the facility boundary, none of these are used as a potable source.

Based on the investigations of other PBOW sites, natural hydrocarbons and hydrogen sulfide are known to be present within the bedrock limestone, and shale formation groundwater generally provides low yields and is of low quality. Consistent with these observations, the groundwater underlying the ULA provides low yield and is of naturally low quality. However, the groundwater underlying the ULA was not summarily excluded for consideration as a tap water

source because OEPA has maintained that an assumption of potable use should initially be made under baseline conditions where no prior use restrictions are in place. Therefore, the development of groundwater for hypothetical on-site residential and on-site worker use as tap water was evaluated for purposes of this BHHRA at the request of OEPA. Groundwater quality and use are discussed greater detail in Section 2.4.1.

Exposure associated with the COPCs was evaluated using the following receptors. Each medium that is quantitatively evaluated for each receptor (provided that COPCs are identified for that medium) is listed in parentheses:

- Current groundskeeper (surface soil)
- Future groundskeeper (overburden groundwater and total soil [surface soil])
- Indoor worker (overburden groundwater and total soil [surface soil])
- Construction worker (overburden groundwater and total soil [surface soil])
- On-site resident (overburden groundwater; noncancer hazards evaluated separately for the young child [ages 1 through 6 years] and adult, total soil [surface soil])
- Hunter (surface soil)
- Hunter's child (surface soil).

The resident was evaluated for noncancer hazards separately for the young child (ages 1 through 6 years) and adult life stages, and the noncancer hazard results are presented separately for the child and adult residents. Cancer risk results for the child and adult resident were evaluated based on a 30-year combined child/adult exposure duration and are presented as combined child/adult cancer risks.

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

5.3.3 Risk Characterization

Risk characterization is the process of applying numerical methods and professional judgment to determine the potential for adverse human health effects to result from the presence of COPCs. Noncancer hazards and cancer risks are characterized separately, including COPCs that induce

both types of effects. The equations and input values used to calculate cancer risks and noncancer hazards are included in Appendix H.

5.3.3.1 Cancer Risk

The risk from exposure to potential chemical carcinogens is estimated as the probability of an individual developing cancer over a lifetime and is called the ILCR. Total ILCRs in the range of 1E-6 to 1E-4 are regarded as acceptable (EPA, 1990); this range is referred to as the NCP risk management range. Risks less than this range are regarded as negligible. A target cancer risk goal of 1E-5 was selected by the PBOW Project Delivery Team as a basis to consider remedial action. Use of this 1E-5 goal represents a departure from the Army's practice of generally using a cancer risk exceeding a value of 1E-4 (the upper end of the NCP risk management range) to trigger remedial action considerations.

5.3.3.2 Noncancer Effects of Chemicals

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

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

5.3.3.3 Risk Characterization Results

Cancer and noncancer risk characterization results were evaluated in the BHHRA for each ULA environmental medium and each receptor scenario using the methods summarized in Sections 5.3.3.1 and 5.3.3.2 and described in Appendix H.

Risk characterization for each receptor scenario that includes groundwater exposure was run separately for overburden/shale groundwater and limestone bedrock groundwater. The cancer risks and noncancer hazards for each receptor exposed to ULA media are shown in Table 5-8.

The overall HI and ILCR values are summarized in the following bullets; exceedances of PBOW cancer risk criteria (ILCR more than 1E-5) are shown as bold and exceedances of the noncancer hazard criterion (HI more than 1) or the NCP risk management range (1E-6 to 1E-4) are shown as bold italics:

- Current groundskeeper: ILCR = 1E-7; HI = 0 (the COPC in soil is not associated with noncancer health effects).
- Future groundskeeper: **ILCR = 2E-5**; HI = 0.3.
- Future indoor worker: **ILCR = 2E-5**; HI = 0.3.
- Construction worker: ILCR = 6E-9; HI = 0 (the COPC in soil is not associated with noncancer health effects).
- Hypothetical future resident: **ILCR = 1E-4**; adult HI = 1; child HI calculated for target organs = 0.4 (heart), 0.9 (skin), 0.4 (thryroid), 0.2 (gastrointestinal tract), 0.4 (central nervous system). (The COPC in soil is not associated with noncancer health effects.)
- Hunter: ILCR = 8E-9; HI = 0 (the COPC in soil is not associated with noncancer health effects).
- Hunter's child: ILCR = 0; HI = 0 (the COPC in soil is not associated with noncancer health effects and does not accumulate in venison).

Further evaluation in the BHHRA (Appendix H) identified the concentrations of arsenic present in groundwater as unrelated to former site operations at the ULA. If background-related arsenic in groundwater is excluded, the ILCR for the future groundskeeper, future indoor worker, and hypothetical future resident are all below the PBOW risk criteria and NCP risk management range.

5.3.4 BHHRA Conclusions

The ILCR values for the future groundskeeper, future indoor worker, and hypothetical on-site resident initially exceeded the PBOW cancer risk criterion, but the exceedances were due to arsenic in groundwater, which appears to be naturally occurring (Appendix H). The estimated cancer risks for exposure to soil are below the PBOW cancer risk criterion for all scenarios.

The noncancer hazard estimates for future groundskeeper, future indoor worker, and hypothetical on-site resident are below the PBOW noncancer HI criterion with the exception of the HI estimate for the hypothetical on-site resident child. However, the target organ HI values for this

receptor are each below the target HI criterion. Thus, the estimated noncancer hazard estimates are below the PBOW criterion for all scenarios.

Use of the overburden groundwater is regarded as unlikely. Even though the monitoring wells appear to produce sufficient yield for potable use, this groundwater unit is seasonally dependent and spatially limited under most of PBOW, and the readily available municipal water supply obviates the need for use of groundwater as a potential source of tap water in the general vicinity of PBOW. Also, as discussed in Section 2.4.2, NASA has recently expressed intentions of placing institutional controls on the Plum Brook Station property that would prohibit the use of on-site groundwater in perpetuity.

Even if this groundwater unit were used as a source of potable water, the presence of arsenic, which drives the cancer risks associated with the groundwater pathways, appears to be unrelated to former PBOW operations. Also, the MDC of arsenic (5.8 µg/L) in ULA groundwater is less than the promulgated Safe Drinking Water Act Maximum Contaminant Level (10 µg/L) that is permissible for municipal tap water.

If the contributions of exposure to groundwater are appropriately excluded, no ILCR estimated for any scenario exceeds the PBOW risk goal of 1E-05. No receptor had HI values that exceed the noncancer hazard criterion (HI greater than 1). These results indicate that exposures to the environmental media at the ULA are unlikely to pose an unacceptable cancer risk or noncancer health effects to receptors.

5.4 Screening-Level Ecological Risk Assessment

This section provides a summary of the SLERA report for the ULA (Shaw, 2014b), which is included as Appendix I. The SLERA was performed to satisfy project administrative requirements, including those described by FUDS regulations (USACE, 2004). All data and other information presented herein have been previously presented in the full ULA SLERA and/or SCR reports (Appendices I and G, respectively).

The SLERA was performed to evaluate and provide an estimate of current and future ecological hazard associated with exposure to potential releases to soil from the ULA. This summary provides an ecological site description, identifies COPECs, identifies ecological receptors, characterizes exposure, characterizes ecological risks, and the conclusions of the SLERA. The ULA SLERA is consistent with EPA guidance and with the procedures established in previous risk assessments performed at PBOW (e.g., the SLERA for TNTA and TNTC [IT, 2001b]) as well as the Garage Maintenance Area work plan (Shaw, 2013c).

5.4.1 Ecological Site Description

This section summarizes the general discussion of site background and the area of concern, surface water resources, wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area was based on a compilation of existing ecological information and site reconnaissance activities discussed in Sections 5.4.1.1 and 5.4.1.2. Additional ecological site description is provided in Appendix I.

5.4.1.1 Site Background

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

The ULA is approximately 2.2 acres in size. The site exhibits very little topography, and is nearly flat. The area consists primarily of a former rail line with open areas to the north and south of the former bed. The site is bounded to the west by a drainage ditch and the Former Sellite Area and to the east by NASA maintenance buildings. Surface water from the Former Sellite Area drains into the unnamed ditch near the western edge of the site that originates south of the site.

5.4.1.2 Site Reconnaissance

Ecologists performed site visits to LBA on April 27, June 1, and September 1, 2011. These visits were performed at different times of year to identify early- and late-blooming plant species (especially any threatened or endangered species) and to identify migrating and nesting bird species. These site visits were also used to compile lists of other fauna observed at the site. No federally or state-listed species were observed. A full species list is presented in the SLERA (Appendix I).

Prior to arrival at PBOW, site personnel obtained maps and other relevant site information and determined the locations of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be

released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visit to evaluate the site for more subtle clues of potential effects from contaminant release. Information obtained during the reconnaissance trips was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area.

5.4.1.3 Surface Water

Due to the minimal topography at this site, surface water tends to pool in localized shallow depressions. The area as a whole drains to the unnamed ditch that borders the site to the west. This ditch is approximately 8 feet wide at the top and relatively shallow, with a maximum depth of approximately 3 feet below the bank elevation in the middle of the ditch. This ditch was previously evaluated in the Former Sellite Area investigation (Chapter 4.0). Therefore, it is not evaluated in the ULA SLERA.

5.4.1.4 Wetlands

According to the NWI maps for the area (U.S. Fish and Wildlife Service, 2013), there are no designated wetlands at the ULA site. It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes (such as those present at PBOW), because minor depressions often contain isolated wetlands not easily identified through interpretation of aerial photographs (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps). It should also be noted that the NWI map classification may have been based on previous anthropogenic conditions.

A wetland delineation effort recently performed at PBOW identified several wetlands at the ULA. These include two small, unconnected wetlands between Maintenance Road and the line of soil borings south of the former railroad, and some wetlands associated with the drainage ditch that forms the western border of the site (ES, 2012). These wetlands are depicted on Figure 5-1. Although these wetlands do not currently have jurisdictional standing, they are considered sensitive habitats that are likely subject to the protection of applicable state and federal wetland regulations and statutes.

5.4.1.5 Vegetative Communities

Vegetative communities at the ULA were classified during the site reconnaissance trips (Figure 2-2 of Appendix I). The ULA consists primarily of upland old field and shrub thicket habitat, with marsh and wet meadows present on either side of the ditch. Upland old field habitat that is periodically mowed is adjacent to Maintenance Road. During the site reconnaissance, the study area was examined for vegetative stress, which included looking for plants displaying stunted

growth, poor foliage growth, tissue discoloration, and a loss of leaf coverage. No areas of stressed vegetation were observed at the site.

5.4.1.6 Species Inventory

A total of 122 plant species were documented at the ULA during the early summer and fall vegetation surveys. Signs of four mammal species (opossum, cottontail rabbit, raccoon, and white-tailed deer) and 25 bird species were observed during spring and fall field reconnaissance. Fourteen of the 25 observed bird species were present during the breeding season and are presumed to be nesting at the site. No amphibian or reptile species were observed during the site reconnaissance.

No threatened or endangered species were identified at the ULA during the site reconnaissance visits. Also, a review of information on sensitive species at the PBOW facility provided by ODNR and from other wildlife inventories available for the installation did not indicate that threatened or endangered species are present at the site or likely to utilize the habitat at the ULA on a regular basis.

5.4.2 Identification of Chemicals of Potential Ecological Concern

A screening process was performed on the analytical data from the RI and SI to identify COPECs that may pose a threat to ecological receptors. These data include all soil samples collected to a depth of 6 feet. All sample locations evaluated in the SLERA are presented on Figure 5-1.

The COPEC selection process was performed to develop a subset of chemicals detected at the site that are not naturally occurring or associated with non-site-related sources. These chemicals may also be present at sufficient frequency, concentration, and location to pose a potential risk to ecological receptors. This selection process and the screening values used for COPEC selection are described in the SLERA (Appendix I). The results of the COPEC screening are presented in Table 5-9 for soil at the ULA. Cadmium was the only chemical selected as a COPEC in soil at the ULA. As described in greater detail in the SLERA (Appendix I), the very low detections of cadmium are not likely to be site-related, and are unlikely to result in adverse ecological impacts. Therefore, cadmium was not selected for additional evaluation in the SLERA.

5.4.3 SLERA Conclusions

In general, concern regarding exposure to chemicals at the ULA is very low for ecological receptors. Cadmium was the only COPEC identified in soil at the ULA, and low frequency of detection and detected concentrations of this metal resulted in the conclusion that no further

investigation was necessary. Also, the small size of the site further reduces any concern for ecological receptors, as the home range size and density characteristics of various species of concern make it unlikely that multiple individuals of a given species (i.e., local populations) would be exposed to the 2.2-acre site on a regular basis. Therefore, the potential for adverse ecological impacts is considered to be very low at this site, and no chemicals are identified for further evaluation for protection of the environment at the ULA.

6.0 DERP-FUDS Project No. G05OH001825 Recommendations

The purpose of the RI is to gather information concerning the site characteristics so that appropriate remedial alternatives may be developed in the FS. However, it is unnecessary to perform an FS if the BHHRA indicates that the human health risk goals are met under baseline conditions and the ecological risk assessment indicates a lack of adverse ecological effects (USACE, 2004; DoD, 2012). The recommendations for the three sites that comprise the DERP-FUDS Garage Maintenance Area (FUDS Project No. G05OH001825) site are provided in this chapter.

6.1 Recommendations for the Locomotive Building Area

The environmental media associated with the LBA appear to be adequately characterized (Section 3.2). The BHHRA (Section 3.3) and SLERA (Section 3.4) did not identify any chemicals of concern that require further evaluation or a remedial action for the protection of human or ecological receptors, respectively.

Based on the findings of the RI that media at the LBA pose no unacceptable risks or hazards to human health or the environment that are attributable to former DoD activities and no DoD-related chemical exceeds a chemical-specific applicable or relevant and appropriate requirement (ARAR) level, no further action is recommended at the LBA.

6.2 Recommendations for the Former Sellite Area

The environmental media associated with the Former Sellite Area appear to be adequately characterized (Section 4.2). The Former Sellite Area BHHRA (Section 4.3) found that DoD-related contaminants in soils resulted in exposure scenarios with ILCR values that exceed the PBOW cancer risk goal for the current and future groundskeeper and the adult resident. Also, the HI value for the child resident resulted in an exceedance of the PBOW noncancer hazard goal. The chemicals of concern are PCBs, known by their Aroclor designations. In addition, very low-pH soils resulting from former PBOW operations were identified as a human health contact hazard and an ecological stressor as evidenced by barren areas. Therefore, it is recommended that an FS be performed to address the PCB soil contamination and the acidic soil conditions. The basis for these recommendations is further discussed in the following paragraphs.

The Former Sellite Area BHHRA shows that the ILCR and HI values exceed the respective PBOW cancer risk and/or noncancer hazard goals for several receptors that are hypothetically exposed to Former Sellite Area media, including groundwater. However, because of the poor

groundwater quality and low yield in vicinity of the Former Sellite Area combined with a readily available municipal water source, significant use of groundwater is implausible at the PBOW facility. If the contributions of exposure to groundwater are appropriately excluded, only the ILCR for exposures to DoD-related contaminants in surface soil for the current groundskeeper (ILCR=5E-5) and to DoD-related contaminants in total soil for the future groundskeeper (ILCR=4E-5) and hypothetical on-site resident scenarios (1E-4) exceed the PBOW risk goal of 1E-5. No scenarios exceed the NCP cancer risk management range of 1E-6 to 1E-4. These ILCRs are nearly entirely associated with potential ingestion and dermal contact with Aroclors in soils. Also, the HI value (HI=2) associated with exposure by the on-site resident child exposure to Aroclor 1254 in total soil exceeds the PBOW HI goal.

RBRCs were calculated for chromium in surface soil; Aroclors in surface soil, total soil, and sediment; and benzo(a)pyrene in total soil. Chromium is not recommended for further consideration because the BHHRA determined that chromium in the Former Sellite Area soil is consistent with natural background concentrations. Benzo(a)pyrene is also not recommended for further action, as it is likely not present as in Former Sellite Area Soil as the result of a DoD-related release. A recent public health study for eastern Sandusky County, in the vicinity of Clyde, Ohio (Ohio Department of Health, 2011) showed background PAH concentrations that were higher than those observed at the Former Sellite Area. Specifically, benzo(a)pyrene was detected at a maximum concentration of 0.89 mg/kg in Former Sellite Area soil, as compared to an MDC of 1.49 mg/kg in eastern Sandusky County background soil. The Ohio Department of Health concluded that soils at the PAH concentrations found in eastern Sandusky County soils were within health guidelines for a 30-year child/adult resident. It is also noted that for the Former Sellite Area, only the resident had an ILCR associated with benzo(a)pyrene in soil that equaled the lower end of the NCP cancer risk management range (ILCR = 1E-6); the ILCR values associated with benzo(a)pyrene in Former Sellite Area soil for the other receptors were de minimus (i.e., less than 1E-6).

Exposure to Aroclors in surface soil and total soil resulted in total ILCRs that exceeded the PBOW ILCR goal of 1E-5 for the current and future groundskeeper and the future resident. Exposure to Aroclor 1254 in total soil resulted in an HI value for the resident child that exceeded the PBOW HI goal. Therefore, total Aroclors and Aroclor 1254 are recommended for additional delineation and evaluation and remedial action in the FS.

In addition to chemical contamination in the form of PCBs at the Former Sellite Area, soil pH is also recommended for further evaluation in the FS. The low-pH soils at the Former Sellite Area resulted from disposal of waste generated as a byproduct of sellite production. The waste

material consists of silt-size residual material resulting from the burning of sulfur, but also includes residual elemental sulfur scattered on the ground surface. The sulfur may represent an ongoing source that contributes to acidic conditions via its oxidation by rainwater.

Especially low pH soils that co-occur with several barren areas observed at the Former Sellite Area are interpreted to be resultant from the waste material (Figure 4-14). Soil samples collected from these barren areas have pH values as low as pH 1.1 S.U. Within the barren areas, the low pH soil extends to depths of 5 feet or more within the source areas. Soil pH values increase at the Former Sellite Area with distance from the source areas. Both human health and ecological concerns are associated with low pH in soil. With regards to human health, according to the United Nations (2005) Globally Harmonized System (GHS) of Classification and Labelling, solid substances at pH less than or equal to 2.0 that may become moistened on skin or mucous membranes are Category 1 skin corrosives that cause irreversible skin damage and are likewise classified as Category 1 eye corrosives that cause irreversible eye damage. The potential for acidic soils at pH values greater than 2.0 to be eye corrosives or irritants and/or skin corrosives, irritants, or mild irritants cannot be eliminated without specific dermal toxicity testing as described in the GHS. The Occupational Safety and Health Administration (OSHA) dermal corrosive and eye corrosive classification categories (1910.1200.A.0.2 and A.0.3) are consistent with the GHS. Personal protective equipment (e.g., Tyvek coveralls) would typically be recommended for work in soils as acidic as those found in the Former Sellite Area, as consistent with OSHA General Duty provisions (29 Code of Federal Regulations 1910.5(a)(1)) where a recognized hazard is not covered by a specific standard.

The SLERA identified lead and PCBs in soil as potential chemical contaminants that could adversely affect ecological receptors that are exposed to them. However, the HQs calculated for lead were relatively low (the marsh wren was the only receptor with a LOAEL-based HQ that exceeded 1) and were primarily attributable to a single elevated concentration of lead of 4,060 mg/kg at sample location FSB-SB09. This location also had elevated PCBs (e.g., the concentration of Aroclor 1260 at this location was 18.2 mg/kg). Therefore, any remediation for PCBs is expected to reduce the concern for lead for ecological concerns. Ecological concerns are also relevant for acidic soil. As discussed in the SLERA (Section 4.4), increased acidity in soils can result in substances previously bound to clays becoming more mobile as protons displace metals bound to the clays. The release of the metals from the soil matrix results in increased bioavailability, which increases the potential for a contaminant to be assimilated as a toxicant into the body when ingested and/or its potential uptake by plants. Bioavailability has a significant impact on the overall toxicity of a given concentration of many inorganic and organic compounds. The role of low pH on phytotoxicity of some metals is well documented; for

example, aluminum primarily exists in soil as aluminosilicates. As the pH is lowered, aluminum is released from the silicate layer, and the presence of soluble aluminum increases. Exposure of plants to soluble aluminum is known to cause reduced root growth rates and development. Due to the high correlation between pH levels and plant toxicity for some metals, EPA (2008) recommends that pH levels of 5.5 and 5 S.U. be used as screening values for aluminum and iron, respectively. The collocation of low pH soils with barren areas devoid of vegetation (Figure 4-14) presents strong evidence that site-related acidity has adversely impacted the vegetation community at the Former Sellite Area.

The low pH levels detected in the Former Sellite Area soil represents a situation that is relatively unconventional in risk assessment practice; whereas the highly acidic soil presents a recognized human health and an obvious ecological stressor, it is unclear if any legal mandate exists for its remediation. DoD policy guidance states that DoD shall comply with applicable statutes and regulations governing response actions to address DoD-related contamination and will protect human health and the environment by implementing the process and conditions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, and the NCP (DoD, 2012). CERCLA mandates the remediation of sites contaminated with hazardous substances, as well as “pollutants or contaminants,” which “include any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring” (CERCLA Section 101[33]). Further, risk assessment guidance developed by the EPA to perform a Superfund evaluation for sites where the release of hazardous substances, pollutants, or contaminants has occurred stipulates that adverse human health and ecological effects associated with stressors in the environment should be evaluated. Although the stressors evaluated in risk assessments typically consist of the chemical contamination in one or more media, a stressor may also be nonchemical in nature. In ecological risk assessment, a stressor is defined as any physical, chemical, or biological entity that can induce an adverse response (EPA, 1992). Likewise, exposure is defined in human health risk assessment as human contact with a chemical or physical agent (EPA, 1989). Because of its potential to cause burns or act as a skin and eye irritant in humans and to increase bioavailability of contaminants and cause phytotoxicity resulting from an increased mobilization of metals in the soil matrix, the acidic soil is proposed for further evaluation in the FS.

6.3 Recommendations for the Unloading Area

The environmental media associated with the ULA appear to be adequately characterized (Section 5.2). The BHHRA (Section 5.3) and SLERA (Section 5.4) did not identify any chemicals of concern that require further evaluation or a remedial action for the protection of human or ecological receptors, respectively.

Based on the findings of the RI that media at the ULA poses no DoD-related unacceptable risks or hazards to human health or the environment and no DoD-related chemical exceeds a chemical-specific ARAR level, no further action is recommended at the ULA.

6.4 Overall Project Recommendations

An FS is recommended to address remediation for low pH and PCB contamination in soil at the Former Sellite Area. This recommendation is based on the findings of the RI that PCBs in Former Sellite Area soil represents a potential threat to human health and ecological receptors and the acidic soil is a likely stressor for humans (burns, skin and eye irritation) and ecological communities. Evidence of the latter effect can be observed by the strong correlation between the location of the acidic soils and the barren areas lacking vegetation. Although pH has been rigorously delineated at this site, further delineation of PCB contamination in the Former Sellite Area is recommended as part of the FS. Because the LBA and ULA are administratively part of the GMA DERP-FUDS site, the FS will also address media at these two sites, but will present a recommendation for no further action for each.

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TABLES

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB01						LBA-SB02					
				LOCATION	LS						LS					
				SAMPLE NO	LBA0001		**LBA0002**		**LBA0003**		LBA0004		LBA0005		LBA0006	
				SAMPLE DATE	**20-Jan-09**		20-Jan-09		20-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		0 - 1 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	-	-	-	-	-	-	0.324		0.53		-	-
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	-	-	-	-	-	-	0.294		0.438		-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	-	-	-	-	-	-	0.153	J	0.321		1.37	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	-	-	-	-	-	-	0.842	J
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	-	-	-	-	-	-	2.34	
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	-	-	-	-	-	-	0.308	
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	-	-	-	-	-	-	0.707	
VOLATILES																
Acetone	mg/kg	6,100	NE	0.339	0.0367	J	-	-	0.0305	J	0.124	J	0.0297	J	0.0282	J
Benzene	mg/kg	1.1	NE	0.00381	-	-	0.00217	J	0.00121	J	-	-	0.00381	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	-	-	-	-	0.00573	J	0.0103	J	-	-	-	-
Carbon disulfide	mg/kg	82	NE	0.00735	-	-	-	-	0.000988	J	-	-	-	-	-	-
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	0.0254	J	-	-	-	-	0.00323	J	-	-
Dichloroethene, 1,1-	mg/kg	24	NE	0.00563	-	-	0.00301	J	-	-	-	-	0.00254	J	-	-
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.00986	-	-	0.0032	J	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	0.00346	-	-	0.00346	J	-	-	-	-	0.00151	J	-	-
Toluene	mg/kg	500	NE	0.00599	-	-	0.00312	J	0.00186	J	-	-	0.00599	J	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	1.21	J	-	-	0.0156	J	1.19		0.0309	
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	0.0624	J	-	-	0.00263	J	0.0487	J	0.0122	
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.00178	-	-	-	-	0.000988	J	-	-	0.00171	J	-	-
Vinyl acetate	mg/kg	97	NE	0.00197	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Acenaphthylene	mg/kg	NE	NE	0.224	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.381	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.0426	J	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.106	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	0.0395	J	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.461	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	mg/kg	610	NE	0.059	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	-	-	-	-	-	-	0.268	J	1.03		9.88	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	-	-	-	-	-	-	-	-	0.389	J	3.82	
Fluoranthene	mg/kg	230	NE	1.26	0.0616	J	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.13	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	1.66	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	1.02	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	0.0627	J	-	-	-	-	-	-	-	-	-	-
PCBs																
Aroclor 1221	mg/kg	0.14	NE	0.19	-	-	-	-			-	-	-	-		
Aroclor 1260	mg/kg	0.22	NE	0.24	-	-	-	-			-	-	-	-		
METALS																
Aluminum	mg/kg	7,700	15,500	12000	4,400		7,580		9,330		7,710		9,960		8,330	
Antimony	mg/kg	3.1	9.3	1.46	0.386	J	0.722		0.375	J	0.303	J	0.581		0.488	J
Arsenic	mg/kg	0.39	36.5	15.3	4.5	J	10.1	J	4.78	J	7.11	J	8.1	J	5.84	J
Barium	mg/kg	1,500	826	218	16.3		33.6		61.3		218		67.7		44.3	
Beryllium	mg/kg	16	1	9.26	**5.22**	J	**5.15**	J	**6.74**	J	**6.24**	J	**7.39**	J	**5.35**	J
Cadmium	mg/kg	7	NE	0.819	-	-	0.513	J	0.263	J	0.699		0.36	J	0.338	J
Calcium	mg/kg	NE	52,300	288000	1,180		**74,000**		49,300	J	8,530	J	3,360		43,000	J
Chromium	mg/kg	0.29	29	19	10.4		11.1		13.6		10.9		17		13.1	

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB01						LBA-SB02					
				LOCATION	LS						LS					
				SAMPLE NO	LBA0001		**LBA0002**		**LBA0003**		LBA0004		LBA0005		LBA0006	
				SAMPLE DATE	**20-Jan-09**		20-Jan-09		20-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		0 - 1 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Cobalt	mg/kg	2.3	116	53.8	3.52		8.81		10.3	J	16.5	J	8.62		8.88	J
Copper	mg/kg	310	56.2	31.6	6.54		27		29.2	J	17.5	J	23.9		27.4	J
Iron	mg/kg	5,500	234,000	33900	15,000	J	16,600	J	21,500		17,500		22,700	J	16,300	
Lead	mg/kg	400	48.6	103	5.29		23		13		14.7		15		15.1	
Magnesium	mg/kg	NE	10,400	29600	796	J	**16,800**	J	**18,600**	J	2,100	J	3,510	J	**18,300**	J
Manganese	mg/kg	180	3,506	3000	198	J	384	J	548	J	1,560	J	706	J	240	J
Mercury	mg/kg	2.3	0.09	0.158	0.0198	J	0.0159	J	**0.157**	J	0.0317		0.0198	J	-	-
Nickel	mg/kg	150	55.1	43.5	9.01	J	22	J	27.1	J	21.9	J	31.4	J	24.9	J
Potassium	mg/kg	NE	3,390	1720	201		934		1,230		285		748		1,020	
Selenium	mg/kg	39	2	0.85	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/kg	39	11.1	2.25	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	NE	262	41.4		113		130		24		45.7		96.4	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.654		0.31	J	-	-	0.357	J	0.416	J
Vanadium	mg/kg	39	40.9	28.2	26.5		18.8		22.9		23.7		24.7		21.7	
Zinc	mg/kg	2,300	321.75	113	26		60		66.7		44.9		70.2		60.4	
GENERAL CHEMISTRY																
Total organic carbon	mg/kg	NE	NE	3040							3,040					

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB03										LBA-SB04					
				LOCATION	LS										LS					
				SAMPLE NO	LBA0007		LBA0008		LBA0009		LBA0010		LBA0011		LBA0014		LBA0012		LBA0013	
				SAMPLE DATE	20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		16-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		2_5 - 3_2 Ft		8 - 10 Ft		8 - 10 Ft		_9 - 1_9 Ft		3_9 - 5_9 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																				
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.163	J
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOLATILES																				
Acetone	mg/kg	6,100	NE	0.339	0.133	J	0.08	J	0.1		-	-	-	-	-	-	0.0303	J	0.0219	J
Benzene	mg/kg	1.1	NE	0.00381	-	-	-	-	-	-	-	-	-	-	0.00225	J	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0129	J	0.0092	J	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	mg/kg	82	NE	0.00735	0.00254	J	0.00735	J	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	-	-	-	-	-	-	0.0158	J	0.00263	J	-	-	-	-
Dichloroethene, 1,1-	mg/kg	24	NE	0.00563	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.00986	-	-	-	-	-	-	-	-	-	-	0.00986	J	-	-	-	-
Naphthalene	mg/kg	3.6	NE	0.00346	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	500	NE	0.00599	-	-	0.00104	J	-	-	-	-	-	-	0.00338	J	-	-	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	0.00139	J	-	-	-	-	0.0928		0.115		-	-	-	-
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	-	-	-	-	-	-	-	-	0.121		-	-	-	-
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.00178	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Vinyl acetate	mg/kg	97	NE	0.00197	-	-	-	-			-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																				
Acenaphthylene	mg/kg	NE	NE	0.224	-	-	0.0706	J	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.381	-	-	0.0811	J	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.0645	J	0.236	J	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	0.054	J	0.187	J	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	0.0996	J	0.284	J	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.106	-	-	0.106	J	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	0.0808	J	0.232	J	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.461	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	mg/kg	610	NE	0.059	0.059	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.26	0.141	J	0.455	J	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.13	-	-	0.13	J	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	1.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	1.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	0.072	J	0.161	J	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	0.111	J	0.337	J	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																				
Aroclor 1221	mg/kg	0.14	NE	0.19	-	-	-	-	-	-	-	-					-	-	-	-
Aroclor 1260	mg/kg	0.22	NE	0.24	0.0798		0.104		0.24		-	-					-	-	-	-
METALS																				
Aluminum	mg/kg	7,700	15,500	12000	6,790		6,330		7,680		8,700		7,110		7,750		5,800		5,390	
Antimony	mg/kg	3.1	9.3	1.46	0.954		0.759		-	-	0.348	J	0.407	J	0.381	J	-	-	-	-
Arsenic	mg/kg	0.39	36.5	15.3	8.05	J	11.5	J	10.3		4.42	J	6.28	J	9.37	J	5.2	J	4.58	J
Barium	mg/kg	1,500	826	218	51.9	J	152	J	106		61.2		58.2		41.8		22.1		20.7	
Beryllium	mg/kg	16	1	9.26	**5.73**	J	**8.07**	J	-	-	**6.18**	J	**5.32**	J	**5.94**	J	**5.24**	J	**5.21**	J
Cadmium	mg/kg	7	NE	0.819	0.525		0.819		0.81		-	-	0.315	J	0.291	J	-	-	-	-
Calcium	mg/kg	NE	52,300	288000	4,600		4,500		4,840		2,970		**53,500**	J	51,800	J	1,620		2,250	
Chromium	mg/kg	0.29	29	19	10.7		10.1		10.8		13.8		11.1		11.9		11.8		12	

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB03										LBA-SB04					
				LOCATION	LS										LS					
				SAMPLE NO	LBA0007		LBA0008		LBA0009		LBA0010		LBA0011		LBA0014		LBA0012		LBA0013	
				SAMPLE DATE	20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		16-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		2_5 - 3_2 Ft		8 - 10 Ft		8 - 10 Ft		_9 - 1_9 Ft		3_9 - 5_9 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Cobalt	mg/kg	2.3	116	53.8	6.14	J	33.2	J	16.9		6.63		8.91	J	7.58	J	4.82		4.35	
Copper	mg/kg	310	56.2	31.6	14.2		13.8		17		11.8		27.5	J	26.1	J	8.81		8.67	
Iron	mg/kg	5,500	234,000	33900	16,300	J	29,100	J	25,100		17,300	J	16,900		18,700		14,800	J	14,200	J
Lead	mg/kg	400	48.6	103	**103**	J	39.9	J	28.6		9.31		14		15.4		6.88		7.39	
Magnesium	mg/kg	NE	10,400	29600	2,010	J	2,160	J	2,450		2,200	J	**19,400**	J	**18,900**	J	913	J	1,050	J
Manganese	mg/kg	180	3,506	3000	287	J	1,680	J	1,240	J	228	J	475	J	367	J	324	J	253	J
Mercury	mg/kg	2.3	0.09	0.158	0.042		0.0441		-	-	0.055		**0.158**	J	0.0144	J	0.0188	J	0.0118	J
Nickel	mg/kg	150	55.1	43.5	14	J	25.1	J	29.8		20.3	J	23.5	J	21.6	J	11.8	J	11.1	J
Potassium	mg/kg	NE	3,390	1720	628		624		949		342		866		983		188		205	
Selenium	mg/kg	39	2	0.85	-	-	-	-	0.85		-	-	-	-	-	-	-	-	-	-
Silver	mg/kg	39	11.1	2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	NE	262	34.6		45.8		-	-	52.9		110		105		37.8		40	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.308	J	-	-	-	-	0.327	J	0.34	J	-	-	-	-
Vanadium	mg/kg	39	40.9	28.2	20.1		22		17.1		20.9		18.3		19.2		27.5		25.5	
Zinc	mg/kg	2,300	321.75	113	67.6		71.8		58		60.5		56.4		55.8		30		30	
GENERAL CHEMISTRY																				
Total organic carbon	mg/kg	NE	NE	3040																

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB05						LBA-SB07		LBA-SB08		LBA-SB09	
				LOCATION	LS						MP		MP		MP	
				SAMPLE NO	LBA0015		LBA0016		LBA0017		LBA0023		LBA0024		LBA0025	
				SAMPLE DATE	19-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09	
				DEPTH	0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		3 - 4.1 Ft		3 - 4.1 Ft		3 - 4.2 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	-	-	-	-	-	-	-	-	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	-	-	-	-	-	-	-	-
VOLATILES																
Acetone	mg/kg	6,100	NE	0.339	0.112	J	-	-	0.021	J						
Benzene	mg/kg	1.1	NE	0.00381	-	-	-	-	-	-						
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0113	J	-	-	-	-						
Carbon disulfide	mg/kg	82	NE	0.00735	-	-	-	-	0.00307	J						
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	0.00427	J	0.0345	J						
Dichloroethene, 1,1-	mg/kg	24	NE	0.00563	-	-	-	-	0.00563	J						
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.00986	-	-	-	-	-	-						
Naphthalene	mg/kg	3.6	NE	0.00346	-	-	-	-	-	-						
Toluene	mg/kg	500	NE	0.00599	-	-	-	-	-	-						
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	0.00538	J	0.0132		0.324	J						
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	-	-	-	-						
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.00178	-	-	-	-	-	-						
Vinyl acetate	mg/kg	97	NE	0.00197	-	-	-	-	-	-						
SEMIVOLATILES																
Acenaphthylene	mg/kg	NE	NE	0.224	-	-	-	-	-	-	-	-	-	-	0.195	J
Anthracene	mg/kg	1,700	NE	0.381	-	-	-	-	-	-	-	-	-	-	0.257	J
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	-	-	-	-	-	-	0.163	J	0.18	J	0.651	J
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	-	-	-	-	-	-	-	-	-	-	0.498	J
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	-	-	-	-	-	-	0.327	J	-	-	1.01	J
Benzo(ghi)perylene	mg/kg	NE	NE	0.106	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	-	-	-	-	-	-	-	-	0.74	J	0.241	J
Chrysene	mg/kg	15	NE	0.784	-	-	-	-	-	-	0.251	J	0.271	J	0.719	J
Dibenzofuran	mg/kg	7.8	NE	0.461	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	mg/kg	610	NE	0.059	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.26	-	-	-	-	-	-	0.171	J	0.23	J	1.02	J
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.13	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	1.66	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	1.02	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	-	-	-	-	-	-	-	-	-	-	0.202	J
Pyrene	mg/kg	170	NE	1.13	-	-	-	-	-	-	0.213	J	0.221	J	0.91	J
PCBs																
Aroclor 1221	mg/kg	0.14	NE	0.19	-	-	-	-								
Aroclor 1260	mg/kg	0.22	NE	0.24	-	-	-	-								
METALS																
Aluminum	mg/kg	7,700	15,500	12000	8,260		11,000		6,920		9,160		7,740		2,200	
Antimony	mg/kg	3.1	9.3	1.46	-	-	0.684		0.403	J	0.288	J	1.46	J	1.24	J
Arsenic	mg/kg	0.39	36.5	15.3	5.97	J	11.6	J	7.92	J	1.38	J	1.44	J	3.41	J
Barium	mg/kg	1,500	826	218	60.1		61.3		64.4		120		94.3		26.7	
Beryllium	mg/kg	16	1	9.26	**5.36**	J	**8.55**	J	**5.69**	J	**1.2**	J	**1.15**	J	**1.14**	J
Cadmium	mg/kg	7	NE	0.819	0.253	J	0.305	J	-	-	-	-	0.264	J	0.221	J
Calcium	mg/kg	NE	52,300	288000	5,520		3,050		51,200	J	**288,000**	J	**288,000**	J	**240,000**	J
Chromium	mg/kg	0.29	29	19	12.4		18.5		11		6.31		9.62		4.63	

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB05						LBA-SB07		LBA-SB08		LBA-SB09	
				LOCATION	LS						MP		MP		MP	
				SAMPLE NO	LBA0015		LBA0016		LBA0017		LBA0023		LBA0024		LBA0025	
				SAMPLE DATE	19-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09	
				DEPTH	0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		3 - 4.1 Ft		3 - 4.1 Ft		3 - 4.2 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Cobalt	mg/kg	2.3	116	53.8	4.21		10.1		8.37	J	1.74	J	1.65	J	2.13	J
Copper	mg/kg	310	56.2	31.6	18.7		30.1		26.8	J	9.11	J	10.4	J	11.4	J
Iron	mg/kg	5,500	234,000	33900	14,300	J	31,600	J	18,100		4,920		5,390		6,980	
Lead	mg/kg	400	48.6	103	12.2		15.9		12.4		7.71		10.8		12.9	
Magnesium	mg/kg	NE	10,400	29600	1,680	J	3,940	J	**18,500**	J	**23,500**	J	**28,500**	J	**29,600**	J
Manganese	mg/kg	180	3,506	3000	201	J	539	J	514	J	1,050	J	965	J	369	J
Mercury	mg/kg	2.3	0.09	0.158	0.0353		0.0238		-	-	0.0159	J	0.00931	J	0.017	J
Nickel	mg/kg	150	55.1	43.5	14.5	J	32.3	J	22.3	J	5.06	J	5.58	J	7.33	J
Potassium	mg/kg	NE	3,390	1720	481		1,020		823		462		411		305	
Selenium	mg/kg	39	2	0.85	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/kg	39	11.1	2.25	-	-	-	-	-	-	0.48		1.01		2.25	
Sodium	mg/kg	NE	NE	262	41.7		55.4		100		262		223		142	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.402	J	0.269	J	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	28.2	21.6		27.6		19		6.31		6.6		7.96	
Zinc	mg/kg	2,300	321.75	113	48.1		81.4		57.2		33.9		44.7		16.3	
GENERAL CHEMISTRY																
Total organic carbon	mg/kg	NE	NE	3040												

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB06										LBA-SB10									
				LOCATION	RCA										RCA									
				SAMPLE NO	LBA0018		LBA0019		LBA0020		LBA0021		LBA0022		LBA0026		LBA0027		LBA0028		LBA0029		LBA0030	
				SAMPLE DATE	20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		3 - 4_4 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																								
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.378	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOLATILES																								
Acetone	mg/kg	6,100	NE	0.339	0.104	J	-	-	0.0151	J	0.0352	J	-	-	0.339	J	0.087	J	0.072		0.0524	J	0.0247	J
Benzene	mg/kg	1.1	NE	0.00381	-	-	0.00303	J	0.00254	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.00827	J	-	-	-	-	0.00555	J	-	-	0.0147	J	0.0078	J	-	-	-	-	-	-
Carbon disulfide	mg/kg	82	NE	0.00735	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethene, 1,1-	mg/kg	24	NE	0.00563	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.00986	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	0.00346	-	-	-	-	-	-	-	-			-	-	-	-			-	-	-	-
Toluene	mg/kg	500	NE	0.00599	-	-	0.00576	J	0.0032	J	0.00123	J	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.00178	-	-	0.00178	J	-	-	-	-			-	-	-	-			-	-	-	-
Vinyl acetate	mg/kg	97	NE	0.00197	-	-	-	-	-	-	-	-			-	-	0.00197	UJ			-	-	-	-
SEMIVOLATILES																								
Acenaphthylene	mg/kg	NE	NE	0.224	0.224	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.381	0.381	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.652	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	0.395	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	0.878	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.106	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	0.784	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.461	0.461	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	mg/kg	610	NE	0.059	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.352	J
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0771	J
Fluoranthene	mg/kg	230	NE	1.26	1.26	J	-	-	-	-	-	-	-	-	-	-	0.0401	J	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	1.66	1.66	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	1.02	1.02	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	0.843	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	1.13	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																								
Aroclor 1221	mg/kg	0.14	NE	0.19	-	-	-	-							-	-	-	-	-	-	-	-		
Aroclor 1260	mg/kg	0.22	NE	0.24	-	-	-	-							-	-	-	-	-	-	-	-		
METALS																								
Aluminum	mg/kg	7,700	15,500	12000	7,020		7,410		7,850		7,930		7,660		7,210		5,830		7,240		7,180		12,000	
Antimony	mg/kg	3.1	9.3	1.46	0.377	J	0.341	J	0.445	J	0.519	J	-	-	0.573	J	0.247	J	-	-	0.317	J	0.814	
Arsenic	mg/kg	0.39	36.5	15.3	11.3	J	7.5	J	5.55	J	7.58	J	5		9.26	J	6.74	J	5.9		12.2	J	15.3	J
Barium	mg/kg	1,500	826	218	68		46.1		42	J	107	J	54.5		50.5	J	39.6	J	37.9		76.6	J	63.1	J
Beryllium	mg/kg	16	1	9.26	**9.26**	J	**6.59**	J	**5.84**	J	**7.29**	J	-	-	**6.41**	J	**5.17**	J	-	-	**7.47**	J	**9.03**	J
Cadmium	mg/kg	7	NE	0.819	0.338	J	0.254	J	0.32	J	0.408	J	-	-	0.492	J	0.261	J	-	-	0.486		0.671	
Calcium	mg/kg	NE	52,300	288000	5,080		47,700	J	47,100	J	43,900	J	50,100		4,380	J	3,220	J	3,000		3,980	J	7,120	J
Chromium	mg/kg	0.29	29	19	11.5		11.6		12.4		12.3		13.5		13.2	J	10.8	J	13.9		12.9	J	19	J

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB06										LBA-SB10									
				LOCATION	RCA										RCA									
				SAMPLE NO	LBA0018		LBA0019		LBA0020		LBA0021		LBA0022		LBA0026		LBA0027		LBA0028		LBA0029		LBA0030	
				SAMPLE DATE	20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		3 - 4_4 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Cobalt	mg/kg	2.3	116	53.8	9.09		9.71	J	7.78	J	14.5	J	8		7.31	J	4.75	J	-	-	14.5	J	24.4	J
Copper	mg/kg	310	56.2	31.6	16.8		26.7	J	27	J	28.1	J	21.5		13.6		10.4		10.2		13.5		31.5	
Iron	mg/kg	5,500	234,000	33900	31,400	J	21,500		18,400		23,500		18,200		18,300		14,600		17,800		23,700		28,800	
Lead	mg/kg	400	48.6	103	18.3		11.4		13.6		14.5		8.4		16	J	11.9	J	9		10.9	J	21.7	J
Magnesium	mg/kg	NE	10,400	29600	1,800	J	**16,500**	J	**20,500**	J	**17,600**	J	**14,600**		1,650	J	1,220	J	1,410		1,530	J	5,500	J
Manganese	mg/kg	180	3,506	3000	519	J	417	J	315	J	798	J	351	J	281		187		160	J	726		1,140	
Mercury	mg/kg	2.3	0.09	0.158	0.0456		0.014	J	0.0122	J	0.0148	J	-	-	0.0318		0.0266		-	-	0.0272		0.0167	J
Nickel	mg/kg	150	55.1	43.5	21.7	J	22.9	J	23	J	28.2	J	21.4		20.1	J	15.3	J	15.3		33.1	J	43.5	J
Potassium	mg/kg	NE	3,390	1720	591		822		1,010		983		1,720		374		293		-	-	320		1,030	
Selenium	mg/kg	39	2	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.61		-	-	-	-
Silver	mg/kg	39	11.1	2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	NE	262	50.4		93.3		106		95.4		-	-	30.8		23.5		-	-	26.7		53.4	
Thallium	mg/kg	NE	1.3	0.678	0.294	J	0.302	J	0.307	J	0.385	J	-	-	0.558		-	-	-	-	-	-	0.678	
Vanadium	mg/kg	39	40.9	28.2	24.4		20.3		21.2		22.7		17.8		25.4		20.6		26.2		27.7		27.9	
Zinc	mg/kg	2,300	321.75	113	58.4		59		56.1		63.8		48.2		60.1	J	47.5	J	45.5		102	J	96.9	J
GENERAL CHEMISTRY																								
Total organic carbon	mg/kg	NE	NE	3040																				

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB11						LBA-SB12					
				LOCATION	RCA						RCA					
				SAMPLE NO	LBA0031		LBA0032		LBA0033		LBA0034		LBA0035		LBA0036	
				SAMPLE DATE	19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		3_9 - 5_9 Ft		8 - 10 Ft		0 - 1 Ft		3 - 3_9 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	0.527		-	-	-	-	-	-	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	1.13		0.947		5.68		-	-	0.393		-	-
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	4.12		-	-	-	-	-	-
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	22.7		-	-	-	-	-	-
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	1.52		-	-	-	-	-	-
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	11.8		-	-	-	-	-	-
VOLATILES																
Acetone	mg/kg	6,100	NE	0.339	0.265	J	0.0388	J	0.0301	J	0.152	J	0.0464	J	0.0525	J
Benzene	mg/kg	1.1	NE	0.00381	-	-	-	-	-	-	-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0136	J	-	-	-	-	0.00999	J	-	-	0.00791	J
Carbon disulfide	mg/kg	82	NE	0.00735	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethene, 1,1-	mg/kg	24	NE	0.00563	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.00986	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	0.00346	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	500	NE	0.00599	-	-	-	-	0.00324	J	-	-	-	-	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.00178	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl acetate	mg/kg	97	NE	0.00197	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Acenaphthylene	mg/kg	NE	NE	0.224	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.381	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.106	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.461	-	-	-	-	-	-	-	-	-	-	-	-
Di-n-butyl phthalate	mg/kg	610	NE	0.059	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	1.29		0.866		5.82		-	-	0.23	J	-	-
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	0.204	J	0.129	J	2.49		-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.26	-	-	-	-	-	-	0.0499	J	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.13	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	1.66	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	1.02	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																
Aroclor 1221	mg/kg	0.14	NE	0.19	-	-	-	-			0.19		-	-		
Aroclor 1260	mg/kg	0.22	NE	0.24	0.0629	J	0.061	J			-	-	-	-		
METALS																
Aluminum	mg/kg	7,700	15,500	12000	6,690		8,940		10,400		5,950		7,140		11,800	
Antimony	mg/kg	3.1	9.3	1.46	-	-	0.27	J	0.505		0.25	J	-	-	0.306	J
Arsenic	mg/kg	0.39	36.5	15.3	8.54	J	11	J	5.19	J	8.68	J	6.83	J	6.6	J
Barium	mg/kg	1,500	826	218	55.2	J	154	J	62.4	J	93.8	J	74.4	J	58.6	J
Beryllium	mg/kg	16	1	9.26	**6.88**	J	**8.88**	J	**6.78**	J	**6.74**	J	**7.02**	J	**7.35**	J
Cadmium	mg/kg	7	NE	0.819	-	-	-	-	0.313	J	0.503		-	-	-	-
Calcium	mg/kg	NE	52,300	288000	1,970	J	1,460	J	37,600	J	3,650	J	1,320	J	32,200	J
Chromium	mg/kg	0.29	29	19	14.7	J	16.4	J	15.3	J	11.7	J	14.7	J	17.6	J

Table 3-1

Detections Above RBSCs and/or BSCs in Surface, Subsurface, and Maintenance Pit Soil Samples - LBA
GMA Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-SB11						LBA-SB12					
				LOCATION	RCA						RCA					
				SAMPLE NO	LBA0031		LBA0032		LBA0033		LBA0034		LBA0035		LBA0036	
				SAMPLE DATE	19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
				DEPTH	0 - 1 Ft		3_9 - 5_9 Ft		8 - 10 Ft		0 - 1 Ft		3 - 3_9 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Cobalt	mg/kg	2.3	116	53.8	4.68	J	53.8	J	12.7	J	21.3	J	17.2	J	8.82	J
Copper	mg/kg	310	56.2	31.6	14.2		15.3		31.6		12		12.8		28.4	
Iron	mg/kg	5,500	234,000	33900	21,600		33,900		22,000		19,800		21,800		23,800	
Lead	mg/kg	400	48.6	103	10	J	12.9	J	15.4	J	12.9	J	9.64	J	12.3	J
Magnesium	mg/kg	NE	10,400	29600	1,070	J	1,530	J	**15,600**	J	1,360	J	1,240	J	**10,900**	J
Manganese	mg/kg	180	3,506	3000	115		3,000		796		1,160		493		556	
Mercury	mg/kg	2.3	0.09	0.158	0.026		0.0299		-	-	0.0309		0.0287		0.0135	J
Nickel	mg/kg	150	55.1	43.5	14.3	J	38.2	J	33.2	J	22.6	J	23.6	J	29.1	J
Potassium	mg/kg	NE	3,390	1720	242		363		1,210		433		264		1,320	
Selenium	mg/kg	39	2	0.85	-	-	0.516	J	-	-	-	-	-	-	-	-
Silver	mg/kg	39	11.1	2.25	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	NE	262	18.8		29.2		87.7		26.9		27.8		91.4	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.294	J	0.336	J	-	-	-	-	0.39	J
Vanadium	mg/kg	39	40.9	28.2	25.7		28.2		23.7		23.5		22.5		24.3	
Zinc	mg/kg	2,300	321.75	113	69.9	J	113	J	74		64.5	J	80.1	J	72.4	J
GENERAL CHEMISTRY																
Total organic carbon	mg/kg	NE	NE	3040												

LBA - Locomotive Building Area
MP - Maintenance Pit.
NE - Not established (RBSCs), not evaluated (BSCs).
Shaded cell indicates value is greater than RBSC.
Bold text indicates value is greater than the BSC.
Blank cells indicate that the chemical was not analyzed.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from Oak Ridge Nation Laboratory (ORNL)-U.S. Environmental Protection Agency (EPA), 2009, Regional Screening Level Table, December 10, on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.
MDC - Maximum detected concentration for the AOC ("B" qualified data not included).
BSC - Background screening concentration.
"-" - Not Detected.
mg/kg - Milligram per kilogram.

Validation Qualifiers (VQ)
J - The analyte was positively identified; the reported value is estimated.

Table 3-2

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater Samples - LBA
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-PZ01		LBA-PZ02		LBA-PZ03		LBA-PZ04		LBA-PZ05					
				LOCATION	LS		LS		LS		LS		LS		LS		LS	
				SAMPLE NO	LBA3000		LBA3003		LBA3004		LBA3005		LBA3006		LBA3001		LBA3002	
				SAMPLE DATE	31-Jan-09		29-Jan-09		29-Jan-09		30-Jan-09		28-Jan-09		28-Jan-09		28-Jan-09	
				DEPTH	7.17 - 7.28 Ft		14.14-14.14 Ft		8.42 - 8.46 Ft		6.70 - 6.71 Ft		10.07 - 10.1 Ft		10.07 - 10.1 Ft		10.07 - 10.1 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																		
Amino-2,6-dinitrotoluene, 4-	µg/L	7.3	NE	1.7	-	-	-	-	1.71		-	-	-	-	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	µg/L	7.3	NE	1.6	-	-	-	-	1.6		-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	µg/L	0.099	NE	17.2	-	-	-	-	17.2		-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	µg/L	0.099	NE	15.1	-	-	-	-	15.1		-	-	-	-	-	-	-	-
HMX	µg/L	180	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/L	0.12	NE	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 2-	µg/L	0.31	NE	6.9	-	-	-	-	6.89		-	-	-	-	-	-	-	-
Nitrotoluene, 3-	µg/L	0.37	NE	3.9	-	-	-	-	3.91		-	-	-	-	-	-	-	-
Nitrotoluene, 4-	µg/L	4.2	NE	1.8	-	-	-	-	1.8		-	-	-	-	-	-	-	-
VOLATILES																		
Acetone	µg/L	2,200	NE	3.5	-	-	3.46	J	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/L	8.5	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	µg/L	100	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	µg/L	0.2	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.15	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	µg/L	2.4	NE	10.0	6.66		-	-	0.77	J	10		0.81	J	0.79	J	-	-
Dichloroethene, 1,1-	µg/L	34	NE	0.7	-	-	-	-	-	-	0.66	J	-	-	-	-	-	-
Dichloroethene, cis-1,2-	µg/L	37	NE	0.3	-	-	-	-	0.34	J	-	-	-	-	-	-	-	-
Naphthalene	µg/L	0.14	NE	4.3	-	-	-	-	4.33		-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	µg/L	910	NE	58.4	58.4		0.72	J	38.5		18.1		1.06	J	0.96	J	2.2	
Trichloroethene	µg/L	2	NE	7.0	0.81	J	-	-	7.03		-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	µg/L	1.5	NE	0.4	-	-	-	-	0.4	J	-	-	-	-	-	-	-	-
SEMIVOLATILES																		
Di-n-butyl phthalate	µg/L	370	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	µg/L	0.099	NE	13.3	-	-	-	-	13.3		-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	µg/L	0.099	NE	7.1	-	-	-	-	7.11	J	-	-	-	-	-	-	-	-
METALS-UNFILTERED																		
Aluminum	µg/L	3,700	309	27500	162		**12,800**		261		**12,600**		**4,710**		**3,860**		**27,500**	
Arsenic	µg/L	0.045	7.4	42.7	-	-	**42.7**		-	-	**13.5**		**14.4**		**11.9**		**22.4**	
Barium	µg/L	730	11,800	323	31.7		323		16		110		114		107		255	
Beryllium	µg/L	7.3	NE	13.7	-	-	13.7		-	-	12.3		4.05	J	3.2	J	-	-
Cadmium	µg/L	1.8	NE	4.6	4.63		2.43	J	2.97	J	-	-	2.23	J	2.7	J	-	-
Calcium	µg/L	NE	316,000	299000	156,000		299,000		75,300		243,000		94,000		83,500		160,000	
Chromium	µg/L	0.043	NE	39.1	-	-	20.4		-	-	20.3		6.35	J	-	-	39.1	
Cobalt	µg/L	1.1	12.1	18.6	-	-	**18.6**		-	-	**12.4**		6.12	J	5.01	J	-	-

Table 3-2

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater Samples - LBA
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-PZ01		LBA-PZ02		LBA-PZ03		LBA-PZ04		LBA-PZ05					
				LOCATION	LS		LS		LS		LS		LS		LS		LS	
				SAMPLE NO	LBA3000		LBA3003		LBA3004		LBA3005		LBA3006		LBA3001		LBA3002	
				SAMPLE DATE	31-Jan-09		29-Jan-09		29-Jan-09		30-Jan-09		28-Jan-09		28-Jan-09		28-Jan-09	
				DEPTH	7.17 - 7.28 Ft		14.14-14.14 Ft		8.42 - 8.46 Ft		6.70 - 6.71 Ft		10.07 - 10.1 Ft		10.07 - 10.1 Ft		10.07 - 10.1 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Copper	µg/L	150	19.8	66	5.98	J	**66**		-	-	**53.7**		17.2		17.4		**54.3**	
Iron	µg/L	2,600	1,550	48900	469		**40,700**		681		**36,000**		**12,600**		**10,200**		**48,900**	
Lead	µg/L	15	NE	48.6	-	-	48.6		-	-	26.6		8.41		6.91		31.2	
Magnesium	µg/L	NE	217,000	90700	30,900		90,700		16,300		76,500		30,100		26,500		55,000	
Manganese	µg/L	88	636	1450	25.3		**1,450**		35.1		**698**		366		286		**1,240**	
Nickel	µg/L	73	8.6	58.2	-	-	**20.5**		-	-	**17.6**		7.86		4.98	J	**58.2**	
Potassium	µg/L	NE	116,000	8560	878		4,800		510	J	2,860		2,610		2,430		8,560	
Selenium	µg/L	18	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	20400	5,240		20,400		2,820		7,790		12,300		12,700		10,800	
Vanadium	µg/L	18	NE	65.9	-	-	35.9		-	-	37.1		11.6		9.17		65.9	
Zinc	µg/L	1,100	507	141	-	-	136		-	-	111		38	J	31.9	J	141	
METALS-FILTERED																		
Aluminum	µg/L	3,700	309	159	-	-	-	-	-	-	-	-	159		128		-	-
Arsenic	µg/L	0.045	7.4	28.0	-	-	**28**		-	-	-	-	1.99	J	**9.75**	J	-	-
Barium	µg/L	730	11,800	93.6	30.9		87.7		15.1		27.4		90.5		93.6		-	-
Cadmium	µg/L	1.8	NE	4.5	4.46		-	-	-	-	3.29	J	-	-	-	-	-	-
Calcium	µg/L	NE	316,000	154000	154,000		65,600		71,600		80,700		70,600		72,400		70,900	
Cobalt	µg/L	1.1	12.1	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	µg/L	2,600	1,550	446	90.9		-	-	-	-	-	-	446		382		132	
Lead	µg/L	15	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	µg/L	NE	217,000	29600	29,600		20,200		15,800		20,900		20,000		20,200		18,700	
Manganese	µg/L	88	636	273	21.4		273		29.5		24.6		110		108		104	
Mercury	µg/L	1.1	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	µg/L	73	8.6	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	µg/L	NE	116,000	2080	792		2,080		357	J	-	-	1,470		1,480		-	-
Selenium	µg/L	18	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	18200	5,140		18,200		3,060		7,290		11,900		12,500		11,600	
Vanadium	µg/L	18	NE	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1,100	507	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER QUALITY PARAMETERS																		
Alkalinity	µg/L	NE	NE	240000	240,000		177,000		103,000		238,000		172,000		119,000		230,000	
Chloride	µg/L	NE	NE	7960	6,140	J	7,960	J	3,610		3,240	J	6,980	J	6,550	J	6,300	J
Cyanide, total	µg/L	73	NE	0													-	-
Hardness	µg/L	NE	NE	1120000	517,000		1,120,000		255,000		921,000		359,000		317,000		680,000	
HARDNESS (as CaCO3)	µg/L	NE	NE	0														
Nitrate	µg/L	5,800	NE	0													-	-
Nitrate-Nitrite	µg/L	NE	NE	581	297	J	-	-	581		61	J	26	J	-	-		
Sulfate	µg/L	NE	NE	193000	193,000		43,800	J	30,500		28,200		53,300	J	52,800	J	56,200	
Total dissolved solids	µg/L	NE	NE	700000	584,000		172,000		239,000		295,000		331,000	J	700,000	J	310,000	
Total suspended solids	µg/L	NE	NE	3860000	-	-	3,860,000		21,000		1,770,000		641,000		676,000		1,200,000	
Turbidity	NTU	NE	NE	866	10.9	J	866	J	19.7	J	165	J	403	J	375	J	64	

Table 3-2

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater Samples - LS/RCA
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

LBA - Locomotive Building Area.
NE - Not established (RBSCs), not evaluated (BSCs).
NA - Not Analyzed.
Shaded cell indicates value is greater than RBSC.
Bold text indicates value is greater than the BSC.
Blank cells indicate that the chemical was not analyzed.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs d
U.S. Environmental Protection Agency (EPA), 2009, Regional Screening Level Table, December 10, on line at www.epa.gov/r
For chemicals that exhibit both cancer and noncancer effects,
whichever type of effect results in a lower concentration
(using an ILCR of 1E-6 and an HQ of 0.1), that concentration is selected
as the RBSC.
MDC - Maximum detected concentration for the AOC ("B" qualified data
not included).
BSC - Background screening concentration.
"-" - Not Detected.
µg/L - Parts per billion.
mg/L - Parts per million.
prior to groundwater sample collection.
NM - Not measured.

Temporary piezometers from RCA not sampled. Recharge rate in all piezometers less
than 50 ml per minute.

Validation Qualifiers (VQ)
J - The analyte was positively identified; the reported value is estimated.
B - The analyte was not detected significantly above the levels found in the
associated method blank or field blanks.

Table 3-3

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-MW01				LBA-MW02											
				LOCATION	LS				LS											
				SAMPLE NO	LB3067		LB3075		LB3068		LB3069		LB3070		LB3076		LB3077		LB3079	
				SAMPLE DATE	12-May-09		4-Nov-09		19-May-09		19-May-09		19-May-09		5-Nov-09		5-Nov-09		5-Nov-09	
				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	
				SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG		FD		FS	
				LOW-FLOW SAMPLED	No		No		Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																				
Amino-2,6-dinitrotoluene, 4-	µg/L	7.3	NE	0.48	-	-	-	-	0.28		-	-	0.26		0.48	J	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	µg/L	7.3	NE	0.54	-	-	-	-	0.2		0.2		-	-	0.54	J	0.29	J	-	-
Dinitrotoluene, 2,4-	µg/L	0.099	NE	17.8	-	-	-	-	5.4	J	10.8	J	9.9		3.4	J	17.8	J	14	
Dinitrotoluene, 2,6-	µg/L	0.099	NE	12.4	-	-	-	-	5.3	J	7.8	J	6.9		5.9	J	12.4	J	11	
HMX	µg/L	180	NE	0.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/L	0.12	NE	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	
Nitrotoluene, 2-	µg/L	0.31	NE	74.7	-	-	-	-	25.1	J	48.5	J	39		8.1	J	74.7	J	51	
Nitrotoluene, 3-	µg/L	0.37	NE	9.1	-	-	-	-	2.9	J	5.7	J	4.5		1.2	J	9.1	J	-	-
Nitrotoluene, 4-	µg/L	4.2	NE	8.6	-	-	-	-	2.9	J	5.8	J	4.5		0.56	J	8.6	J	5.4	
VOLATILES																				
Acetone	µg/L	2,200	NE	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	µg/L	8.5	NE	0.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	µg/L	100	NE	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	µg/L	0.2	NE	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.15	NE	0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloroethane, 1,1-	µg/L	2.4	NE	8.3	2.2		2		1.6		1.5		1.4		3		3.7		3.6	
Dichloroethene, 1,1-	µg/L	34	NE	1.9	-	-	-	-	1.1	J	-	-	1.9		1.2		-	-	-	-
Dichloroethene, cis-1,2-	µg/L	37	NE	0.87	-	-	-	-	0.81	J	0.87	J	-	-	0.78	J	0.83	J	-	-
Trichloroethane, 1,1,1-	µg/L	910	NE	40.0	1.3		-	-	36.8		40		40		29.5		32.7		33	
Trichloroethene	µg/L	2	NE	5.6	-	-	-	-	5.6		5.2		4.8		4.3		4.8		5.1	
SEMIVOLATILES																				
Di-n-butyl phthalate	µg/L	370	NE	1.3	-	-	-	-	1.3	B	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	µg/L	0.099	NE	12.9	-	-	-	-	2.1	J	6.4	J	-	-	6.1	J	12.9	J	-	-
Dinitrotoluene, 2,6-	µg/L	0.099	NE	8.4	-	-	-	-	2.4	J	4.3	J	-	-	6	J	8.4	J	-	-
METALS-UNFILTERED																				
Aluminum	µg/L	3,700	309	1340	58.9	B	176	J	39.5	B	35.2	B	-	-	**361**		**313**		**1,190**	
Barium	µg/L	730	11,800	260	73.5	J	61.7	J	59.7	J	60.7	J	-	-	76.6	J	82.1	J	-	-
Calcium	µg/L	NE	316,000	189000	189,000		165,000	J	80,700	J	83,200	J	79,200		89,300		92,300		84,200	
Chromium	µg/L	0.043	NE	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	µg/L	1.1	12.1	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	µg/L	2,600	1,550	2830	242	J	684		-	-	-	-	-	-	200	J	207	J	1,430	
Lead	µg/L	15	NE	4.5	-	-	-	-	-	-	2.3	J	-	-	2.5	B	3.4	B	-	-
Magnesium	µg/L	NE	217,000	47900	45,000		45,700		17,300		17,800		17,100		19,400		20,600		21,100	
Manganese	µg/L	88	636	458	436		458		57.3		59.7		55.4		184		159		160	
Nickel	µg/L	73	8.6	21.0	4.3	J	2.4	J	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	µg/L	NE	116,000	19000	4,200	J	4,190	J	1,920	J	1,870	J	-	-	2,110	J	2,200	J	-	-
Selenium	µg/L	18	NE	6.7	6.3	J	4.9	J	-	-	-	-	-	-	4.5	J	-	-	-	-
Sodium	µg/L	NE	1,390,000	97100	28,300		31,200		8,500	J	5,600	J	5,680		5,380	J	6,170	J	7,420	
Vanadium	µg/L	18	NE	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1,100	507	18.3	-	-	-	-	-	-	9.2	J	-	-	-	-	-	-	-	-

Table 3-3

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-MW01				LBA-MW02											
				LOCATION	LS				LS											
				SAMPLE NO	LB3067		LB3075		LB3068		LB3069		LB3070		LB3076		LB3077		LB3079	
				SAMPLE DATE	12-May-09		4-Nov-09		19-May-09		19-May-09		19-May-09		5-Nov-09		5-Nov-09		5-Nov-09	
				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	
				SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG		FD		FS	
				LOW-FLOW SAMPLED	No		No		Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
METALS-FILTERED																				
Aluminum	µg/L	3,700	309	37.6	-	-	-	-	37.6	J	28.3	J	-	-	-	-	-	-	-	-
Barium	µg/L	730	11,800	190	66.9	J	56	J	51.3	J	49.2	J	-	-	28	J	33.8	J	-	-
Calcium	µg/L	NE	316,000	197000	197,000		159,000		77,300		78,400		76,100		82,600		85,700		81,500	
Cobalt	µg/L	1.1	12.1	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	µg/L	15	NE	2.7	-	-	-	-	-	-	-	-	-	-	2.1	J	2.4	J	-	-
Magnesium	µg/L	NE	217,000	47000	45,100		44,200		15,800		16,100		16,500		15,000		15,700		15,000	
Manganese	µg/L	88	636	457	457		135		47.2		46.1		57.3		30.1	J	46.3	J	47.4	
Mercury	µg/L	1.1	NE	0.16	-	-	-	-	-	-	-	-	-	-	-	-	0.16	J	-	-
Nickel	µg/L	73	8.6	21.1	5	J	2.7	J	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	µg/L	NE	116,000	19800	4,240	J	4,000	J	1,050	J	1,530	J	-	-	914	B	1,080	B	-	-
Selenium	µg/L	18	NE	5.9	5.9	J	-	-	3.6	J	-	-	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	98100	28,700		30,100		4,210	J	4,960	J	5,660		4,120	J	4,550	J	-	-
Vanadium	µg/L	18	NE	0.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1,100	507	15.5	-	-	14.5	J	-	-	9.5	J	-	-	-	-	-	-	-	-
WATER QUALITY PARAMETERS																				
Alkalinity	µg/L	NE	NE	333000	299,000		285,000		234,000		237,000		230,000		250,000		277,000		280,000	
Chloride	µg/L	NE	NE	195000	105,000		171,000		7,300		7,300		5,700		7,000		7,200		5,800	
Cyanide, total	µg/L	73	NE	16	8.5	J	-	-	7.5	J	-	-	-	-	-	-	-	-	-	-
Hardness	µg/L	NE	NE	320000									300,000						320,000	
HARDNESS (as CaCO3)	µg/L	NE	NE	657000	657,000		600,000		273,000		281,000				303,000		315,000			
Nitrate	µg/L	5,800	NE	300															300	
Nitrate-Nitrite	µg/L	NE	NE	900	-	-	110		710	J	750	J	900		440	J	450	J		
Sulfate	µg/L	NE	NE	282000	190,000		139,000		38,000		38,100		49,500		37,300	J	39,600	J	51,300	
Total dissolved solids	µg/L	NE	NE	951000	876,000		790,000		396,000	J	316,000		350,000		339,000		365,000		370,000	
Total suspended solids	µg/L	NE	NE	206000	14,000		20,000		-	-	6,000	J	-	-	-	-	7,000	J	38,000	
Turbidity	NTU	NE	NE	30.9	8.6		12.7		2.1	J	2.9	J	0.6		2	J	9.7	J	16	

Table 3-3

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-MW03				RCA-MW01		RCA-MW02				RCA-MW03			
				LOCATION	LS				RCA		RCA				RCA			
				SAMPLE NO	LB3071		LB3080		RC3074		RC3075		RC3081		RC3076		RC3082	
				SAMPLE DATE	10-May-09		3-Nov-09		12-May-09		11-May-09		3-Nov-09		11-May-09		4-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes		No		No		No		No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																		
Amino-2,6-dinitrotoluene, 4-	µg/L	7.3	NE	0.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amino-4,6-dinitrotoluene, 2-	µg/L	7.3	NE	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	µg/L	0.099	NE	17.8	-	-	-	-	-	-	0.23		-	-	-	-	-	-
Dinitrotoluene, 2,6-	µg/L	0.099	NE	12.4	-	-	-	-	-	-	0.29		-	-	-	-	-	-
HMX	µg/L	180	NE	0.32	-	-	0.32		-	-	-	-	-	-	-	-	-	-
Nitrobenzene	µg/L	0.12	NE	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 2-	µg/L	0.31	NE	74.7	-	-	-	-	-	-	2.1		1.8		-	-	-	-
Nitrotoluene, 3-	µg/L	0.37	NE	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrotoluene, 4-	µg/L	4.2	NE	8.6	-	-	-	-	-	-	1.2		0.61		-	-	-	-
VOLATILES																		
Acetone	µg/L	2,200	NE	10	-	-	-	-	-	-	-	-	-	-	10	J	-	-
Bromoform	µg/L	8.5	NE	0.36	-	-	-	-	-	-	-	-	-	-	0.36	J	-	-
Carbon disulfide	µg/L	100	NE	0.54	-	-	0.54	J	-	-	-	-	-	-	-	-	-	-
Carbon tetrachloride	µg/L	0.2	NE	4	-	-	4		-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	µg/L	0.15	NE	0.20	-	-	-	-	-	-	-	-	-	-	0.2	J	-	-
Dichloroethane, 1,1-	µg/L	2.4	NE	8.3	6.3		8.3		-	-	-	-	-	-	-	-	-	-
Dichloroethene, 1,1-	µg/L	34	NE	1.9	1.4		0.68	J	-	-	-	-	-	-	-	-	-	-
Dichloroethene, cis-1,2-	µg/L	37	NE	0.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	µg/L	910	NE	40.0	35.3		22.1		-	-	-	-	-	-	-	-	-	-
Trichloroethene	µg/L	2	NE	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																		
Di-n-butyl phthalate	µg/L	370	NE	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	µg/L	0.099	NE	12.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,6-	µg/L	0.099	NE	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
METALS-UNFILTERED																		
Aluminum	µg/L	3,700	309	1340	-	-	20.4	J	**386**	J	77.1	J	**1,290**		52.2	J	**1,340**	
Barium	µg/L	730	11,800	260	125	J	260		188	J	77.2	J	55.8	J	114	J	102	J
Calcium	µg/L	NE	316,000	189000	90,200		78,000	J	94,300		126,000		93,200	J	25,400		34,400	J
Chromium	µg/L	0.043	NE	3.3	-	-	-	-	-	-	-	-	2.8	J	-	-	3.3	J
Cobalt	µg/L	1.1	12.1	6.1	-	-	-	-	-	-	6.1	J	3.7	J	-	-	2.3	J
Iron	µg/L	2,600	1,550	2830	-	-	-	-	348		-	-	**2,830**		-	-	**2,510**	
Lead	µg/L	15	NE	4.5	-	-	-	-	-	-	-	-	4.5	B	2.1	J	3.7	B
Magnesium	µg/L	NE	217,000	47900	26,100		28,300		23,200		47,900		37,400		15,100		15,000	
Manganese	µg/L	88	636	458	68.2		292		77.8		422		272		53		102	
Nickel	µg/L	73	8.6	21.0	3.2	J	3	J	3.6	J	**21**	J	**11.4**	J	-	-	**9.1**	J
Potassium	µg/L	NE	116,000	19000	5,570	J	5,530	J	6,570	J	18,900		19,000	J	14,900		16,300	J
Selenium	µg/L	18	NE	6.7	-	-	-	-	6.7	B	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	97100	21,600		24,600		31,000		97,100		85,900		69,100		66,700	
Vanadium	µg/L	18	NE	3.4	-	-	-	-	1.1	J	-	-	3.4	J	-	-	3	J
Zinc	µg/L	1,100	507	18.3	11.3	J	-	-	-	-	13.1	B	17.3	J	13.4	B	18.3	J

Table 3-3

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	LBA-MW03				RCA-MW01		RCA-MW02				RCA-MW03			
				LOCATION	LS				RCA		RCA				RCA			
				SAMPLE NO	LB3071		LB3080		RC3074		RC3075		RC3081		RC3076		RC3082	
				SAMPLE DATE	10-May-09		3-Nov-09		12-May-09		11-May-09		3-Nov-09		11-May-09		4-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes		No		No		No		No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
METALS-FILTERED																		
Aluminum	µg/L	3,700	309	37.6	-	-	-	-	-	-	13.7	J	-	-	-	-	-	-
Barium	µg/L	730	11,800	190	131	J	190	J	182	J	82.7	J	46.6	J	111	J	98.1	J
Calcium	µg/L	NE	316,000	197000	86,500		81,800		99,300		122,000		79,400		23,000		23,500	
Cobalt	µg/L	1.1	12.1	6.1	-	-	-	-	-	-	6.1	J	1.4	J	-	-	-	-
Lead	µg/L	15	NE	2.7	2.7	J	-	-	-	-	2	J	-	-	-	-	2.4	J
Magnesium	µg/L	NE	217,000	47000	25,800		26,800		24,100		47,000		33,700		13,900		13,800	
Manganese	µg/L	88	636	457	71.7		181		68.2		389		157		84.7		25.6	
Mercury	µg/L	1.1	NE	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	µg/L	73	8.6	21.1	3.5	J	-	-	3.1	J	**21.1**	J	6.3	J	3.1	J	3.4	J
Potassium	µg/L	NE	116,000	19800	5,600	J	4,270	J	6,600	J	19,800		16,700		14,800		15,300	
Selenium	µg/L	18	NE	5.9	4.8	J	-	-	3.8	J	3.8	J	-	-	4	J	-	-
Sodium	µg/L	NE	1,390,000	98100	20,400		18,200		32,600		98,100	J	75,700		69,000	J	66,200	
Vanadium	µg/L	18	NE	0.92	-	-	-	-	-	-	0.92	J	-	-	-	-	-	-
Zinc	µg/L	1,100	507	15.5	11.3	J	-	-	15.5	J	9.2	J	7.4	J	-	-	7.6	J
WATER QUALITY PARAMETERS																		
Alkalinity	µg/L	NE	NE	333000	246,000		333,000		267,000		322,000		320,000		307,000		295,000	
Chloride	µg/L	NE	NE	195000	6,800		195,000	J	21,700		11,600		11,400		12,200		12,100	
Cyanide, total	µg/L	73	NE	16	13	J	-	-	16		13		-	-	-	-	-	-
Hardness	µg/L	NE	NE	320000														
HARDNESS (as CaCO3)	µg/L	NE	NE	657000	333,000		311,000		331,000		512,000		387,000		126,000		148,000	
Nitrate	µg/L	5,800	NE	300														
Nitrate-Nitrite	µg/L	NE	NE	900	-	-	110		-	-	-	-	32	J	-	-	-	-
Sulfate	µg/L	NE	NE	282000	69,800		45,400		67,100		282,000		210,000		4,300		4,400	
Total dissolved solids	µg/L	NE	NE	951000	580,000		394,000		509,000		951,000		694,000		230,000		348,000	
Total suspended solids	µg/L	NE	NE	206000	5,000	J	4,000		70,000		27,000		206,000		-	-	52,000	
Turbidity	NTU	NE	NE	30.9	-	-	1	J	21.3		3		30.9		2.1		25	

Table 3-3

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - LS/RCA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

LBA - Locomotive Building Area

NE - Not established (RBSCs), not evaluated (BSCs).
NA - Not Analyzed.
Shaded cell indicates value is greater than RBSC.
Bold text indicates value is greater than the BSC.
Blank cells indicate that the chemical was not analyzed.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1.
U.S. Environmental Protection Agency (EPA), 2009, Regional Screening Level Table, December 10, on line at www
For chemicals that exhibit both cancer and noncancer effects,
whichever type of effect results in a lower concentration
(using an ILCR of 1E-6 and an HQ of 0.1), that concentration is selected
as the RBSC.
MDC - Maximum detected concentration for the AOC ("B" qualified data
not included).
BSC - Background screening concentration.
"-" - Not Detected.
µg/L - Parts per billion.
mg/L - Parts per million.
prior to groundwater sample collection.
NM - Not measured.

Temporary piezometers from RCA not sampled. Recharge rate in all piezometers less
than 50 ml per minute.

Validation Qualifiers (VQ)
J - The analyte was positively identified; the reported value is estimated.
B - The analyte was not detected significantly above the levels found in the
associated method blank or field blanks.

Table 3-4

Detections Above RBSCs and/or BSCs in Bedrock Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	IT-MNTA-BEDGW-001				LBA-BEDGW-002		RCA-BEDGW-002			
				SAMPLE NO	LB3074		BEDGW-001-1109		LB3073		RC3078		RC3084	
				SAMPLE DATE	19-May-09		6-Nov-09		12-May-09		11-May-09		5-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LOW-FLOW SAMPLED	No		No		No		No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES														
Acetone	ug/L	2,200	NE	345	345	J	-	-	-	-	50.7	J	-	-
Benzene	ug/L	0.41	2.4	1680	-	-	**3.7**		**1,680**	J	**31.9**		**114**	
Butanone, 2-	ug/L	710	NE	81.3	81.3	J	-	-	56.3	J	-	-	13.2	
Carbon disulfide	ug/L	100	NE	11.6	11.6	J	3.8		-	-	-	-	-	-
Chloroform	ug/L	0.19	NE	66.7	66.7		-	-	26.8		-	-	-	-
Chloromethane	ug/L	19	NE	35.6	-	-	-	-	35.6	J	12.8		-	-
Ethylbenzene	ug/L	1.5	0.87	169	**16.7**	J	**9.9**		**169**		**17**		**43.4**	
Methyl-2-pentanone, 4-	ug/L	200	NE	3.3	-	-	3.3	J	-	-	-	-	-	-
Methylene chloride	ug/L	4.8	NE	77.6	77.6	J	-	-	-	-	-	-	-	-
Tetrachloroethane, 1,1,2,2-	ug/L	0.067	NE	3.7	-	-	1.2		-	-	3.7		-	-
Toluene	ug/L	230	1.7	692	**14.2**	J	**10**		**692**		**28.9**		**93.6**	
Xylenes, total	ug/L	20	5.5	1130	**235**		**136**		**1,130**		**97.2**		**234**	
SEMIVOLATILES														
3-Methylphenol and 4-Methylphenol	ug/L	NE	NE	5.2	-	-	-	-	5.2		-	-	-	-
Dimethylphenol, 2,4-	ug/L	73	NE	12.3	-	-	-	-	12.3		1.5	J	1.6	J
Fluorene	ug/L	150	NE	5.4	5.4	J	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	ug/L	15	NE	256	71		256	J	20.9		6.3		8.1	
Methylphenol, 2-	ug/L	180	NE	5.6	-	-	-	-	5.6		-	-	-	-
Naphthalene	ug/L	0.14	NE	64.9	17.7	J	64.9	J	25.6		4.5	J	7.2	
Phenanthrene	ug/L	NE	NE	37.3	12.7	J	37.3	J	-	-	-	-	-	-
Phenol	ug/L	1,100	NE	8	-	-	-	-	8		-	-	-	-
METALS-UNFILTERED														
Aluminum	ug/L	3,700	309	155	90.4	B	79.6	J	73.8	B	155	J	138	J
Arsenic	ug/L	0.045	7.4	131	-	-	-	-	**131**		**19.9**		**28**	
Barium	ug/L	730	11,800	762	343		305		762		485		562	

Table 3-4

Detections Above RBSCs and/or BSCs in Bedrock Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	IT-MNTA-BEDGW-001				LBA-BEDGW-002		RCA-BEDGW-002			
				SAMPLE NO	LB3074		BEDGW-001-1109		LB3073		RC3078		RC3084	
				SAMPLE DATE	19-May-09		6-Nov-09		12-May-09		11-May-09		5-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LOW-FLOW SAMPLED	No		No		No		No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Cadmium	ug/L	1.8	NE	1.4	1.4	J	-	-	-	-	-	-	-	-
Calcium	ug/L	NE	316,000	462000	314,000	J	280,000		**462,000**		**343,000**		**360,000**	
Iron	ug/L	2,600	1,550	2940	591		180	J	**2,940**		-	-	385	
Lead	ug/L	15	NE	2.6	2.6	J	-	-	-	-	-	-	-	-
Magnesium	ug/L	NE	217,000	352000	**234,000**		212,000		**352,000**		**241,000**		**275,000**	
Manganese	ug/L	88	636	1070	95.5		85.8		**1,070**		227		158	
Nickel	ug/L	73	8.6	7.2	-	-	-	-	7.2	J	-	-	-	-
Potassium	ug/L	NE	116,000	120000	111,000		**120,000**		87,700		57,600		72,000	
Selenium	ug/L	18	NE	11.7	-	-	-	-	11.7	J	6.8	B	8.5	J
Sodium	ug/L	NE	1,390,000	1230000	1,230,000		1,130,000		1,140,000		638,000		770,000	
Thallium	ug/L	NE	NE	6.4	3.8	J	-	-	6.4	J	-	-	-	-
Vanadium	ug/L	18	NE	2.8	2.8	J	1.6	J	1.4	J	1.6	J	-	-
Zinc	ug/L	1,100	507	14.8	11.6	J	11.5	B	-	-	14.8	B	9.2	B
METALS-FILTERED														
Aluminum	ug/L	3,700	309	71.7	43.3	J	52.6	J	-	-	35.6	J	71.7	J
Arsenic	ug/L	0.045	7.4	125	-	-	-	-	**125**		**13.1**		**42.7**	
Barium	ug/L	730	11,800	764	329		304		764		494		576	
Calcium	ug/L	NE	316,000	471000	312,000		275,000		**471,000**		309,000		**371,000**	
Lead	ug/L	15	NE	3.3	2	J	2.3	J	-	-	3.3	J	-	-
Magnesium	ug/L	NE	217,000	365000	**231,000**		211,000		**365,000**		**223,000**		**287,000**	
Manganese	ug/L	88	636	1000	47		70.2		**1,000**		186		177	
Nickel	ug/L	73	8.6	5.7	-	-	-	-	5.7	J	-	-	-	-
Potassium	ug/L	NE	116,000	120000	113,000		**120,000**		90,200		57,900		75,200	
Selenium	ug/L	18	NE	9.3	-	-	4.2	J	9.3	J	7	J	7.2	J
Sodium	ug/L	NE	1,390,000	1210000	1,210,000		1,160,000		1,170,000		634,000	J	793,000	
Thallium	ug/L	NE	NE	0	-	-	-	-	-	-	-	-	-	-
Vanadium	ug/L	18	NE	2.7	2.7	J	0.93	J	1.1	J	1.9	J	1.3	J
Zinc	ug/L	1,100	507	11.2	11.2	J	-	-	-	-	-	-	-	-

Table 3-4

Detections Above RBSCs and/or BSCs in Bedrock Groundwater Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	IT-MNTA-BEDGW-001				LBA-BEDGW-002		RCA-BEDGW-002			
				SAMPLE NO	LB3074		BEDGW-001-1109		LB3073		RC3078		RC3084	
				SAMPLE DATE	19-May-09		6-Nov-09		12-May-09		11-May-09		5-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LOW-FLOW SAMPLED	No		No		No		No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
WATER QUALITY PARAMETERS														
Alkalinity	ug/L	NE	NE	773000	773,000		718,000		369,000		753,000		770,000	
Chloride	ug/L	NE	NE	3260000	132,000		2,550,000		3,260,000		1,480,000		2,520,000	
Cyanide, total	ug/L	73	NE	110	71		-	-	14	J	110	J	-	-
HARDNESS (as CaCO3)	ug/L	NE	NE	2600000	1,740,000		1,570,000		2,600,000		1,850,000		2,030,000	
Nitrate-Nitrite	ug/L	NE	NE	200	-	-	90	J	-	-	-	-	200	J
Sulfate	ug/L	NE	NE	218000	9,600		-	-	14,800		218,000		39,400	J
Total dissolved solids	ug/L	NE	NE	7970000	5,780,000		4,680,000		7,970,000		3,320,000		3,910,000	
Total suspended solids	ug/L	NE	NE	193000	53,000		193,000		60,000		-	-	17,000	
Turbidity	NTU	NE	NE	168	66	J	71.5		168		47.4		76.4	

LBA - Locomotive Builiding Area
NE - Not established (RBSCs), not evaluated (BSCs).
NA - Not Analyzed.
Shaded cell indicates value is greater than RBSC.
Bold text indicates value is greater than the BSC.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from Oak Ridge Nation Laboratory (ORNL)-
U.S. Environmental Protection Agency (EPA), 2009, Regional Screening Level Table, December 10,
on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a
noncancer hazard quotient (HQ) of 0.1.
For chemicals that exhibit both cancer and noncancer effects,
whichever type of effect results in a lower concentration
(using an ILCR of 1E-6 and an HQ of 0.1), that concentration is selected
as the RBSC.
MDC - Maximum detected concentration for the AOC ("B" qualified data
not included).
BSC - Background screening concentration.
"-" - Not Detected.
µg/L - Parts per billion.
mg/L - Parts per million.
Ferrous iron measured in field using Hach test kit.
Oxidation reduction potential - Final YSI water quality meter field measurement
prior to groundwater sample collection.
NM - Not measured.

Validation Qualifiers (VQ)
J - The analyte was positively identified; the reported value is estimated.
B - The analyte was not detected significantly above the levels found in the
associated method blank or field blanks.

Table 3-5

Detections Above RBSCs in Surface Water Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

			LOCATION CODE	LBA-SW01		LBA-SW02		LBA-SW03						LBA-SW04		LBA-SW05		LBA-SW06		LBA-SW07	
			SAMPLE NO	LBA2000		LBA2001		LBA2002		LBA2003		LBA2004		LBA2005		LBA2006		LBA2007		LBA2008	
			SAMPLE DATE	20-May-09		21-May-09		21-May-09		21-May-09		21-May-09		21-May-09		22-May-09		22-May-09		22-May-09	
			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	
			SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG		REG		REG		REG	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																					
Dichloroethane, 1,1-	µg/L	24	0.45	0.25	J	0.39	J	0.26	J	0.45	J	-	-	-	-	0.39	J	-	-	-	-
Dichloroethene, cis-1,2-	µg/L	370	0.24	-	-	-	-	0.22	J	0.24	J	-	-	-	-	-	-	-	-	-	-
Trichloroethane, 1,1,1-	µg/L	9,100	0.59	-	-	0.47	J	0.59	J	0.53	J	-	-	-	-	-	-	-	-	-	-
METALS																					
Aluminum	µg/L	37,000	23,800	1,790		1,660		1,990		1,540		1,720		2,460		2,520		23,800		11.3	B
Arsenic	µg/L	0.45	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.8	J	-	-
Barium	µg/L	7,300	155	49.8	J	101	J	64.5	J	58.2	J	-	-	62.6	J	62.2	J	155	J	41.6	J
Beryllium	µg/L	73	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	J	-	-
Calcium	µg/L	NE	152,000	141,000		140,000		152,000		149,000		132,000		144,000		146,000		114,000		110,000	
Chromium	µg/L	0.43	39.8	2.6	J	2.8	J	3.2	J	2.9	J	-	-	4.1	J	4.6	J	39.8		-	-
Cobalt	µg/L	11	16.3	-	-	4.2	J	2.4	J	2.3	J	-	-	2.5	J	3	J	16.3	J	-	-
Copper	µg/L	1,500	38.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38.5		-	-
Iron	µg/L	26,000	43,900	2,570		4,020		4,650		3,570		2,850		4,920		5,890		43,900		1,090	
Lead	µg/L	15	18	2.6	J	3.2	J	5	J	3.9	J	-	-	4.3	J	5.5	J	18		-	-
Magnesium	µg/L	NE	29,600	27,300		27,400		29,600		29,000		26,000		27,900		28,600		28,100		17,400	
Manganese	µg/L	880	2,220	554		1,760		1,870		1,560		1,170		1,050		2,220		662		381	
Nickel	µg/L	730	71.6	4.8	J	8.9	J	7.9	J	6.4	J	-	-	8.6	J	8.7	J	71.6		-	-
Potassium	µg/L	NE	6,540	2,260	J	6,540	J	2,070	J	1,900	J	-	-	2,180	J	2,050	J	4,920	J	1,280	J
Selenium	µg/L	180	4.4	-	-	-	-	3.4	J	3.8	J	-	-	-	-	3.5	J	4.4	J	-	-
Sodium	µg/L	NE	35,000	27,600		32,400		34,700		34,300		35,000		25,200		27,000		18,200		31,700	
Vanadium	µg/L	180	46.1	5	J	4.5	J	5	J	4.3	J	-	-	5.7	J	6.9	J	46.1	J	-	-
Zinc	µg/L	11,000	177	19.7	J	32		35		30.2		21.2		31.1		33.4		177		-	-
GENERAL CHEMISTRY																					
HARDNESS (as CaCO3)	µg/L	NE	464,000	464,000																	

Shaded cell indicates value is greater than RBSC.
Blank cells indicate that the chemical was not analyzed.
LBA - Locomotive Building Area
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from Oak Ridge Nation Laboratory (ORNL)-
U.S. Environmental Protection Agency (EPA), 2009, Regional Screening Level Table, December 10, on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.
For chemicals that exhibit both cancer and noncancer effects, whichever type of effect results in a lower concentration
(using an ILCR of 1E-6 and an HQ of 0.1), that concentration is selected as the RBSC.
MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).
"-" - Not Detected.
NE - Not Established.
µg/L - Parts per billion.

Validation Qualifiers (VQ)
J - The analyte was positively identified; the reported value is estimated.
B - Analyte was not detected significantly above the levels found in the associated method blank or field blanks.

Table 3-6

Detections Above RBSCs in Sediment Samples - LBA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

			LOCATION CODE	LBA-SD01		LBA-SD02		LBA-SD03		LBA-SD04		LBA-SD05		LBA-SD06					
			SAMPLE NO	LBA1000		LBA1001		LBA1002		LBA1003		LBA1004		LBA1005		LBA1006		LBA1007	
			SAMPLE DATE	20-May-09		21-May-09		21-May-09		21-May-09		22-May-09		22-May-09		22-May-09		22-May-09	
			DEPTH	0 - _5 Ft		0 - _5 Ft		0 - _5 Ft		0 - _5 Ft		0 - _5 Ft		0 - _5 Ft		0 - _5 Ft		0 - _5 Ft	
			SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG		FD		FS	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																			
Acetone	mg/kg	61,000	0.0921	-	-	0.0921	J	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulfide	mg/kg	820	0.0019	-	-	-	-	-	-	-	-	-	-	0.0019	J	-	-	-	-
Methylene chloride	mg/kg	110	0.0582	0.0582		0.0195	B	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																			
Benzo(b)fluoranthene	mg/kg	1.5	0.0481	-	-	-	-	-	-	-	-	-	-	0.0481	J	0.0458	J	-	-
Fluoranthene	mg/kg	2,300	0.0934	-	-	-	-	-	-	-	-	-	-	0.0738	J	0.0934	J	-	-
Phenanthrene	mg/kg	NE	0.0546	-	-	-	-	-	-	-	-	-	-	-	-	0.0546	J	-	-
Pyrene	mg/kg	1,700	0.0694	-	-	-	-	-	-	-	-	-	-	0.0562	J	0.0694	J	-	-
METALS																			
Aluminum	mg/kg	77,000	10900	6,300		5,710	J	7,780	J	7,760	J	8,850		10,700		9,900		10,900	
Arsenic	mg/kg	3.9	17.8	16		9.4	J	8.3	J	17.8	J	9.5		11.7		10.4		16.5	
Barium	mg/kg	15,000	156	75.7		90.3	J	58.8	J	92.1	J	63.8		70.7		81.6		156	
Beryllium	mg/kg	160	0.96	0.75		0.61		0.67	J	0.96		0.68		0.84		0.77		0.72	
Cadmium	mg/kg	70	1.9	1.9		0.46		0.46	J	0.97		0.64		0.56		0.56		-	-
Calcium	mg/kg	NE	11200	11,200	J	3,510	J	3,900	J	7,050	J	10,300		3,300		3,220		3,520	
Chromium	mg/kg	2.9	18.8	10.4		10.7	J	13.5	J	13.4	J	15.9		18.8		17.6		18.3	
Cobalt	mg/kg	23	26	24.9		17.5	J	11.8	J	26	J	10.8		11.3		11.7		24.6	
Copper	mg/kg	3,100	26.2	13.5		10.5	J	13.3	J	22.2	J	22.7		24.5		21		26.2	
Iron	mg/kg	55,000	32200	21,000		20,500	J	18,700	J	30,200	J	22,100		25,500		23,300		32,200	
Lead	mg/kg	400	17.9	10.8		9	J	9.5	J	17.9	J	11.5		10.4		10.5		17	
Magnesium	mg/kg	NE	4940	2,840		1,590	J	2,160	J	3,090	J	4,940		3,620		3,190		3,820	
Manganese	mg/kg	1,800	5360	5,360		1,510		828	J	1,610		737		779		1,170		2,280	
Mercury	mg/kg	23	0.031	0.025	J	0.023	J	-	-	0.031	J	0.022	J	0.022	J	0.023	J	-	-
Nickel	mg/kg	1,500	63.2	52.2		26.6	J	26.1	J	39.8	J	26.6		33.8		34.2		63.2	
Potassium	mg/kg	NE	1430	781	J	614	J	781	J	829	J	1,250	J	1,430		1,370		1,420	
Selenium	mg/kg	390	3	3	J	2.1	J	1.7	J	2.2	J	1.7	J	1.9	J	1.8	J	-	-
Sodium	mg/kg	NE	192	182	J	110	J	134	J	192	J	166	J	150	J	164	J	-	-
Thallium	mg/kg	NE	3.1	1.9		0.26	J	-	-	-	-	-	-	-	-	-	-	3.1	
Vanadium	mg/kg	390	27.7	22.2		19.4	J	21.9	J	26.5	J	24.5		27		25.8		27.7	
Zinc	mg/kg	23,000	80.3	80.3		52.4	J	54.1	J	73.9	J	55		63		59.1		78.3	
GENERAL CHEMISTRY																			
Total Organic Carbon	mg/kg	15,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NE - Not established (RBSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from Oak Ridge Nation Laboratory (ORNL)-
U.S. Environmental Protection Agency (EPA), 2009, Regional Screening Level Table, December 10, on line at www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.

For chemicals that exhibit both cancer and noncancer effects, whichever type of effect results in a lower concentration
(using an ILCR of 1E-6 and an HQ of 0.1), that concentration is selected as the RBSC.

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

"-" - Not Detected.

mg/kg - Parts per million.

Validation Qualifiers (VQ)

J - The analyte was positively identified; the reported value is estimated.

Table 3-7

Statistical Summary and COPC Selection for Chemicals Detected in LBA Surface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics														
Aluminum	11 / 11	100	4.40E+03		8.26E+03		1.81E+00	2.35E+01	6.58E+03	1.55E+04	7700	N (b)		---
Antimony	6 / 11	55	2.50E-01	J	8.57E-01		4.51E-01	1.20E+00	4.03E-01	9.30E+00	3.1	N (b)		---
Arsenic	11 / 11	100	4.50E+00	J	1.13E+01	J	9.02E-01	1.20E+00	7.45E+00	3.65E+01	0.39	N (b)		---
Barium	11 / 11	100	1.63E+01		2.18E+02		2.00E-01	2.35E+01	7.11E+01	8.26E+02	1500	N (b)		---
Beryllium	9 / 11	82	5.22E+00	J	9.26E+00	J	1.81E-01	5.90E-01	5.29E+00	1.00E+00	16	N (a)		---
Cadmium	7 / 11	64	2.53E-01	J	6.99E-01		2.10E-01	5.02E-01	3.82E-01		7	N (a)		---
Calcium	11 / 11	100	1.18E+03		1.38E+04		4.51E+00	5.88E+02	4.90E+03	5.23E+04	Nutrient	N (c)		---
Chromium	11 / 11	100	1.04E+01		5.10E+01		4.51E-01	5.90E-01	1.53E+01	2.90E+01	0.29	Y	2.24E+01	2.24E+01
Cobalt	9 / 11	82	3.52E+00		2.13E+01	J	3.61E-01	5.90E+00	8.67E+00	1.16E+02	2.3	N (b)		---
Copper	11 / 11	100	6.54E+00		1.87E+01		4.51E-01	2.90E+00	1.37E+01	5.62E+01	310	N (b)		---
Iron	11 / 11	100	1.30E+04		3.14E+04	J	3.64E+00	1.18E+01	1.84E+04	2.34E+05	5500	N (b)		---
Lead	11 / 11	100	5.29E+00		2.22E+02		3.20E-01	5.02E-01	3.68E+01	4.86E+01	400	N (a)		---
Magnesium	11 / 11	100	7.96E+02	J	2.87E+03		1.81E+00	5.88E+02	1.57E+03	1.04E+04	Nutrient	N (c)		---
Manganese	11 / 11	100	1.15E+02		1.56E+03	J	1.81E-01	1.80E+00	5.22E+02	3.51E+03	180	N (b)		---
Mercury	9 / 11	82	1.88E-02	J	4.56E-02		2.13E-02	1.20E-01	3.59E-02	8.50E-02	2.3	N (b)		---
Nickel	11 / 11	100	9.01E+00	J	2.26E+01	J	2.71E-01	4.70E+00	1.64E+01	5.51E+01	150	N (b)		---
Potassium	11 / 11	100	1.88E+02		1.07E+03		2.26E+01	5.88E+02	4.74E+02	3.39E+03	Nutrient	N (c)		---
Sodium	9 / 11	82	1.88E+01		5.04E+01		9.02E+00	5.88E+02	7.89E+01		Nutrient	N (c)		---
Thallium	3 / 11	27	2.94E-01	J	5.58E-01		4.45E-01	1.20E+00	3.40E-01	1.30E+00	0.51 g	N (b)		---
Vanadium	11 / 11	100	2.03E+01		2.75E+01		1.81E-01	5.90E+00	2.36E+01	4.09E+01	39	N (b)		---
Zinc	11 / 11	100	2.60E+01		2.73E+02		2.10E+00	2.51E+00	7.06E+01	3.22E+02	2300	N (b)		---
Polychlorinated biphenyls (PCB)														
Aroclor 1221	1 / 11	9	1.90E-01		1.90E-01		3.50E-02	4.29E-02	3.54E-02		0.14	Y	1.03E-01	1.03E-01
Aroclor 1260	3 / 11	27	6.29E-02	J	1.90E-01		3.50E-02	4.29E-02	4.61E-02		0.22	N (a)		---
Nitroaromatics														
Amino-2,6-dinitrotoluene, 4-	2 / 9	22	3.24E-01		5.27E-01		2.88E-01	3.00E-01	2.10E-01		15	N (a)		---
Amino-4,6-dinitrotoluene, 2-	1 / 9	11	2.94E-01		2.94E-01		2.88E-01	3.00E-01	1.64E-01		15	N (a)		---
Semivolatile Organic Compounds														
Acenaphthylene	2 / 11	18	7.06E-02	J	2.24E-01	J	3.50E-01	2.06E+00	2.92E-01		340 h	N (a)		---
Anthracene	2 / 11	18	8.11E-02	J	3.81E-01	J	3.50E-01	2.06E+00	3.07E-01		1700	N (a)		---
Benzo(a)anthracene	3 / 11	27	4.26E-02	J	6.52E-01	J	3.50E-01	2.06E+00	3.25E-01		0.15	Y	2.92E-01	2.92E-01
Benzo(a)pyrene	2 / 11	18	1.21E-01	JJ	3.95E-01	J	3.50E-01	2.06E+00	3.12E-01		0.015	Y	3.41E-01	3.41E-01
Benzo(b)fluoranthene	2 / 11	18	1.92E-01	JJ	8.78E-01	J	3.50E-01	2.06E+00	3.62E-01		0.15	Y	7.42E-01	7.42E-01
Benzo(ghi)perylene	1 / 11	9	1.06E-01	J	1.06E-01	J	3.50E-01	2.06E+00	3.68E-01		170 i	N (a)		---
Chrysene	3 / 11	27	3.95E-02	J	7.84E-01	J	3.50E-01	2.06E+00	3.37E-01		15	N (a)		---
Dibenzofuran	2 / 11	18	4.61E-01	J	1.40E+00	J	3.50E-01	2.06E+00	4.09E-01		7.8	N (a)		---
Di-n-butyl phthalate	1 / 11	9	5.90E-02	J	5.90E-02	J	3.50E-01	2.06E+00	3.64E-01		610	N (a)		---
Dinitrotoluene, 2,4-	3 / 11	27	2.68E-01	J	4.00E+00		3.50E-01	2.06E+00	7.26E-01		0.71	Y	1.44E+00	1.44E+00
Dinitrotoluene, 2,6-	1 / 11	9	2.04E-01	J	2.04E-01	J	3.50E-01	2.06E+00	3.77E-01		0.71	N (a)		---
Fluoranthene	5 / 11	45	4.01E-02	J	1.26E+00	J	3.50E-01	2.06E+00	3.65E-01		230	N (a)		---
Indeno(1,2,3-cd)pyrene	1 / 11	9	1.30E-01	J	1.30E-01	J	3.50E-01	2.06E+00	3.71E-01		0.15	N (a)		---
Methylnaphthalene, 2-	2 / 11	18	1.66E+00	J	5.60E+00		3.50E-01	2.06E+00	9.00E-01		31	N (a)		---
Naphthalene	2 / 11	18	1.02E+00	J	3.40E+00		3.50E-01	2.06E+00	6.41E-01		3.6	N (a)		---
Phenanthrene	3 / 11	27	1.17E-01	JJ	1.50E+00		3.50E-01	2.06E+00	4.45E-01		170 i	N (a)		---
Pyrene	3 / 11	27	6.27E-02	J	1.13E+00	J	3.50E-01	2.06E+00	3.77E-01		170	N (a)		---

Table 3-7

Statistical Summary and COPC Selection for Chemicals Detected in LBA Surface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Volatile Organic Compounds														
Acetone	9 / 9	100	3.03E-02	J	2.65E-01	J	4.62E-02	5.92E-02	1.27E-01		6100	N (a)		---
Butanone, 2-	7 / 7	100	8.27E-03	J	1.36E-02	J	5.28E-02	5.92E-02	1.08E-02		2800	N (a)		---
Carbon disulfide	1 / 9	11	4.95E-03	JJ	4.95E-03	JJ	9.23E-03	1.18E-02	5.35E-03		82	N (a)		---
Toluene	1 / 9	11	1.04E-03	J	1.04E-03	J	9.23E-03	1.18E-02	4.92E-03		500	N (a)		---
Trichloroethane, 1,1,1-	3 / 9	33	1.39E-03	J	1.56E-02	J	9.23E-03	1.18E-02	6.08E-03		870	N (a)		---
Trichloroethene	1 / 9	11	2.63E-03	J	2.63E-03	J	9.23E-03	1.18E-02	5.06E-03		2.8	N (a)		---

BSC - Background screening criterion.
COPC - Chemical of Potential Concern.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/kg - Milligrams per kilogram.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas* , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.04 (U.S. Environmental Protection Agency (EPA), 2009, ProUCL Version 4.00.04, 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). Calculated only for COPC.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] RBSC based on thallium from EPA, 2010, Integrated Risk Information System.
[h] RBSC based on anthracene.
[i] RBSC based on pyrene.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-8

Statistical Summary and COPC Selection for Chemicals Detected in LBA Subsurface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]
Inorganics													
Aluminum	26 / 26	100	5.39E+03		1.72E+04		1.81E+00	3.00E+01	9.24E+03	1.55E+04	7700		Y
Antimony	17 / 26	65	2.70E-01	J	1.30E+00		4.54E-01	1.50E+00	5.23E-01	9.30E+00	3.1		N (b)
Arsenic	25 / 26	96	4.40E+00		1.77E+01		9.07E-01	1.50E+00	8.32E+00	3.65E+01	0.39		N (b)
Barium	26 / 26	100	2.07E+01		4.25E+02		1.85E-01	3.00E+01	8.59E+01	8.26E+02	1500		N (b)
Beryllium	19 / 26	73	6.60E-01		9.03E+00	J	1.81E-01	7.50E-01	4.77E+00	1.00E+00	16		N (a)
Cadmium	15 / 26	58	2.54E-01	J	6.71E-01		2.30E-01	5.26E-01	2.98E-01		7		N (a)
Calcium	26 / 26	100	1.32E+03	J	7.40E+04		4.54E+00	7.50E+02	2.13E+04	5.23E+04	Nutrient		N (c)
Chromium	26 / 26	100	1.10E+01		2.86E+01		4.54E-01	7.50E-01	1.57E+01	2.90E+01	0.29		N (b)
Cobalt	24 / 26	92	4.35E+00		5.38E+01	J	3.63E-01	7.50E+00	1.35E+01	1.16E+02	2.3		N (b)
Copper	26 / 26	100	7.80E+00		3.16E+01		4.54E-01	3.70E+00	2.11E+01	5.62E+01	310		N (b)
Iron	26 / 26	100	1.19E+04		4.64E+04		3.63E+00	1.50E+01	2.33E+04	2.34E+05	5500		N (b)
Lead	26 / 26	100	7.39E+00		2.30E+01		3.40E-01	5.26E-01	1.37E+01	4.86E+01	400		N (b)
Magnesium	26 / 26	100	1.05E+03	J	1.94E+04	J	1.81E+00	7.50E+02	8.33E+03	1.04E+04	Nutrient		N (c)
Manganese	26 / 26	100	1.46E+02		3.00E+03		1.81E-01	2.20E+00	6.70E+02	3.51E+03	180		N (b)
Mercury	15 / 26	58	1.18E-02	J	1.58E-01	J	2.11E-02	1.50E-01	4.37E-02	8.50E-02	2.3		N (a)
Nickel	26 / 26	100	1.07E+01		5.03E+01		2.72E-01	6.00E+00	2.90E+01	5.51E+01	150		N (b)
Potassium	26 / 26	100	2.05E+02		2.26E+03		2.27E+01	7.50E+02	9.59E+02	3.39E+03	Nutrient		N (c)
Selenium	1 / 26	4	5.16E-01	J	5.16E-01	J	5.70E-01	1.05E+00	4.36E-01	1.11E+01	39		N (b)
Sodium	18 / 26	69	2.67E+01		1.30E+02		9.07E+00	7.50E+02	1.48E+02		Nutrient		N (c)
Thallium	14 / 26	54	2.69E-01	J	6.78E-01		4.54E-01	1.50E+00	4.37E-01	1.30E+00	0.51	g	N (b)
Vanadium	26 / 26	100	1.83E+01		4.99E+01		1.81E-01	7.50E+00	2.57E+01	4.09E+01	39		Y
Zinc	26 / 26	100	3.00E+01		1.13E+02	J	2.27E+00	3.00E+00	7.33E+01	3.22E+02	2300		N (b)
Polychlorinated biphenyls (PCB)													
Aroclor 1260	1 / 14	7	6.10E-02	J	6.10E-02	J	3.70E-02	4.90E-02	2.32E-02		0.22		N (a)
Nitroaromatics													
Amino-2,6-dinitrotoluene, 4-	1 / 18	6	5.30E-01		5.30E-01		2.91E-01	3.00E-01	1.69E-01		15		N (a)
Amino-4,6-dinitrotoluene, 2-	2 / 18	11	1.63E-01	J	4.38E-01		2.91E-01	3.00E-01	1.65E-01		15		N (a)
Dinitrotoluene, 2,4-	6 / 18	33	3.21E-01		5.68E+00		2.91E-01	1.46E+00	6.04E-01		0.71		Y
Dinitrotoluene, 2,6-	2 / 18	11	8.42E-01	J	4.12E+00		2.91E-01	1.46E+00	4.07E-01		0.71		Y
Nitrotoluene, 2-	2 / 18	11	2.34E+00		2.27E+01		2.91E-01	2.91E+00	1.52E+00		2.9		Y
Nitrotoluene, 3-	2 / 18	11	3.08E-01		1.52E+00		2.91E-01	3.00E-01	2.33E-01		0.61		Y
Nitrotoluene, 4-	2 / 18	11	7.07E-01		1.18E+01		2.91E-01	1.46E+00	8.26E-01		24		N (a)
Semivolatile Organic Compounds													
Dinitrotoluene, 2,4-	8 / 23	35	2.30E-01	J	9.88E+00		3.70E-01	2.08E+00	9.91E-01		0.71		Y
Dinitrotoluene, 2,6-	5 / 23	22	7.71E-02	J	3.82E+00		3.70E-01	4.90E-01	4.59E-01		0.71		Y

Table 3-8

Statistical Summary and COPC Selection for Chemicals Detected in LBA Subsurface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]
Volatile Organic Compounds												
Acetone	12 / 12	100	2.10E-02	J	5.25E-02	J	1.46E-02	5.54E-02	3.34E-02		6100	N (a)
Benzene	6 / 18	33	1.21E-03	J	3.81E-03	J	8.89E-03	2.15E-02	4.27E-03		1.1	N (a)
Butanone, 2-	3 / 3	100	5.55E-03	J	7.91E-03	J	4.62E-02	4.74E-02	6.40E-03		2800	N (a)
Carbon disulfide	2 / 18	11	9.88E-04	J	3.07E-03	J	8.89E-03	2.15E-02	5.38E-03		82	N (a)
Dichloroethane, 1,1-	6 / 18	33	2.63E-03	J	3.45E-02	J	8.89E-03	2.15E-02	8.16E-03		3.3	N (a)
Dichloroethene, 1,1-	3 / 18	17	2.54E-03	J	5.63E-03	J	8.89E-03	2.15E-02	5.03E-03		24	N (a)
Dichloroethene, cis-1,2-	2 / 18	11	3.20E-03	J	9.86E-03	J	8.89E-03	2.15E-02	5.55E-03		78	N (a)
Naphthalene	2 / 18	11	1.51E-03	J	3.46E-03	J	8.89E-03	2.15E-02	4.99E-03		3.6	N (a)
Toluene	7 / 18	39	1.86E-03	J	5.99E-03	J	8.89E-03	2.15E-02	4.57E-03		500	N (a)
Trichloroethane, 1,1,1-	7 / 18	39	1.32E-02		1.21E+00	J	8.89E-03	5.49E-01	1.68E-01		870	N (a)
Trichloroethene	4 / 18	22	1.22E-02		1.21E-01		8.89E-03	2.15E-02	1.77E-02		2.8	N (a)
Trimethylbenzene, 1,2,4-	3 / 18	17	9.88E-04	J	1.78E-03	J	8.89E-03	2.15E-02	4.89E-03		6.2	N (a)

BSC - Background screening criterion.
COPC - Chemical of Potential Concern.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas* , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.04 (U.S. Environmental Protection Agency (EPA), 2009, ProUCL Version 4.00.04, 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). Calculated only for COPC.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] RBSC based on thallium from EPA, 2010, Integrated Risk Information System.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-9

Statistical Summary and COPC Selection for Chemicals Detected in LBA Total Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics															
Aluminum	37 / 37	100	4.40E+03		1.72E+04		1.81E+00	3.00E+01	8.45E+03	1.55E+04	7700		Y	9.11E+03	9.11E+03
Antimony	23 / 37	62	2.50E-01	J	1.30E+00		4.51E-01	1.50E+00	4.88E-01	9.30E+00	3.1		N (b)		---
Arsenic	36 / 37	97	4.40E+00		1.77E+01		9.02E-01	1.50E+00	8.06E+00	3.65E+01	0.39		N (b)		---
Barium	37 / 37	100	1.63E+01		4.25E+02		1.85E-01	3.00E+01	8.15E+01	8.26E+02	1500		N (b)		---
Beryllium	28 / 37	76	6.60E-01		9.26E+00	J	1.81E-01	7.50E-01	4.93E+00	1.00E+00	16		N (a)		---
Cadmium	22 / 37	59	2.53E-01	J	6.99E-01		2.10E-01	5.26E-01	3.23E-01		7		N (a)		---
Calcium	37 / 37	100	1.18E+03		7.40E+04		4.51E+00	7.50E+02	1.64E+04	5.23E+04	Nutrient		N (c)		---
Chromium	37 / 37	100	1.04E+01		5.10E+01		4.51E-01	7.50E-01	1.56E+01	2.90E+01	0.29		Y	1.77E+01	1.77E+01
Cobalt	33 / 37	89	3.52E+00		5.38E+01	J	3.61E-01	7.50E+00	1.20E+01	1.16E+02	2.3		N (b)		---
Copper	37 / 37	100	6.54E+00		3.16E+01		4.51E-01	3.70E+00	1.89E+01	5.62E+01	310		N (b)		---
Iron	37 / 37	100	1.19E+04		4.64E+04		3.63E+00	1.50E+01	2.18E+04	2.34E+05	5500		N (b)		---
Lead	37 / 37	100	5.29E+00		2.22E+02		3.20E-01	5.26E-01	2.06E+01	4.86E+01	400		N (a)		---
Magnesium	37 / 37	100	7.96E+02	J	1.94E+04	J	1.81E+00	7.50E+02	6.32E+03	1.04E+04	Nutrient		N (c)		---
Manganese	37 / 37	100	1.15E+02		3.00E+03		1.81E-01	2.20E+00	6.26E+02	3.51E+03	180		N (b)		---
Mercury	24 / 37	65	1.18E-02	J	1.58E-01	J	2.11E-02	1.50E-01	4.14E-02	8.50E-02	2.3		N (a)		---
Nickel	37 / 37	100	9.01E+00	J	5.03E+01		2.71E-01	6.00E+00	2.52E+01	5.51E+01	150		N (b)		---
Potassium	37 / 37	100	1.88E+02		2.26E+03		2.26E+01	7.50E+02	8.15E+02	3.39E+03	Nutrient		N (c)		---
Selenium	1 37	3	5.16E-01	J	5.16E-01	J	5.30E-01	1.05E+00	4.38E-01	2.00E+00	39		N (b)		
Sodium	27 / 37	73	1.88E+01		1.30E+02		9.02E+00	7.50E+02	1.28E+02		Nutrient		N (c)		---
Thallium	17 / 37	46	2.69E-01	J	6.78E-01		4.45E-01	1.50E+00	4.08E-01	1.30E+00	0.51	g	N (b)		---
Vanadium	37 / 37	100	1.83E+01		4.99E+01		1.81E-01	7.50E+00	2.51E+01	4.09E+01	39		Y	2.65E+01	2.65E+01
Zinc	37 / 37	100	2.60E+01		2.73E+02		2.10E+00	3.00E+00	7.25E+01	3.22E+02	2300		N (b)		---
Polychlorinated biphenyls (PCB)															
Aroclor 1221	1 / 25	4	1.90E-01		1.90E-01		3.50E-02	4.90E-02	2.69E-02		0.14		Y	3.96E-02	3.96E-02
Aroclor 1260	4 / 25	16	6.10E-02	J	1.90E-01		3.50E-02	4.90E-02	3.33E-02		0.22		N (a)		---
Nitroaromatics															
Amino-2,6-dinitrotoluene, 4-	3 / 27	11	3.24E-01		5.30E-01		2.88E-01	3.00E-01	1.82E-01		15		N (a)		---
Amino-4,6-dinitrotoluene, 2-	3 / 27	11	1.63E-01	J	4.38E-01		2.88E-01	3.00E-01	1.64E-01		15		N (a)		---
Dinitrotoluene, 2,6-	2 / 27	7	8.42E-01	J	4.12E+00		2.88E-01	1.46E+00	3.20E-01		0.71		Y	9.75E-01	9.75E-01
Nitrotoluene, 2-	2 / 27	7	2.34E+00		2.27E+01		2.88E-01	2.91E+00	1.06E+00		2.9		Y	7.66E+00	7.66E+00
Nitrotoluene, 3-	2 / 27	7	3.08E-01		1.52E+00		2.88E-01	3.00E-01	2.04E-01		0.61		Y	1.52E+00	1.52E+00
Nitrotoluene, 4-	2 / 27	7	7.07E-01		1.18E+01		2.88E-01	1.46E+00	6.00E-01		24		N (a)		---
Semivolatile Organic Compounds															
Acenaphthylene	2 / 34	6	7.06E-02	J	2.24E-01	J	3.50E-01	2.06E+00	2.33E-01		340	h	N (a)		---
Anthracene	2 / 34	6	8.11E-02	J	3.81E-01	J	3.50E-01	2.06E+00	2.38E-01		1700		N (a)		---
Benzo(a)anthracene	3 / 34	9	4.26E-02	J	6.52E-01	J	3.50E-01	2.06E+00	2.43E-01		0.15		Y	1.98E-01	1.98E-01
Benzo(a)pyrene	2 / 34	6	1.21E-01	JJ	3.95E-01	J	3.50E-01	2.06E+00	2.39E-01		0.015		Y	2.02E-01	2.02E-01
Benzo(b)fluoranthene	2 / 34	6	1.92E-01	JJ	8.78E-01	J	3.50E-01	2.06E+00	2.55E-01		0.15		Y	3.12E-01	3.12E-01
Benzo(ghi)perylene	1 / 34	3	1.06E-01	J	1.06E-01	J	3.50E-01	2.06E+00	2.57E-01		170	i	N (a)		---
Chrysene	3 / 34	9	3.95E-02	J	7.84E-01	J	3.50E-01	2.06E+00	2.47E-01		15		N (a)		---
Dibenzofuran	2 / 34	6	4.61E-01	J	1.40E+00	J	3.50E-01	2.06E+00	2.70E-01		7.8		N (a)		---
Di-n-butyl phthalate	1 / 34	3	5.90E-02	J	5.90E-02	J	3.50E-01	2.06E+00	2.56E-01		610		N (a)		---
Dinitrotoluene, 2,4-	11 / 34	32	2.30E-01	J	9.88E+00		3.50E-01	2.08E+00	9.05E-01		0.71		Y	1.52E+00	1.52E+00
Fluoranthene	5 / 34	15	4.01E-02	J	1.26E+00	J	3.50E-01	2.06E+00	2.56E-01		230		N (a)		---
Indeno(1,2,3-cd)pyrene	1 / 34	3	1.30E-01	J	1.30E-01	J	3.50E-01	2.06E+00	2.58E-01		0.15		N (a)		---
Methylnaphthalene, 2-	2 / 34	6	1.66E+00	J	5.60E+00		3.50E-01	2.06E+00	4.29E-01		31		N (a)		---

Table 3-9

Statistical Summary and COPC Selection for Chemicals Detected in LBA Total Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Naphthalene	2 / 34	6	1.02E+00	J	3.40E+00		3.50E-01	2.06E+00	3.46E-01		3.6	N (a)		---
Phenanthrene	3 / 34	9	1.17E-01	JJ	1.50E+00		3.50E-01	2.06E+00	2.82E-01		170 [i]	N (a)		---
Pyrene	3 / 34	9	6.27E-02	J	1.13E+00	J	3.50E-01	2.06E+00	2.60E-01		170	N (a)		---
Volatile Organic Compounds														
Acetone	21 / 21	100	2.10E-02	J	2.65E-01	J	1.46E-02	5.92E-02	7.36E-02		6100	N (a)		---
Benzene	6 27	22	1.21E-03	J	3.81E-03	J	8.89E-03	2.15E-02	4.64E-03		1.1	N (a)		
Butanone, 2-	10 / 10	100	5.55E-03	J	1.36E-02	J	4.62E-02	5.92E-02	9.50E-03		2800	N (a)		---
Carbon disulfide	3 / 27	11	9.88E-04	J	4.95E-03	JJ	8.89E-03	2.15E-02	5.37E-03		82	N (a)		---
Dichloroethane, 1,1-	6 27	22	2.63E-03	J	3.45E-02	J	8.89E-03	2.15E-02	7.24E-03		3.3	N (a)		
Dichloroethene, 1,1-	3 27	11	2.54E-03	J	5.63E-03	J	8.89E-03	2.15E-02	5.15E-03		24	N (a)		
Dichloroethene, cis-1,2-	2 27	7	3.20E-03	J	9.86E-03	J	8.89E-03	2.15E-02	5.49E-03		78	N (a)		
Naphthalene	2 27	7	1.51E-03	J	3.46E-03	J	8.89E-03	2.15E-02	5.12E-03		3.6	N (a)		
Toluene	8 / 27	30	1.04E-03	J	5.99E-03	J	8.89E-03	2.15E-02	4.69E-03		500	N (a)		---
Trichloroethane, 1,1,1-	10 / 27	37	1.39E-03	J	1.21E+00	J	8.89E-03	5.49E-01	1.14E-01		870	N (a)		---
Trichloroethene	5 / 27	19	2.63E-03	J	1.21E-01		8.89E-03	2.15E-02	1.35E-02		2.8	N (a)		---
Trimethylbenzene, 1,2,4-	3 27	11	9.88E-04	J	1.78E-03	J	8.89E-03	2.15E-02	5.05E-03		6.2	N (a)		

BSC - Background screening criterion.
COPC - Chemical of Potential Concern.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/kg - Milligrams per kilogram.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas* , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.04 (U.S. Environmental Protection Agency (EPA), 2009, ProUCL Version 4.00.04, 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). Calculated only for COPC.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] RBSC based on thallium from EPA, 2010, Integrated Risk Information System.
[h] RBSC based on anthracene.
[i] RBSC based on pyrene.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-10

Statistical Summary and COPC Selection for Chemicals Detected in LBA Maintenance Pit Material
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

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Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]	EPC [e] mg/kg
Inorganics														
Aluminum	3 / 3	100	2.20E+03		9.16E+03		1.72E+00	1.76E+00	6.37E+03	1.55E+04	7700		N (b)	---
Antimony	3 / 3	100	2.88E-01	J	1.46E+00	J	4.30E-01	4.39E-01	9.96E-01	9.30E+00	3.1		N (b)	---
Arsenic	3 / 3	100	1.38E+00	J	3.41E+00	J	8.60E-01	8.78E-01	2.08E+00	3.65E+01	0.39		N (b)	---
Barium	3 / 3	100	2.67E+01		1.20E+02		1.72E-01	1.76E-01	8.03E+01	8.26E+02	1500		N (b)	---
Beryllium	3 / 3	100	1.14E+00	J	1.20E+00	J	1.72E-01	1.76E-01	1.16E+00	1.00E+00	16		N (a)	---
Cadmium	2 / 3	67	2.21E-01	J	2.64E-01	J	4.30E-01	4.39E-01	2.35E-01		7		N (a)	---
Calcium	3 / 3	100	2.40E+05	J	2.88E+05	J	8.60E+01	8.78E+01	2.72E+05	5.23E+04	Nutrient		N (c)	---
Chromium	3 / 3	100	4.63E+00		9.62E+00		4.30E-01	4.39E-01	6.85E+00	2.90E+01	0.29		N (b)	---
Cobalt	3 / 3	100	1.65E+00	J	2.13E+00	J	3.44E-01	3.51E-01	1.84E+00	1.16E+02	2.3		N (b)	---
Copper	3 / 3	100	9.11E+00	J	1.14E+01	J	4.30E-01	4.39E-01	1.03E+01	5.62E+01	310		N (b)	---
Iron	3 / 3	100	4.92E+03		6.98E+03		3.44E+00	3.51E+00	5.76E+03	2.34E+05	5500		N (b)	---
Lead	3 / 3	100	7.71E+00		1.29E+01		4.30E-01	4.39E-01	1.05E+01	4.86E+01	400		N (b)	---
Magnesium	3 / 3	100	2.35E+04	J	2.96E+04	J	1.72E+00	1.76E+00	2.72E+04	1.04E+04	Nutrient		N (c)	---
Manganese	3 / 3	100	3.69E+02	J	1.05E+03	J	1.72E-01	1.76E-01	7.95E+02	3.51E+03	180		N (b)	---
Mercury	3 / 3	100	9.31E-03	J	1.70E-02	J	1.86E-02	1.99E-02	1.41E-02	8.50E-02	2.3		N (b)	---
Nickel	3 / 3	100	5.06E+00	J	7.33E+00	J	2.58E-01	2.63E-01	5.99E+00	5.51E+01	150		N (b)	---
Potassium	3 / 3	100	3.05E+02		4.62E+02		2.15E+01	2.19E+01	3.93E+02	3.39E+03	Nutrient		N (c)	---
Silver	3 3	100	4.80E-01		2.25E+00		4.30E-01	4.39E-01	1.25E+00	1.11E+01	39		N (b)	---
Sodium	3 / 3	100	1.42E+02		2.62E+02		8.60E+00	8.78E+00	2.09E+02		Nutrient		N (c)	---
Vanadium	3 / 3	100	6.31E+00		7.96E+00		1.72E-01	1.76E-01	6.96E+00	4.09E+01	39		N (b)	---
Zinc	3 / 3	100	1.63E+01		4.47E+01		2.15E+00	2.19E+00	3.16E+01	3.22E+02	2300		N (b)	---
Semivolatile Organic Compounds														
Acenaphthylene	1 / 3	33	1.95E-01	J	1.95E-01	J	1.78E+00	1.82E+00	6.63E-01		340	f	N (a)	---
Anthracene	1 / 3	33	2.57E-01	J	2.57E-01	J	1.78E+00	1.82E+00	6.84E-01		1700		N (a)	---
Benzo(a)anthracene	3 / 3	100	1.63E-01	J	6.51E-01	J	1.78E+00	1.82E+00	3.31E-01		0.15		Y	6.51E-01
Benzo(a)pyrene	1 / 3	33	4.98E-01	J	4.98E-01	J	1.78E+00	1.82E+00	7.64E-01		0.015		Y	4.98E-01
Benzo(b)fluoranthene	2 / 3	67	3.27E-01	J	1.01E+00	J	1.78E+00	1.82E+00	7.42E-01		0.15		Y	1.01E+00
Bis(2-ethylhexyl)phthalate	2 3	67	2.41E-01	J	7.40E-01	J	1.78E+00	1.82E+00	6.29E-01		35		N (a)	---
Chrysene	3 / 3	100	2.51E-01	J	7.19E-01	J	1.78E+00	1.82E+00	4.14E-01		15		N (a)	---
Fluoranthene	3 / 3	100	1.71E-01	J	1.02E+00	J	1.78E+00	1.82E+00	4.74E-01		230		N (a)	---
Phenanthrene	1 / 3	33	2.02E-01	J	2.02E-01	J	1.78E+00	1.82E+00	6.66E-01		170	g	N (a)	---
Pyrene	3 / 3	100	2.13E-01	J	9.10E-01	J	1.78E+00	1.82E+00	4.48E-01		170		N (a)	---

Table 3-10

Statistical Summary and COPC Selection for Chemicals Detected in LBA Maintenance Pit Material
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

BSC - Background screening criterion.
COPC - Chemical of Potential Concern.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/kg - Milligrams per kilogram.
RBSC - Risk based screening concentration.
VQ - Validation qualifier.
GMA - Garage Maintenance Area.
RIR - Remedial investigation report.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas* , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] Concentration used in risk assessment is equal to the maximum detected concentration.
[f] RBSC based on anthracene.
[g] RBSC based on pyrene.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-11

Statistical Summary and COPC Selection for Chemicals Detected in LBA Bedrock Groundwater
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Arithmetic Mean µg/L	BSC [a] µg/L	RBSC [b] µg/L		COPC? [c,d]	95% UCL [e] µg/L	EPC [f] µg/L	EPC mg/L
Inorganics																
Aluminum	3 / 3	100	7.96E+01	J	1.55E+02	J	2.00E+02	2.00E+02	1.24E+02	3.09E+02	3700		N (a)		---	
Arsenic	3 / 5	60	1.99E+01		1.31E+02		1.00E+01	1.00E+01	3.78E+01	7.40E+00	0.045		Y	1.31E+02	1.31E+02	1.31E-01
Barium	5 / 5	100	3.05E+02		7.62E+02		2.00E+02	2.00E+02	4.91E+02	1.18E+04	730		N (b)		---	
Cadmium	1 / 5	20	1.40E+00	J	1.40E+00	J	5.00E+00	5.00E+00	2.28E+00		1.8		N (a)		---	
Calcium	5 / 5	100	2.80E+05		4.62E+05		1.00E+03	1.00E+03	3.52E+05	3.16E+05	Nutrient		N (c)		---	
Iron	4 / 5	80	1.80E+02	J	2.94E+03		3.00E+02	3.00E+02	8.49E+02	1.55E+03	2600		Y	2.02E+03	2.02E+03	2.02E+00
Lead	1 / 5	20	2.60E+00	J	2.60E+00	J	5.00E+00	1.00E+01	3.02E+00		15	g	N (a)		---	
Magnesium	5 / 5	100	2.12E+05		3.52E+05		5.00E+03	5.00E+03	2.63E+05	2.17E+05	Nutrient		N (c)		---	
Manganese	5 / 5	100	8.58E+01		1.07E+03		1.50E+01	1.50E+01	3.27E+02	6.36E+02	88		Y	1.21E+03	1.07E+03	1.07E+00
Nickel	1 / 5	20	7.20E+00	J	7.20E+00	J	4.00E+01	4.00E+01	1.74E+01	8.60E+00	73		N (a)		---	
Potassium	5 / 5	100	5.76E+04		1.20E+05		1.00E+04	2.00E+04	8.97E+04	1.16E+05	Nutrient		N (c)		---	
Selenium	2 / 4	50	8.50E+00	J	1.17E+01	J	1.00E+01	2.00E+01	8.80E+00		18		N (a)		---	
Sodium	5 / 5	100	6.38E+05		1.23E+06		1.00E+05	4.00E+05	9.82E+05	1.39E+06	Nutrient		N (c)		---	
Thallium	2 / 5	40	3.80E+00	J	6.40E+00	J	1.00E+01	1.00E+01	5.04E+00		0.24		Y	7.87E+00	6.40E+00	6.40E-03
Vanadium	4 / 5	80	1.40E+00	J	2.80E+00	J	5.00E+01	5.00E+01	6.48E+00		18		N (a)		---	
Zinc	1 / 2	50	1.16E+01	J	1.16E+01	J	2.00E+01	4.00E+01	1.58E+01	5.01E+02	1100		N (a)		---	
Semivolatile Organic Compounds																
3-Methylphenol and 4-Methylphenol	1 / 5	20	5.20E+00		5.20E+00		4.80E+00	1.00E+02	1.40E+01		93		N (a)		---	
Dimethylphenol, 2,4-	3 / 5	60	1.50E+00	J	1.23E+01		4.80E+00	1.00E+02	1.51E+01		73		N (a)		---	
Fluorene	1 / 5	20	5.40E+00	J	5.40E+00	J	4.80E+00	1.00E+02	1.26E+01		150		N (a)		---	
Methylnaphthalene, 2-	5 / 5	100	6.30E+00		2.56E+02	J	4.80E+00	1.00E+02	7.25E+01		15		Y	4.06E+02	2.56E+02	2.56E-01
Methylphenol, 2-	1 / 5	20	5.60E+00		5.60E+00		4.80E+00	1.00E+02	1.41E+01		180		N (a)		---	
Naphthalene	5 / 5	100	4.50E+00	J	6.49E+01	J	4.80E+00	1.00E+02	2.40E+01		0.14		Y	4.72E+01	4.72E+01	4.72E-02
Phenanthrene	2 / 5	40	1.27E+01	J	3.73E+01	J	4.80E+00	1.00E+02	1.15E+01		110		N (a)		---	
Phenol	1 / 5	20	8.00E+00		8.00E+00		4.80E+00	1.00E+02	1.46E+01		1100		N (a)		---	
Volatile Organic Compounds																
Acetone	2 / 3	67	5.07E+01	J	3.45E+02	J	2.50E+01	5.00E+02	1.36E+02		2200		N (a)		---	
Benzene	4 / 5	80	3.70E+00		1.68E+03	J	1.00E+00	2.00E+01	3.68E+02		0.41		Y	1.85E+03	1.68E+03	1.68E+00
Butanone, 2-	3 / 5	60	1.32E+01		8.13E+01	J	5.00E+00	1.00E+02	3.12E+01		710		N (a)		---	
Carbon disulfide	2 / 5	40	3.80E+00		1.16E+01	J	2.00E+00	4.00E+01	7.48E+00		100		N (a)		---	
Chloroform	2 / 5	40	2.68E+01		6.67E+01		1.00E+00	2.00E+01	1.90E+01		0.19		Y	5.63E+01	5.63E+01	5.63E-02
Chloromethane	2 / 5	40	1.28E+01		3.56E+01	J	2.00E+00	4.00E+01	1.41E+01		19		Y	3.34E+01	3.34E+01	3.34E-02
Ethylbenzene	5 / 5	100	9.90E+00		1.69E+02		1.00E+00	2.00E+01	5.12E+01		1.5		Y	2.06E+02	1.69E+02	1.69E-01
Methyl-2-pentanone, 4-	1 / 5	20	3.30E+00	J	3.30E+00	J	5.00E+00	1.00E+02	2.17E+01		200		N (a)		---	
Methylene chloride	1 / 5	20	7.76E+01	J	7.76E+01	J	5.00E+00	1.00E+02	2.70E+01		4.8		Y	6.04E+01	6.04E+01	6.04E-02
Tetrachloroethane, 1,1,2,2-	2 / 5	40	1.20E+00		3.70E+00		1.00E+00	2.00E+01	5.08E+00		0.067		Y	4.09E+00	3.70E+00	3.70E-03
Toluene	5 / 5	100	1.00E+01		6.92E+02		1.00E+00	2.00E+01	1.68E+02		230		Y	1.15E+03	6.92E+02	6.92E-01
Xylenes, total	5 / 5	100	9.72E+01		1.13E+03		3.00E+00	6.00E+01	3.66E+02		20		Y	1.22E+03	1.13E+03	1.13E+00
General Chemistry																
Chloride	5 / 5	100	1.32E+05		3.26E+06		5.00E+04	2.00E+05	1.99E+06		Nutrient		N (c)		---	
Cyanide, total	3 / 5	60	1.40E+01	J	1.10E+02	J	1.00E+01	1.00E+01	4.10E+01		73		Y	1.10E-01	1.10E-01	
Sulfate	4 / 5	80	9.60E+03		2.18E+05		2.00E+03	5.00E+04	6.14E+04		250000	h	N (a)		---	

µg/L - micrograms per liter.
BSC - Background screening concentration.
COPC - Chemical of Potential Concern.
GMA - Garage Maintenance Area.

Table 3-11

Statistical Summary and COPC Selection for Chemicals Detected in LBA Bedrock Groundwater
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/L - milligrams per liter.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Shaw Environmental, Inc. (Shaw), 2005b, 2004 Groundwater Data Summary and Evaluation Report, Final, Former Plum Brook Ordnance Works, Sandusky, Ohio, April.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (April 2009) tap water values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] 95% Upper confidence limit (UCL) determined using ProUCL Version 4.00.04 (U.S. Environmental Protection Agency (EPA), 2009, ProUCL Version 4.00.04, 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). Calculated only for COPC.
[f] Exposure point concentration (EPC) used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] Screening criteria for lead based on the action level of 15 µg/L (EPA, 1996, *Drinking Water Regulations and Health Advisories* , Office of Water, Washington, DC, October).
[h] US Environmental Protection Agency (EPA), 2009, ***2009 Edition of the Drinking Water Standards and Health Advisories*** , Office of Water, October, EPA 822-R-09-011.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-12

Statistical Summary and COPC Selection for Chemicals Detected in LBA Overburden Groundwater
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentrations Minimum	VQ	Detected Concentrations Maximum	VQ	Reporting Limits Minimum	Reporting Limits Maximum	Arithmetic Mean µg/L	RBSC [b] µg/L		COPC? [c,d]	95% UCL [e] µg/L	EPC [f] µg/L	EPC mg/L
Inorganics															
Aluminum	7 / 8	88	2.04E+01	J	1.34E+03		2.00E+02	2.00E+02	4.24E+02	3700		N (a)		---	
Barium	10 / 10	100	5.58E+01	J	2.60E+02		2.00E+02	2.00E+02	1.01E+02	730		N (a)		---	
Calcium	10 / 10	100	2.54E+04		1.89E+05		1.00E+03	1.00E+03	9.74E+04	Nutrient		N (b)		---	
Chromium	2 / 10	20	2.80E+00	J	3.30E+00	J	1.00E+01	1.00E+01	4.61E+00	0.043		Y	3.51E+00	3.30E+00	3.30E-03
Cobalt	3 / 10	30	2.30E+00	J	6.10E+00	J	5.00E+01	5.00E+01	1.87E+01	1.1		Y	6.07E+00	6.07E+00	6.07E-03
Iron	5 / 10	50	2.04E+02	JJ	2.83E+03		3.00E+02	3.00E+02	7.22E+02	2600		Y	1.48E+03	1.48E+03	1.48E+00
Lead	2 / 7	29	2.10E+00	J	2.30E+00	J	5.00E+00	1.00E+01	3.49E+00	15	g	N (a)		---	
Magnesium	10 / 10	100	1.50E+04		4.79E+04		5.00E+03	5.00E+03	2.98E+04	Nutrient		N (b)		---	
Manganese	10 / 10	100	5.30E+01		4.58E+02		1.50E+01	1.50E+01	2.33E+02	88		Y	3.29E+02	3.29E+02	3.29E-01
Nickel	7 / 10	70	2.40E+00	J	2.10E+01	J	4.00E+01	4.00E+01	1.14E+01	73		N (a)		---	
Potassium	10 / 10	100	1.90E+03	JJ	1.90E+04	J	1.00E+04	1.00E+04	9.26E+03	Nutrient		N (b)		---	
Selenium	3 / 10	30	4.50E+00	J	6.30E+00	J	1.00E+01	2.00E+01	6.07E+00	18		N (a)		---	
Sodium	10 / 10	100	5.78E+03	JJ	9.71E+04		1.00E+04	2.00E+04	4.37E+04	Nutrient		N (b)		---	
Vanadium	2 / 10	20	3.00E+00	J	3.40E+00	J	5.00E+01	5.00E+01	2.06E+01	18		N (a)		---	
Zinc	4 / 8	50	9.20E+00	J	1.83E+01	J	2.00E+01	4.00E+01	1.33E+01	1100		N (a)		---	
Nitroaromatics															
Amino-2,6-dinitrotoluene, 4-	2 / 10	20	2.80E-01		4.80E-01	J	1.90E-01	2.00E-01	1.54E-01	7.3		N (a)		---	
Amino-4,6-dinitrotoluene, 2-	2 / 10	20	2.00E-01		4.15E-01	JJ	1.90E-01	2.00E-01	1.39E-01	7.3		N (a)		---	
Dinitrotoluene, 2,4-	3 / 10	30	2.30E-01		1.06E+01	JJ	1.90E-01	2.00E-01	1.96E+00	0.099		Y	4.67E+00	4.67E+00	4.67E-03
Dinitrotoluene, 2,6-	3 / 10	30	2.90E-01		9.15E+00	JJ	1.90E-01	2.00E-01	1.67E+00	0.099		Y	3.99E+00	3.99E+00	3.99E-03
HMX	1 / 10	10	3.20E-01		3.20E-01		1.90E-01	2.00E-01	1.19E-01	180		N (a)		---	
Nitrotoluene, 2-	4 / 10	40	1.80E+00		4.14E+01	JJ	1.90E-01	8.95E-01	8.27E+00	0.31		Y	3.77E+01	3.77E+01	3.77E-02
Nitrotoluene, 3-	2 / 10	20	4.30E+00	JJ	5.15E+00	JJ	1.90E-01	2.00E-01	1.02E+00	0.37		Y	4.59E+00	4.59E+00	4.59E-03
Nitrotoluene, 4-	4 / 10	40	6.10E-01		4.58E+00	JJ	1.90E-01	2.00E-01	1.13E+00	4.2		Y	4.40E+00	4.40E+00	4.40E-03
Volatile Organic Compounds															
Acetone	1 / 8	13	1.00E+01	J	1.00E+01	J	2.50E+01	2.50E+01	1.22E+01	2200		N (a)		---	
Bromoform	1 / 10	10	3.60E-01	J	3.60E-01	J	1.00E+00	1.00E+00	4.86E-01	8.5		N (a)		---	
Carbon disulfide	1 / 10	10	5.40E-01	J	5.40E-01	J	2.00E+00	2.00E+00	9.54E-01	100		N (a)		---	
Carbon tetrachloride	1 / 10	10	4.00E+00		4.00E+00		1.00E+00	1.00E+00	8.50E-01	0.2		Y	2.38E+00	2.38E+00	2.38E-03
Dibromochloromethane	1 / 10	10	2.00E-01	J	2.00E-01	J	1.00E+00	1.00E+00	4.70E-01	0.15		Y	5.25E-01	2.00E-01	2.00E-04
Dichloroethane, 1,1-	6 / 10	60	1.55E+00		8.30E+00		1.00E+00	1.00E+00	2.57E+00	2.4		Y	4.44E+00	4.44E+00	4.44E-03
Dichloroethene, 1,1-	4 / 10	40	6.80E-01	J	1.40E+00		1.00E+00	1.00E+00	7.38E-01	34		N (a)		---	
Dichloroethene, cis-1,2-	2 / 10	20	8.05E-01	JJ	8.40E-01	JJ	1.00E+00	1.00E+00	5.65E-01	37		N (a)		---	
Trichloroethane, 1,1,1-	5 / 10	50	1.30E+00		3.84E+01		1.00E+00	1.00E+00	1.31E+01	910		N (a)		---	
Trichloroethene	2 / 10	20	4.55E+00		5.40E+00		1.00E+00	1.00E+00	1.40E+00	2		Y	4.84E+00	4.84E+00	4.84E-03
General Chemistry															
Chloride	10 / 10	100	6800		195000	J	2.00E+03	2.00E+05	5.40E+04	Nutrient		N (b)		---	
Cyanide, total	4 / 10	40	7.5	J	13		1.00E+01	1.00E+01	7.20E+00	73		N (a)		---	
Nitrate-Nitrite	5 / 10	50	32	J	730	JJ	1.00E+02	2.00E+03	5.48E+02	1000	f	N (a)		---	
Sulfate	10 / 10	100	4300		282000		2.00E+03	1.00E+04	1.02E+05	250000	g	Y		2.82E+05	

µg/L - micrograms per liter.
COPC - Chemical of Potential Concern.
GMA - Garage Maintenance Area.

Table 3-12

Statistical Summary and COPC Selection for Chemicals Detected in LBA Overburden Groundwater
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Arithmetic Mean µg/L	RBSC [b] µg/L	COPC? [c,d]	95% UCL [e] µg/L	EPC [f] µg/L	EPC mg/L

J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/L - milligrams per liter.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Shaw Environmental, Inc. (Shaw), 2005b, 2004 Groundwater Data Summary and Evaluation Report, Final, Former Plum Brook Ordnance Works, Sandusky, Ohio, April.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) tap water values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] Screening criteria for lead based on the action level of 15 µg/L (EPA, 1996, *Drinking Water Regulations and Health Advisories* , Office of Water, Washington, DC, October).
[f] Because no Regional Screening Level exists for nitrate-nitrite, 0.1 X the nitrate-nitrite MCL (10 mg/L) is used for screening.
[g] US Environmental Protection Agency (EPA), 2009, ***2009 Edition of the Drinking Water Standards and Health Advisories*** , Office of Water, October, EPA 822-R-09-011.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-13

Statistical Summary and COPC Selection for Chemicals Detected in LBA Sediment
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	RBSC [a] mg/kg	COPC? [b,c]	95% UCL [d] mg/kg	EPC [e] mg/kg
Inorganics													
Aluminum	6 / 6	100	5.71E+03	J	1.03E+04		1.30E+01	1.40E+01	7.78E+03	7.70E+04	N (a)		---
Arsenic	6 / 6	100	8.30E+00	J	1.78E+01	J	5.10E-01	5.60E-01	1.20E+01	3.90E-01	Y	1.52E+01	1.52E+01
Barium	6 / 6	100	5.88E+01	J	9.21E+01	J	1.30E+01	1.40E+01	7.61E+01	1.50E+04	N (a)		---
Beryllium	6 / 6	100	6.10E-01		9.60E-01		3.20E-01	3.50E-01	7.46E-01	1.60E+02	N (a)		---
Cadmium	6 / 6	100	4.60E-01	J	1.90E+00		2.50E-01	2.80E-01	8.32E-01	7.00E+01	N (a)		---
Calcium	6 / 6	100	3.26E+03		1.12E+04	J	3.20E+02	3.50E+02	6.54E+03	Nutrient	N (b)		---
Chromium	6 / 6	100	1.04E+01		1.82E+01		6.30E-01	6.90E-01	1.37E+01	2.90E-01	Y	1.62E+01	1.62E+01
Cobalt	6 / 6	100	1.08E+01		2.60E+01	J	3.20E+00	3.50E+00	1.71E+01	2.30E+01	Y	2.28E+01	2.28E+01
Copper	6 / 6	100	1.05E+01	J	2.28E+01		1.60E+00	1.70E+00	1.75E+01	3.10E+03	N (a)		---
Iron	6 / 6	100	1.87E+04	J	3.02E+04	J	6.30E+00	6.90E+00	2.28E+04	5.50E+04	N (a)		---
Lead	6 / 6	100	9.00E+00	J	1.79E+01	J	6.30E+00	6.90E+00	1.15E+01	4.00E+02	N (a)		---
Magnesium	6 / 6	100	1.59E+03	J	4.94E+03		3.20E+02	3.50E+02	3.00E+03	Nutrient	N (b)		---
Manganese	6 / 6	100	7.37E+02		5.36E+03		5.00E+00	2.10E+01	1.84E+03	1.80E+03	Y	3.98E+03	3.98E+03
Mercury	5 / 6	83	2.20E-02	J	3.10E-02	J	9.90E-02	1.20E-01	2.88E-02	2.30E+01	N (a)		---
Nickel	6 / 6	100	2.61E+01	J	5.22E+01		2.50E+00	2.80E+00	3.42E+01	1.50E+03	N (a)		---
Potassium	6 / 6	100	6.14E+02	J	1.40E+03		1.30E+03	1.40E+03	9.43E+02	Nutrient	N (b)		---
Selenium	6 / 6	100	1.70E+00	J	3.00E+00	J	6.30E+00	6.90E+00	2.09E+00	3.90E+02	N (a)		---
Sodium	6 / 6	100	1.10E+02	J	1.92E+02	J	1.30E+03	1.40E+03	1.57E+02	Nutrient	N (b)		---
Thallium	2 / 6	33	2.60E-01	J	1.90E+00		6.30E-01	1.40E+00	5.78E-01	5.10E-01 [f]	Y	1.90E+00	1.90E+00
Vanadium	6 / 6	100	1.94E+01	J	2.65E+01	J	3.20E+00	3.50E+00	2.35E+01	3.90E+02	N (a)		---
Zinc	6 / 6	100	5.24E+01	J	8.03E+01		1.30E+00	1.40E+00	6.28E+01	2.30E+04	N (a)		---
Semivolatiles Organic Compounds													
Benzo(b)fluoranthene	1 / 6	17	4.70E-02	JJ	4.70E-02	JJ	2.10E-01	2.40E-01	1.03E-01	1.50E-01	N (a)		---
Fluoranthene	1 / 6	17	8.36E-02	JJ	8.36E-02	JJ	2.10E-01	2.40E-01	1.09E-01	2.30E+03	N (a)		---
Phenanthrene	1 / 6	17	5.46E-02	J	5.46E-02	J	2.10E-01	2.40E-01	1.04E-01	1.70E+02 [g]	N (a)		---
Pyrene	1 / 6	17	6.28E-02	JJ	6.28E-02	JJ	2.10E-01	2.40E-01	1.05E-01	1.70E+02	N (a)		---
Volatiles Organic Compounds													
Acetone	1 / 6	17	9.21E-02	J	9.21E-02	J	5.80E-02	7.10E-02	4.31E-02	6.10E+03	N (a)		---
Carbon disulfide	1 / 6	17	1.90E-03	J	1.90E-03	J	5.80E-03	7.10E-03	3.11E-03	8.20E+01	N (a)		---
Methylene chloride	1 / 5	20	5.82E-02		5.82E-02		1.20E-02	1.40E-02	1.69E-02	1.10E+01	N (a)		---

COPC - Chemical of Potential Concern
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/kg - Milligrams per kilogram.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) residential soil and are based on a risk level of 1.0E-06 and a hazard index of 1.
[b] N = Chemical is not chosen as a COPC:

Table 3-13

Statistical Summary and COPC Selection for Chemicals Detected in LBA Sediment
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

(a) = maximum detected concentration is less than the RBSC.
(b) = essential nutrient.
[c] Y = Chemical is chosen as COPC.
[d] 95% Upper confidence limit (UCL) determined using ProUCL Version 4.0 (EPA, 2007, ProUCL Version 4.0, Office of Research and Development, Technology Support Center Characterization and Monitoring Branch, Las Vegas, Nevada, April,on line at http://www.epa.gov/esd/tsc/form.htm). Calculated only for COPC.
[e] Expsoure point concentration (EPC) used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] RBSC based on thallium from EPA, 2010, Integrated Risk Information System.
[g] RBSC based on pyrene.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-14

Statistical Summary and COPC Selection for Chemicals Detected in LBA Surface Water
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentration Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Arithmetic Mean µg/L	RBSC [a] µg/L	COPC? [b,c]	95% UCL [d] µg/L	EPC [e] µg/L
Inorganics													
Aluminum	6 / 6	100	1.66E+03		2.38E+04		2.00E+02	2.00E+02	5.67E+03	3.70E+04	N (a)		---
Arsenic	1 / 7	14	8.80E+00	J	8.80E+00	J	1.00E+01	1.00E+01	5.54E+00	4.50E-02	Y	6.69E+00	6.69E+00
Barium	7 / 7	100	4.16E+01	J	1.55E+02	J	2.00E+02	2.00E+02	7.62E+01	7.30E+03	N (a)		---
Beryllium	1 / 7	14	1.10E+00	J	1.10E+00	J	4.00E+00	4.00E+00	1.87E+00	7.30E+00	N (a)		---
Calcium	7 / 7	100	1.10E+05		1.51E+05		1.00E+03	1.00E+03	1.35E+05	Nutrient	N (b)		---
Chromium	6 / 7	86	2.60E+00	J	3.98E+01		1.00E+01	1.00E+01	8.85E+00	4.30E-02	Y	3.16E+01	3.16E+01
Cobalt	5 / 7	71	2.35E+00	JJ	1.63E+01	J	5.00E+01	5.00E+01	1.12E+01	1.10E+01	Y	1.74E+01	1.63E+01
Copper	1 / 7	14	3.85E+01		3.85E+01		2.50E+01	2.50E+01	1.62E+01	1.50E+02	N (a)		---
Iron	7 / 7	100	1.09E+03		4.39E+04		3.00E+02	3.00E+02	9.50E+03	2.60E+04	Y	2.28E+04	2.28E+04
Lead	6 / 7	86	2.60E+00	J	1.80E+01		5.00E+00	1.00E+01	6.15E+00	1.50E+01 [d]	Y	NA	6.15E+00
Magnesium	7 / 7	100	1.74E+04		2.93E+04		5.00E+03	5.00E+03	2.66E+04	Nutrient	N (b)		---
Manganese	7 / 7	100	3.81E+02		2.22E+03		1.50E+01	1.50E+01	1.19E+03	8.80E+02	Y	1.71E+03	1.71E+03
Nickel	6 / 7	86	4.80E+00	J	7.16E+01		4.00E+01	4.00E+01	1.85E+01	7.30E+02	N (a)		---
Potassium	7 / 7	100	1.28E+03	J	6.54E+03	J	1.00E+04	2.00E+04	3.03E+03	Nutrient	N (b)		---
Selenium	3 / 7	43	3.50E+00	J	4.40E+00	J	1.00E+01	1.00E+01	4.50E+00	1.80E+01	N (a)		---
Sodium	7 / 7	100	1.82E+04		3.45E+04		1.00E+04	1.00E+04	2.81E+04	Nutrient	N (b)		---
Vanadium	6 / 7	86	4.50E+00	J	4.61E+01	J	5.00E+01	5.00E+01	1.40E+01	1.80E+02	N (a)		---
Zinc	6 / 7	86	1.97E+01	J	1.77E+02		2.00E+01	2.00E+01	4.80E+01	1.10E+04	N (a)		---
Volatile Organics													
Dichloroethane, 1,1-	4 / 7	57	2.50E-01	J	3.90E-01	J	1.00E+00	1.00E+00	4.12E-01	2.4	N (a)		---
Dichloroethene, cis-1,2-	1 / 7	14	2.30E-01	JJ	2.30E-01	JJ	1.00E+00	1.00E+00	4.61E-01	37	N (a)		---
Trichloroethane, 1,1,1-	2 / 7	29	4.70E-01	J	5.60E-01	JJ	1.00E+00	1.00E+00	5.04E-01	910	N (a)		---

µg/L - Micrograms per liter.
COPC - Chemical of Potential Concern.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
NA - Not applicable.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2010) tap water values are based on a risk level of 1.0E-06 and a hazard index of 1.
[b] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = essential nutrient.
[c] Y = Chemical is chosen as COPC.
[d] Screening criteria for lead based on the action level of 15 µg/L (EPA, 1996, *Drinking Water Regulations and Health Advisories* , Office of Water, Washington, DC, October).
[d] 95% Upper confidence limit (UCL) determined using ProUCL Version 4.00.04 (U.S. Environmental Protection Agency (EPA), 2009, ProUCL Version 4.00.04, 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). Calculated only for COPC
[e] Exposure point concentration (EPC) used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower. The EPC for lead is the mean.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-15

Summary of Risk for All Receptors in the LBA
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Groundskeeper [a]		Construction Worker		Indoor Worker		Resident			Hunter		Hunter's Child	
	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total Adult - HI	Total Child - HI	Total ILCR	Total HI	Total ILCR	Total HI
Bedrock Groundwater Use													
Exposure Media													
Surface Soil [b]	9.40E-06	0.007	NE	NE	7.74E-07	0.002	NE	NE	NE	1.89E-07	0.0003	3.45E-12	0.0000003
Total Soil [b]	8.01E-06	0.2	5.15E-07	0.5	NE	NE	9.77E-06	0.04	0.3	NE	NE	NE	NE
Maintenance Pit [c]	NE	NE	1.56E-07	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
Groundwater	1.04E-03	11	NE	NE	1.04E-03	11	8.24E-03	71	166	NE	NE	NE	NE
Sediment	NE	NE	5.75E-07	0.2	NE	NE	3.63E-06	0.03	0.3	NE	NE	NE	NE
Surface Water	NE	NE	9.26E-09	0.1	NE	NE	2.16E-07	0.05	0.08	NE	NE	NE	NE
Total ILCR or HI	**1.E-03**	**11**	**1.E-06**	**0.9**	**1.E-03**	**11**	**8.E-03**	**72**	**167**	**2.E-07**	**0.0003**	**3.E-12**	**0.0000003**
Overburden Groundwater Use													
Exposure Media													
Surface Soil	9.40E-06	0.007	NE	NE	7.74E-07	0.002	NE	NE	NE	1.89E-07	0.0003	3.45E-12	0.0000003
Total Soil	8.01E-06	0.2	5.15E-07	0.5	NE	NE	9.77E-06	0.04	0.3	NE	NE	NE	NE
Maintenance Pit[b]	NE	NE	1.56E-07	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
Groundwater	5.31E-05	0.7	NE	NE	5.31E-05	0.7	2.30E-04	2	5	NE	NE	NE	NE
Sediment	NE	NE	5.75E-07	0.2	NE	NE	3.63E-06	0.03	0.3	NE	NE	NE	NE
Surface Water	NE	NE	9.26E-09	0.1	NE	NE	2.16E-07	0.05	0.08	NE	NE	NE	NE
Total ILCR or HI	**6.E-05**	**0.9**	**1.E-06**	**0.9**	**5.E-05**	**0.7**	**2.E-04**	**2**	**6**	**2.E-07**	**0.0003**	**3.E-12**	**0.0000003**

GMA - Garage Maintenance Area.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
LBA - Locomotive Building Area
NA - No chemicals of potential concern available for exposure evaluation.
NE - Pathway not evaluated for this receptor.
RIR - Remedial investigation report.

[a] Total ILCR and total HI values for the groundskeeper reflect the respective totals for the future groundskeeper assumed to use either bedrock or overburden groundwater. The total ILCR and HI values for the current groundskeeper are simply those shown for surface soil. The rounded current groundskeeper ILCR is 9E-6 and the rounded HI is 0.01. The ILCR for the current groundskeeper without the contribution of background-related chromium is 3E-6.
[b] The ILCR values for the soil and total soil for the groundskeeper do not include the contribution of chromium in surface soil and total soil that were quantified in the BHHRA because chromium was determined upon further evaluation to result from ambient background conditions.
[c] The Maintenance Pit material is composed of backfill gravel and associated fines. This stony material is unsuitable for use as topsoil or growth medium, thus exposure to this material would be negligible to minimal. Because the construction worker scenario assumes exposure to subsurface soil, this pit material was conservatively evaluated under this scenario for comparative purposes, even though the construction worker scenario makes the unrealistic assumption (in this case) of constant daily exposure.

Source: Garage Maintenance Area (Locomotive Building Area) Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2011)

Table 3-16

Statistical Summary and COPEC Selection for Chemicals Detected in LBA Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean (mg/kg)	BSC [a] (mg/kg)	ESV [b] (mg/kg)	COPEC? [c,d]	Distribution [e]	95% UCL [e] (mg/kg)	EPC [f] (mg/kg)	UCL 0-2' soil depth [g] (mg/kg)	MDC 0-2' soil depth [g] (mg/kg)	EPC 0-2' soil depth [g] (mg/kg)
Inorganics																		
Aluminum	28 / 28	100	4.40E+03		1.72E+04		1.81E+00	3.00E+01	8.25E+03	1.55E+04	pH Dependent	N (d)			---			---
Antimony	14 / 28	50	2.50E-01	J	1.30E+00		4.51E-01	1.50E+00	4.96E-01	9.30E+00	0.27	N (b)			---			---
Arsenic	27 / 28	96	4.40E+00		1.77E+01		9.02E-01	1.50E+00	8.23E+00	3.65E+01	18	N (a)			---			---
Barium	28 / 28	100	1.63E+01		4.25E+02		1.85E-01	3.00E+01	8.88E+01	8.26E+02	330	N (b)			---			---
Beryllium	19 / 28	68	6.60E-01		9.26E+00	J	1.81E-01	7.50E-01	4.41E+00	1.00E+00	21	N (a)			---			---
Cadmium	15 / 28	54	2.53E-01	J	6.99E-01		2.10E-01	5.26E-01	3.18E-01		0.36	Y	Normal	4.12E-01	4.12E-01	5.24E-01	6.99E-01	5.24E-01
Calcium	28 / 28	100	1.18E+03		7.40E+04		4.51E+00	7.50E+02	8.41E+03	5.23E+04	Nutrient	N (c)			---			---
Chromium	28 / 28	100	1.04E+01		5.10E+01		4.51E-01	7.50E-01	1.61E+01	2.90E+01	26	N (d)			---			---
Cobalt	24 / 28	86	3.52E+00		5.38E+01	J	3.61E-01	7.50E+00	1.23E+01	1.16E+02	13	N (b)			---			---
Copper	28 / 28	100	6.54E+00		3.01E+01		4.51E-01	3.70E+00	1.59E+01	5.62E+01	28	N (b)			---			---
Iron	28 / 28	100	1.19E+04		4.64E+04		3.63E+00	1.50E+01	2.22E+04	2.34E+05	pH Dependent	N (b)			---			---
Lead	28 / 28	100	5.29E+00		2.22E+02		3.20E-01	5.26E-01	2.24E+01	4.86E+01	11	N (d)			---			---
Magnesium	28 / 28	100	7.96E+02	J	1.68E+04	J	1.81E+00	7.50E+02	3.18E+03	1.04E+04	Nutrient	N (c)			---			---
Manganese	28 / 28	100	1.15E+02		3.00E+03		1.81E-01	2.20E+00	6.42E+02	3.51E+03	220	N (b)			---			---
Mercury	18 / 28	64	1.18E-02	J	5.50E-02	U	2.11E-02	1.50E-01	4.01E-02	8.50E-02	0.00051	N (b)			---			---
Nickel	28 / 28	100	9.01E+00	J	5.03E+01		2.71E-01	6.00E+00	2.44E+01	5.51E+01	38	N (b)			---			---
Potassium	28 / 28	100	1.88E+02		2.26E+03		2.26E+01	7.50E+02	7.38E+02	3.39E+03	Nutrient	N (c)			---			---
Selenium	1 / 28	4	5.16E-01	J	5.16E-01	J	5.30E-01	1.05E+00	4.19E-01	2.00E+00	0.52	N (a)			---			---
Sodium	18 / 28	64	1.88E+01		1.13E+02		9.02E+00	7.50E+02	1.37E+02		Nutrient	N (c)			---			---
Thallium	8 / 28	29	2.94E-01	J	6.54E-01		4.45E-01	1.50E+00	4.18E-01	1.30E+00	1	N (a)			---			---
Vanadium	28 / 28	100	1.88E+01		4.99E+01		1.81E-01	7.50E+00	2.60E+01	4.09E+01	7.8	N (d)			---			---
Zinc	28 / 28	100	2.60E+01		2.73E+02		2.10E+00	3.00E+00	7.44E+01	3.22E+02	46	N (b)			---			---
Polychlorinated biphenyls (PCB)																		
Aroclor 1221	1 / 25	4	1.90E-01		1.90E-01		3.50E-02	4.90E-02	2.69E-02		0.371	N (a)			---			---
Aroclor 1260	4 / 25	16	6.10E-02	J	1.90E-01		3.50E-02	4.90E-02	3.33E-02		0.371	N (a)			---			---
Nitroaromatics																		
Amino-2,6-dinitrotoluene, 4-	3 / 18	17	3.24E-01		5.30E-01		2.88E-01	3.00E-01	2.00E-01		0.0328	Y	Nonparametric	3.79E-01	3.79E-01	5.27E-01	5.27E-01	5.27E-01
Amino-4,6-dinitrotoluene, 2-	3 / 18	17	1.63E-01	J	4.38E-01		2.88E-01	3.00E-01	1.73E-01		0.0328	Y	Normal	2.42E-01	2.42E-01	2.97E-01	2.94E-01	2.94E-01
Dinitrotoluene, 2,4-	5 / 18	28	1.53E-01	J	1.13E+00		2.88E-01	3.00E-01	2.71E-01		1.28	N (a)			---			---
Semivolatile Organic Compounds																		---
Acenaphthylene	2 / 25	8	7.06E-02	J	2.24E-01	J	3.50E-01	2.06E+00	2.42E-01		29	N (a)			---			---
Anthracene	2 / 25	8	8.11E-02	J	3.81E-01	J	3.50E-01	2.06E+00	2.48E-01		29	N (a)			---			---
Benzo(a)anthracene	3 / 25	12	4.26E-02	J	6.52E-01	J	3.50E-01	2.06E+00	2.56E-01		1.1	N (a)			---			---
Benzo(a)pyrene	2 / 25	8	1.21E-01	JJ	3.95E-01	J	3.50E-01	2.06E+00	2.51E-01		1.1	N (a)			---			---
Benzo(b)fluoranthene	2 / 25	8	1.92E-01	JJ	8.78E-01	J	3.50E-01	2.06E+00	2.73E-01		1.1	N (a)			---			---
Benzo(ghi)perylene	1 / 25	4	1.06E-01	J	1.06E-01	J	3.50E-01	2.06E+00	2.75E-01		1.1	N (a)			---			---
Chrysene	3 / 25	12	3.95E-02	J	7.84E-01	J	3.50E-01	2.06E+00	2.62E-01		1.1	N (a)			---			---
Dibenzofuran	2 / 25	8	4.61E-01	J	1.40E+00	J	3.50E-01	2.06E+00	2.93E-01		NSV	Y	Nonparametric	5.88E-01	5.88E-01	7.55E-01	1.40E+00	7.55E-01
Di-n-butyl phthalate	1 / 25	4	5.90E-02	J	5.90E-02	J	3.50E-01	2.06E+00	2.74E-01		200	N (a)			---			---
Dinitrotoluene, 2,4-	8 / 25	32	2.30E-01	J	4.00E+00		3.50E-01	2.06E+00	5.40E-01		1.28	Y	Gamma	8.19E-01	8.19E-01	1.44E+00	4.00E+00	1.44E+00
Dinitrotoluene, 2,6-	3 / 25	12	1.29E-01	J	3.89E-01	J	3.50E-01	2.06E+00	2.84E-01		0.0328	Y	Normal	2.67E-01	2.67E-01	8.16E-01	2.04E-01	2.04E-01
Fluoranthene	5 / 25	20	4.01E-02	J	1.26E+00	J	3.50E-01	2.06E+00	2.74E-01		1.1	Y	Gamma	2.93E-01	2.93E-01	4.69E-01	1.26E+00	4.69E-01
Indeno(1,2,3-cd)pyrene	1 / 25	4	1.30E-01	J	1.30E-01	J	3.50E-01	2.06E+00	2.76E-01		1.1	N (a)			---			---
Methylnaphthalene, 2-	2 / 25	8	1.66E+00	J	5.60E+00		3.50E-01	2.06E+00	5.09E-01		3.24	Y	Nonparametric	2.19E+00	2.19E+00	2.89E+00	5.60E+00	2.89E+00
Naphthalene	2 / 25	8	1.02E+00	J	3.40E+00		3.50E-01	2.06E+00	3.96E-01		29	N (a)			---			---
Phenanthrene	3 / 25	12	1.17E-01	JJ	1.50E+00		3.50E-01	2.06E+00	3.09E-01		29	N (a)			---			---
Pyrene	3 / 25	12	6.27E-02	J	1.13E+00	J	3.50E-01	2.06E+00	2.79E-01		1.1	Y	Normal	3.27E-01	3.27E-01	4.79E-01	1.13E+00	4.79E-01
Volatile Organic Compounds																		
Acetone	14 / 14	100	2.19E-02	J	2.65E-01	J	1.46E-02	5.92E-02	9.52E-02		2.5	N (a)			---			---
Benzene	3 / 18	17	2.17E-03	J	3.81E-03	J	9.04E-03	2.15E-02	4.82E-03		0.255	N (a)			---			---
Butanone, 2-	7 / 7	100	8.27E-03	J	1.36E-02	J	5.28E-02	5.92E-02	1.08E-02		89.6	N (a)			---			---
Carbon disulfide	1 / 18	6	4.95E-03	JJ	4.95E-03	JJ	9.04E-03	2.15E-02	5.72E-03		0.0941	N (a)			---			---
Dichloroethane, 1,1-	3 / 18	17	3.23E-03	J	2.54E-02	J	9.04E-03	2.15E-02	6.29E-03		20.1	N (a)			---			---
Dichloroethene, 1,1-	2 / 18	11	2.54E-03	J	3.01E-03	J	9.04E-03	2.15E-02	5.04E-03		8.28	N (a)			---			---
Dichloroethene, cis-1,2-	1 / 18	6	3.20E-03	J	3.20E-03	J	9.04E-03	2.15E-02	5.32E-03		0.784	N (a)			---			---
Naphthalene-voc	2 / 18	11	1.51E-03	J	3.46E-03	J	9.04E-03	2.15E-02	5.01E-03		29	N (a)			---			---
Toluene	4 / 18	22	1.04E-03	J	5.99E-03	J	9.04E-03	2.15E-02	4.91E-03		200	N (a)			---			---
Trichloroethane, 1,1,1-	6 / 18	33	1.39E-03	J	1.21E+00	J	9.04E-03	4.95E-01	1.39E-01		29.8	N (a)			---			---

Table 3-16

Statistical Summary and COPEC Selection for Chemicals Detected in LBA Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean (mg/kg)	BSC [a] (mg/kg)	ESV [b] (mg/kg)	COPEC? [c,d]	Distribution [e]	95% UCL [e] (mg/kg)	EPC [f] (mg/kg)	UCL 0-2' soil depth [g] (mg/kg)	MDC 0-2' soil depth [g] (mg/kg)	EPC 0-2' soil depth [g] (mg/kg)
Trichloroethene	3 / 18	17	2.63E-03	J	6.24E-02	J	9.04E-03	2.15E-02	1.07E-02		12.4	N (a)			---			---
Trimethylbenzene, 1,2,4-	2 / 18	11	1.71E-03	J	1.78E-03	J	9.04E-03	2.15E-02	5.11E-03		NSV	Y	Nonparametric	1.81E-03	1.78E-03	ND	ND	NA

BSC - Background screening criterion
COPEC - Chemical of Potential Ecological Concern
EPC - Exposure point concentration
ESV - Ecological screening value
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/kg - milligrams per kilogram
NA - Not applicable
ND - Not detected; chemical was only detected at deeper soil depth ranges.
NSV - No screening value
RIR - Remedial investigation report.
UCL - Upper confidence limit
VQ - Validation qualifier

[a] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas*** , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] ESVs and their sources are presented in the full SLERA (Appendix C)
[c] N = Chemical is not chosen as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
(d) = statistical test shows background and site data to be the same.
(e) = infrequently detected (fewer than 5 percent of all samples)
[d] Y = Chemical is chosen as COPEC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.05 (U.S. Environmental Protection Agency (EPA), 2010, ProUCL Version 4.00.05, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/software.htm.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] The EPC for the COPEC at the 0-2 feet soil depth range is used as the exposure concentration for some ecological receptors.

Source: Garage Maintenance Area (Locomotive Building Area) Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2011)

Table 3-17

Statistical Summary and COPEC Selection of Chemicals Detected in LBA Surface Water
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentration Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Arithmetic Mean µg/L	ESV [a] µg/L	COPEC? [b,c]	Distribution [d]	95% UCL [d] µg/L	EPC [e] µg/L
Inorganics														
Aluminum	6 / 6	100	1.66E+03		2.38E+04		2.00E+02	2.00E+02	5.67E+03	87	Y	Nonparametric	2.15E+04	2.15E+04
Arsenic	1 / 7	14	8.80E+00	J	8.80E+00	J	1.00E+01	1.00E+01	5.54E+00	3.1	Y	Nonparametric	6.69E+00	6.69E+00
Barium	7 / 7	100	4.16E+01	J	1.55E+02	J	2.00E+02	2.00E+02	7.62E+01	4	Y	Approx Gamma	1.12E+02	1.12E+02
Beryllium	1 / 7	14	1.10E+00	J	1.10E+00	J	4.00E+00	4.00E+00	1.87E+00	0.66	Y	Nonparametric	2.12E+00	1.10E+00
Calcium	7 / 7	100	1.10E+05		1.51E+05		1.00E+03	1.00E+03	1.35E+05	Nutrient	N (b)			---
Chromium	6 / 7	86	2.60E+00	J	3.98E+01		1.00E+01	1.00E+01	8.85E+00	42	N (a)			---
Cobalt	5 / 7	71	2.35E+00	JJ	1.63E+01	J	5.00E+01	5.00E+01	1.12E+01	23	N (a)			---
Copper	1 / 7	14	3.85E+01		3.85E+01		2.50E+01	2.50E+01	1.62E+01	1.58	Y	Nonparametric	2.41E+01	2.41E+01
Iron	7 / 7	100	1.09E+03		4.39E+04		3.00E+02	3.00E+02	9.50E+03	1000/Nutrient	N (b)			---
Lead	6 / 7	86	2.60E+00	J	1.80E+01		5.00E+00	1.00E+01	6.15E+00	1.17	Y	Approx Gamma	9.79E+00	9.79E+00
Magnesium	7 / 7	100	1.74E+04		2.93E+04		5.00E+03	5.00E+03	2.66E+04	Nutrient	N (b)			---
Manganese	7 / 7	100	3.81E+02		2.22E+03		1.50E+01	1.50E+01	1.19E+03	120	Y	Normal	1.71E+03	1.71E+03
Nickel	6 / 7	86	4.80E+00	J	7.16E+01		4.00E+01	4.00E+01	1.85E+01	28.9	Y	Nonparametric	5.73E+01	5.73E+01
Potassium	7 / 7	100	1.28E+03	J	6.54E+03	J	1.00E+04	2.00E+04	3.03E+03	Nutrient	N (b)			---
Selenium	3 / 7	43	3.50E+00	J	4.40E+00	J	1.00E+01	1.00E+01	4.50E+00	0.39	Y	Approx Gamma	5.13E+00	4.40E+00
Sodium	7 / 7	100	1.82E+04		3.45E+04		1.00E+04	1.00E+04	2.81E+04	Nutrient	N (b)			---
Vanadium	6 / 7	86	4.50E+00	J	4.61E+01	J	5.00E+01	5.00E+01	1.40E+01	12	Y	Nonparametric	3.70E+01	3.70E+01
Zinc	6 / 7	86	1.97E+01	J	1.77E+02		2.00E+01	2.00E+01	4.80E+01	65.7	Y	Nonparametric	1.44E+02	1.44E+02
Volatile Organics														
Dichloroethane, 1,1-	4 / 7	57	2.50E-01	J	3.90E-01	J	1.00E+00	1.00E+00	4.12E-01	47	N (a)			---
Dichloroethene, cis-1,2-	1 / 7	14	2.30E-01	JJ	2.30E-01	JJ	1.00E+00	1.00E+00	4.61E-01	590	N (a)			---
Trichloroethane, 1,1,1-	2 / 7	29	4.70E-01	J	5.60E-01	JJ	1.00E+00	1.00E+00	5.04E-01	11	N (a)			---

µg/L - micrograms per liter.
COPEC - Chemical of Potential Ecological Concern.
EPC - Exposure point concentration
ESV - Ecological screening value
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] ESVs and their sources are presented in the full SLERA (Appendix C)
[b] N = Chemical is not chosen as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = essential nutrient.
[c] Y = Chemical is chosen as COPEC.
[d] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.05 (U.S. Environmental Protection Agency (EPA), 2010, ProUCL Version 4.00.05, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/software.htm.
[e] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.

Source: Garage Maintenance Area (Locomotive Building Area) Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2011)

Table 3-18

Statistical Summary and COPEC Selection of Chemicals Detected in LBA Sediment
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	ESV [b] mg/kg	COPEC? [c,d]	Distribution [e]	95% UCL [e] (mg/kg)	EPC [f] mg/kg
Inorganics															
Aluminum	6 / 6	100	5.71E+03	J	1.03E+04		1.30E+01	1.40E+01	7.78E+03	1.55E+04	NSV	N (b)			---
Arsenic	6 / 6	100	8.30E+00	J	1.78E+01	J	5.10E-01	5.60E-01	1.20E+01	3.65E+01	9.79E+00	N (b)			---
Barium	6 / 6	100	5.88E+01	J	9.21E+01	J	1.30E+01	1.40E+01	7.61E+01	8.26E+02	NSV	N (b)			---
Beryllium	6 / 6	100	6.10E-01		9.60E-01		3.20E-01	3.50E-01	7.46E-01	1.00E+00	NSV	N (b)			---
Cadmium	6 / 6	100	4.60E-01	J	1.90E+00		2.50E-01	2.80E-01	8.32E-01	NA	9.90E-01	Y	Gamma	1.46E+00	1.46E+00
Calcium	6 / 6	100	3.26E+03		1.12E+04	J	3.20E+02	3.50E+02	6.54E+03	5.23E+04	Nutrient	N (c)			---
Chromium	6 / 6	100	1.04E+01		1.82E+01		6.30E-01	6.90E-01	1.37E+01	2.90E+01	4.34E+01	N (a)			---
Cobalt	6 / 6	100	1.08E+01		2.60E+01	J	3.20E+00	3.50E+00	1.71E+01	1.16E+02	5.00E+01	N (a)			---
Copper	6 / 6	100	1.05E+01	J	2.28E+01		1.60E+00	1.70E+00	1.75E+01	5.62E+01	3.16E+01	N (a)			---
Iron	6 / 6	100	1.87E+04	J	3.02E+04	J	6.30E+00	6.90E+00	2.28E+04	2.34E+05	Nutrient	N (c)			---
Lead	6 / 6	100	9.00E+00	J	1.79E+01	J	6.30E+00	6.90E+00	1.15E+01	4.86E+01	3.58E+01	N (a)			---
Magnesium	6 / 6	100	1.59E+03	J	4.94E+03		3.20E+02	3.50E+02	3.00E+03	1.04E+04	NSV	N (b)			---
Manganese	6 / 6	100	7.37E+02		5.36E+03		5.00E+00	2.10E+01	1.84E+03	3.51E+03	4.60E+02	Y	Gamma	3.98E+03	3.98E+03
Mercury	5 / 6	83	2.20E-02	J	3.10E-02	J	9.90E-02	1.20E-01	2.88E-02	8.50E-02	1.80E-01	N (a)			---
Nickel	6 / 6	100	2.61E+01	J	5.22E+01		2.50E+00	2.80E+00	3.42E+01	5.51E+01	2.27E+01	N (b)			---
Potassium	6 / 6	100	6.14E+02	J	1.40E+03		1.30E+03	1.40E+03	9.43E+02	3.39E+03	Nutrient	N (c)			---
Selenium	6 / 6	100	1.70E+00	J	3.00E+00	J	6.30E+00	6.90E+00	2.09E+00	2.00E+00	NSV	Y	Normal	2.50E+00	2.50E+00
Sodium	6 / 6	100	1.10E+02	J	1.92E+02	J	1.30E+03	1.40E+03	1.57E+02	NA	Nutrient	N (c)			---
Thallium	2 / 6	33	2.60E-01	J	1.90E+00		6.30E-01	1.40E+00	5.78E-01	1.30E+00	NSV	Y	Nonparametric	1.90E+00	1.90E+00
Vanadium	6 / 6	100	1.94E+01	J	2.65E+01	J	3.20E+00	3.50E+00	2.35E+01	4.09E+01	NSV	N (b)			---
Zinc	6 / 6	100	5.24E+01	J	8.03E+01		1.30E+00	1.40E+00	6.28E+01	3.22E+02	1.21E+02	N (a)			---
Semivolatiles Organic Compounds															
Benzo(b)fluoranthene	1 / 6	17	4.70E-02	JJ	4.70E-02	JJ	2.10E-01	2.40E-01	1.03E-01		1.04E+01	N (a)			---
Fluoranthene	1 / 6	17	8.36E-02	JJ	8.36E-02	JJ	2.10E-01	2.40E-01	1.09E-01		4.23E-01	N (a)			---
Phenanthrene	1 / 6	17	5.46E-02	J	5.46E-02	J	2.10E-01	2.40E-01	1.04E-01		2.04E-01	N (a)			---
Pyrene	1 / 6	17	6.28E-02	JJ	6.28E-02	JJ	2.10E-01	2.40E-01	1.05E-01		1.95E-01	N (a)			---
Volatiles Organic Compounds															
Acetone	1 / 6	17	9.21E-02	J	9.21E-02	J	5.80E-02	7.10E-02	4.31E-02		9.90E-03	Y	Nonparametric	6.46E-02	6.46E-02
Carbon disulfide	1 / 6	17	1.90E-03	J	1.90E-03	J	5.80E-03	7.10E-03	3.11E-03		2.39E-02	N (a)			---
Methylene chloride	1 / 5	20	5.82E-02		5.82E-02		1.20E-02	1.40E-02	1.69E-02		1.59E-01	N (a)			---

BSC - Background screening concentration.
COPEC - Chemical of potential ecological concern
EPC - Exposure point concentration
ESV - Ecological screening value
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
LBA - Locomotive Building Area
mg/kg - milligrams per kilogram
NA - Not available
NSV - No screening value available
RIR - Remedial investigation report.
VQ - Validation qualifier

[a] Soil background screening concentrations are used for sediment. See SLERA text for details.
[b] ESVs and their sources are presented in the full SLERA (Appendix C)
[c] N = Chemical is not chosen as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPEC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.05 (U.S. Environmental Protection Agency (EPA), 2010, ProUCL Version 4.00.05, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/software.htm.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.

Source: Garage Maintenance Area (Locomotive Building Area) Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2011)

Table 3-19

Wildlife Hazard Quotients for All LBA Assessment Receptors
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

COPEC	Deer Mouse		Short-tailed Shrew		Cottontail Rabbit		Marsh Wren		White-tailed Deer		Raccoon		Red-Tailed Hawk		Muskrat	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals																
Aluminum	**1.66E+00**	1.66E-01	**1.71E+00**	1.71E-01	5.65E-01	5.65E-02	5.27E-02	5.27E-03	2.28E-03	2.28E-04	1.02E-01	1.02E-02	2.24E-05	2.24E-06	1.04E+00	1.04E-01
Arsenic	7.89E-03	7.89E-04	8.14E-03	8.14E-04	2.69E-03	2.69E-04	3.51E-04	1.41E-04	1.09E-05	1.09E-06	1.44E-04	1.44E-05	1.49E-07	5.97E-08	4.97E-03	4.97E-04
Barium	3.26E-03	8.40E-04	3.36E-03	8.67E-04	1.11E-03	2.87E-04	1.45E-03	7.25E-04	4.50E-06	1.16E-06	5.32E-05	1.37E-05	6.16E-07	3.07E-07	2.06E-03	5.30E-04
Beryllium	2.48E-04	4.95E-05	2.56E-04	5.11E-05	8.46E-05	1.69E-05	NA	NA	3.42E-07	6.83E-08	6.93E-06	1.39E-06	NA	NA	1.56E-04	3.12E-05
Cadmium	4.18E-01	4.18E-02	6.06E-01	6.06E-02	2.08E-02	2.08E-03	9.93E-01	7.20E-02	4.01E-05	4.01E-06	1.07E-03	1.07E-04	1.74E-05	1.26E-06	2.29E-01	2.29E-02
Copper	3.06E-04	2.36E-04	3.15E-04	2.44E-04	1.04E-04	8.06E-05	1.38E-04	1.05E-04	4.21E-07	3.26E-07	2.82E-05	2.18E-05	5.86E-08	4.46E-08	1.93E-04	1.49E-04
Lead	1.82E-04	1.82E-05	1.88E-04	1.88E-05	6.21E-05	6.21E-06	2.34E-03	2.34E-04	2.51E-07	2.51E-08	1.90E-06	1.90E-07	2.91E-07	2.91E-08	1.15E-04	1.15E-05
Manganese	2.89E-03	8.97E-04	2.98E-03	9.25E-04	9.88E-04	3.06E-04	4.73E-04	4.73E-05	3.99E-06	1.24E-06	1.62E-03	5.03E-04	2.01E-07	2.01E-08	1.07E+00	3.33E-01
Nickel	2.13E-04	1.06E-04	2.20E-04	1.10E-04	7.27E-05	3.63E-05	2.00E-04	1.45E-04	2.93E-07	1.47E-07	1.22E-05	6.12E-06	8.48E-08	6.13E-08	1.34E-04	6.71E-05
Selenium	3.27E-03	1.98E-03	3.37E-03	2.04E-03	1.12E-03	6.77E-04	2.38E-03	1.19E-03	4.51E-06	2.73E-06	8.73E-03	5.29E-03	1.15E-06	3.36E-07	**2.09E+00**	1.27E+00
Thallium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E-01	1.60E-02	0.00E+00	0.00E+00	1.69E-01	1.69E-02
Vanadium	2.62E-02	2.62E-03	2.70E-02	2.70E-03	8.93E-03	8.93E-04	8.77E-04	8.77E-05	3.61E-05	3.61E-06	9.85E-04	9.85E-05	3.72E-07	3.72E-08	1.65E-02	1.65E-03
Zinc	1.34E-04	6.68E-05	1.38E-04	6.90E-05	4.56E-05	2.28E-05	2.68E-03	2.97E-04	1.84E-07	9.21E-08	1.24E-05	6.19E-06	1.14E-06	1.26E-07	8.43E-05	4.21E-05
Nitroaromatics																
4-Amino-2,6-dinitrotoluene	2.33E-02	4.36E-03	1.26E-03	2.36E-04	8.84E-03	1.66E-03	2.62E-02	1.03E-03	1.45E-05	2.72E-06	2.42E-05	4.53E-06	1.72E-06	6.78E-08	0.00E+00	0.00E+00
2-Amino-4,6-dinitrotoluene	1.30E-02	2.43E-03	8.05E-04	1.51E-04	4.93E-03	9.25E-04	1.46E-02	5.75E-04	9.27E-06	1.74E-06	1.35E-05	2.53E-06	9.62E-07	3.78E-08	0.00E+00	0.00E+00
Semivolatile Organics																
2,4-Dinitrotoluene	4.49E-01	5.98E-02	1.23E-01	1.63E-02	1.61E-01	2.15E-02	7.15E-02	2.81E-03	1.94E-04	2.59E-05	6.48E-04	8.65E-05	4.71E-06	1.85E-07	0.00E+00	0.00E+00
2,6-Dinitrotoluene	5.54E-02	7.39E-03	3.99E-02	5.33E-03	1.97E-02	2.63E-03	1.01E-02	3.99E-04	5.39E-05	7.19E-06	8.41E-05	1.12E-05	6.68E-07	2.63E-08	0.00E+00	0.00E+00
All Nitrotoluenes (summed)	***5.40E-01***	***7.40E-02***	***1.65E-01***	***2.20E-02***	***1.95E-01***	***2.67E-02***	***1.22E-01***	***4.82E-03***	***2.72E-04***	***3.76E-05***	***7.70E-04***	***1.05E-04***	***8.06E-06***	***3.17E-07***	***0.00E+00***	***0.00E+00***
2-Methylnapthalene	1.63E-01	1.63E-02	1.97E-01	1.97E-02	1.74E-02	1.74E-03	5.23E-02	5.23E-03	2.66E-05	2.66E-06	3.28E-04	3.28E-05	2.91E-07	2.91E-08	0.00E+00	0.00E+00
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	3.61E-02	3.61E-03	1.35E-02	1.35E-03	1.17E-02	1.17E-03	7.92E-04	7.92E-05	1.56E-05	1.56E-06	5.34E-05	5.34E-06	2.72E-08	2.72E-09	0.00E+00	0.00E+00
Pyrene	5.75E-02	5.75E-03	2.66E-02	2.66E-03	1.66E-02	1.66E-03	1.65E-03	1.65E-04	2.48E-05	2.48E-06	8.45E-05	8.45E-06	2.78E-08	2.78E-09	0.00E+00	0.00E+00
Volatile Organics																
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.08E-08	1.62E-08	0.00E+00	0.00E+00	1.74E-04	3.49E-05

COPEC - Chemical of potential ecological concern.
GMA - Garage Maintenance Area.
LBA - Locomotive Building Area
LOAEL - Lowest-observed-adverse-effect level.
NA - No toxicity data available; hazard quotients not calculated.
NOAEL - No-observed-adverse-effect level.
RIR - Remedial investigation report.

Shaded cells indicate a hazard quotient greater than 1, when rounded.

Source: Garage Maintenance Area (Locomotive Building Area) Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2011)

Table 4-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	FSB-SB01		FSB-SB02		FSB-SB03						FSB-SB04		FSB-SB05		FSB-SB06		FSB-SB07		FSB-SB08		FSB-SB09	
				SAMPLE NUMBER	FSB0001		FSB0002		FSB0003		FSB0004		FSB0005		FSB0006		FSB0007		FSB0008		FSB0009		FSB0010		FSB0011	
				SAMPLE DATE	19-May-11		17-May-11		20-May-11		20-May-11		20-May-11		16-May-11		20-May-11		16-May-11		16-May-11		17-May-11		20-May-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																										
Acetone	mg/kg	6,100	NE	0.18	0.0985	J	-	-	0.0366	J	-	-	0.18		0.0848		0.0607	J	0.0652		0.0734	J	-	-	0.035	J
Benzene	mg/kg	1.1	NE	0.0017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0017	J	-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0059	-	-	-	-	0.0059	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0013	J	-	-	-	-	-	-
Hexanone, 2-	mg/kg	21	NE	0.0556	-	-	-	-	-	-	-	-	-	-	0.0284		-	-	0.0203		0.0556		-	-	0.0311	
Methyl acetate	mg/kg	7,800	NE	0.022									0.022													
Methylene chloride	mg/kg	11	NE	0.0186	0.0067	J	0.0094	B	0.0052	J	0.0104	J	0.015		0.0098	B	0.005	J	0.0125	B	0.009		-	-	0.0047	J
Toluene	mg/kg	500	NE	0.0043	-	-	-	-	0.0013	J	0.0016	J	-	-	-	-	0.00094	J	0.0043		0.0024	J	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0034	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0034	J	-	-	-	-	-	-
SEMIVOLATILES																										
Acenaphthylene	mg/kg	NE	NE	0.0252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0252	J	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.0754	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0225	J	0.0754	J	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.0892	-	-	-	-	-	-	-	-	0.02		-	-	-	-	0.0892	J	0.0404	J	-	-	0.0318	J
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	-	-	-	-	-	-	-	-	0.024		-	-	-	-	0.0944	J	0.0318	J	-	-	0.0446	J
Benzo(b)fluoranthene	mg/kg	0.15	NE	0.132	-	-	-	-	-	-	0.0214	J	0.03		-	-	0.0234	J	0.132	J	0.0454	J	-	-	0.0692	J
Benzo(ghi)perylene	mg/kg	NE	NE	0.0527	-	-	-	-	-	-	-	-	0.022		-	-	-	-	0.0527	J	-	-	-	-	0.046	J
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.0454	-	-	-	-	-	-	-	-	0.02		-	-	-	-	0.0454	J	-	-	-	-	0.0261	J
Chrysene	mg/kg	15	NE	0.0911	-	-	-	-	-	-	-	-	0.026		-	-	0.0206	J	0.0911	J	0.037	J	-	-	0.0475	J
Fluoranthene	mg/kg	230	NE	0.179	-	-	-	-	-	-	0.0285	J	0.043		0.0261	J	0.0433	J	0.179	J	0.0808	J	-	-	0.0831	J
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.0637	-	-	-	-	-	-	-	-	0.014		-	-	-	-	0.0637	J	0.0227	J	-	-	0.045	J
Phenanthrene	mg/kg	NE	NE	0.0934	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0934	J	0.0305	J	-	-	0.0266	J
Pyrene	mg/kg	170	NE	0.178	-	-	-	-	-	-	0.0221	J	0.036		0.0263	J	0.035	J	0.178	J	0.0744	J	-	-	0.067	J
METALS																										
Aluminum	mg/kg	7,700	15,500	8770	6,770		2,000	J	3,570		4,330		3,700		2,960		3,630	J	2,670		4,610		6,110		3,890	
Antimony	mg/kg	3.1	9.3	11.7	-	-	-	-	-	-	-	-	-	-	1.6		3.2	J	0.52	J	-	-	-	-	**11.7**	
Arsenic	mg/kg	0.39	36.5	12.9	8.3		12.9	J	2.2	J	1.3	J	2.2		3		2.6	J	2.9		2.4		11.5		8.1	
Barium	mg/kg	1,500	826	107	64.6		68.3		13.1		15.6		28		26.7		23.3	J	17.7	J	31.9		48.9	J	107	
Beryllium	mg/kg	16	1	0.39	0.39		0.08	J	0.18	J	0.2	J	-	-	0.17	J	0.18	J	-	-	0.23	J	-	-	0.21	J
Cadmium	mg/kg	7	ND	6.6	1		0.13	J	-	-	-	-	-	-	0.27		6.6	J	-	-	-	-	-	-	1.7	
Calcium	mg/kg	NE	52,300	100000	2,510		1,530	J	1,270		1,330		**100,000**		20,300	J	**62,700**	J	**99,400**		2,780	J	**55,600**		12,500	
Chromium	mg/kg	0.29	29	39.9	12.9		3.7	J	4.9		6.2		10		5.8		11.3	J	5.4		5.9		17.1		**39.9**	
Cobalt	mg/kg	2.3	116	31	8		0.69	J	2.2	J	1.5	J	-	-	2.6	J	2	J	1.9	J	1.9	J	31	J	5	
Copper	mg/kg	310	56.2	37.5	14.8		5.7	J	2.3		2.1		6.5		6.3		10.8	J	4.3	J	4.8		17.8	J	37.5	
Iron	mg/kg	5,500	234,000	28100	14,800		18,600	J	5,640		5,870		7,400		6,100		6,690	J	7,300		7,180		28,100		20,600	
Lead	mg/kg	400	48.6	4060	**57.7**		12	J	4.1		4.7		**51**		**66.4**		**170**	J	19.3		11.9		9.5		**4,060**	
Magnesium	mg/kg	NE	10,400	14400	1,900		242	J	547		518		9,700		3,850	J	7,380	J	**14,400**		1,140	J	8,940		2,360	
Manganese	mg/kg	180	3,506	1380	788		14.7	J	96.5		73.5		190		172		207	J	273		54.4		1,380		707	
Mercury	mg/kg	1	0.09	2.1	0.032	J	0.05	J	-	-	0.014	J	**0.16**		0.05	J	0.042	J	0.033	J	**0.33**		0.035	J	**2.1**	
Nickel	mg/kg	150	55.1	44.8	19.7		2	J	5.4		3.6		6.1		7.2		8.2	J	5.8	J	5.4		44.8		20.1	
Potassium	mg/kg	NE	3,390	2360	734		2,360		209	J	159	J	-	-	299	J	252	J	249	J	191	J	870	J	463	J
Selenium	mg/kg	39	2	0.89	0.31	J	0.89	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.74	J
Silver	mg/kg	39	11.1	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.16	J
Sodium	mg/kg	NE	ND	268	-	-	268	J	-	-	-	-	-	-	-	-	-	-	-	-	70.8	J	-	-	84.8	J
Vanadium	mg/kg	39	40.9	67.1	17.3		25.6	J	10.4		13		11		7		10.6	J	7.5	J	10.5		**67.1**		13.5	
Zinc	mg/kg	2,300	321.75	171	44.6		8.4	J	15.1		12.9		49		29.4		54	J	20.8		17.8		105		171	
GENERAL CHEMISTRY																										
pH	pH units	NE	NE	2.46																						
Total organic carbon	mg/kg	NE	NE	3920	0.81																					

Table 4-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	FSB-SB10		FSB-SB11		FSB-SB12		FSB-SB13		FSB-SB14		FSB-SB15		FSB-SS11		FSB-SS12		FSB-SS13	
				SAMPLE NUMBER	FSB0012		FSB0013		FSB0014		FSB0015		FSB0016		FSB0051		FSB0066		FSB0067		FSB0068	
				SAMPLE DATE	20-May-11		17-May-11		17-May-11		17-May-11		17-May-11		30-Jun-11		22-Aug-11		22-Aug-11		22-Aug-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																						
Acetone	mg/kg	6,100	NE	0.18	-	-	-	-	-	-	-	-	-	-	-	-						
Benzene	mg/kg	1.1	NE	0.0017	-	-	-	-	-	-	-	-	-	-	-	-						
Butanone, 2-	mg/kg	2,800	NE	0.0059	-	-	-	-	-	-	-	-	-	-	-	-						
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	-	-	-	-	-	-	-	-						
Hexanone, 2-	mg/kg	21	NE	0.0556	-	-	-	-	-	-	-	-	-	-	-	-						
Methyl acetate	mg/kg	7,800	NE	0.022																		
Methylene chloride	mg/kg	11	NE	0.0186	0.0186	B	0.0043	J	0.0056	J	0.0048	J	0.0042	J	0.0064	J						
Toluene	mg/kg	500	NE	0.0043	-	-	0.0011	J	-	-	0.0012	J	-	-	-	-						
Xylenes, total	mg/kg	63	NE	0.0034	-	-	-	-	-	-	-	-	-	-	-	-						
SEMIVOLATILES																						
Acenaphthylene	mg/kg	NE	NE	0.0252	-	-	-	-	-	-	-	-	-	-	-	-						
Anthracene	mg/kg	1,700	NE	0.0754	-	-	-	-	-	-	-	-	-	-	-	-						
Benzo(a)anthracene	mg/kg	0.15	NE	0.0892	-	-	-	-	-	-	-	-	-	-	0.0317	J						
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	-	-	-	-	-	-	-	-	-	-	0.0273	J						
Benzo(b)fluoranthene	mg/kg	0.15	NE	0.132	-	-	-	-	-	-	-	-	-	-	0.043	J						
Benzo(ghi)perylene	mg/kg	NE	NE	0.0527	-	-	-	-	-	-	-	-	-	-	-	-						
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.0454	-	-	-	-	-	-	-	-	-	-	0.0197	J						
Chrysene	mg/kg	15	NE	0.0911	-	-	-	-	-	-	0.0237	J	-	-	0.0394	J						
Fluoranthene	mg/kg	230	NE	0.179	0.0218	J	-	-	-	-	-	-	-	-	0.0771	J						
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.0637	-	-	-	-	-	-	-	-	-	-	0.0216	J						
Phenanthrene	mg/kg	NE	NE	0.0934	-	-	-	-	-	-	-	-	-	-	0.032	J						
Pyrene	mg/kg	170	NE	0.178	-	-	-	-	-	-	-	-	-	-	0.0571	J						
METALS																						
Aluminum	mg/kg	7,700	15,500	8770	4,420		4,140		8,770		424		4,250		1,290							
Antimony	mg/kg	3.1	9.3	11.7	-	-	-	-	-	-	-	-	-	-	-	-						
Arsenic	mg/kg	0.39	36.5	12.9	4.3		3.5		8.9		0.4	J	5.4		3.2							
Barium	mg/kg	1,500	826	107	30.4		29.4		57.7		59.5		90.5		56.1							
Beryllium	mg/kg	16	1	0.39	0.22	J	0.18	J	0.3		-	-	0.13	J	0.091	J						
Cadmium	mg/kg	7	ND	6.6	0.33		-	-	-	-	-	-	-	-	-	-						
Calcium	mg/kg	NE	52,300	100000	32,900		492		996		4,360		4,530		10,400	J						
Chromium	mg/kg	0.29	29	39.9	8.4		5.8		15.6		0.79		11		2.6							
Cobalt	mg/kg	2.3	116	31	6.1		1.6	J	4.8		-	-	2	J	0.57	J						
Copper	mg/kg	310	56.2	37.5	11		6		14.3		0.76	J	10		4.3	J						
Iron	mg/kg	5,500	234,000	28100	12,300		7,080		23,500		431		15,800		5,850							
Lead	mg/kg	400	48.6	4060	7.9		12.3		13.2		6.6		12.3		12.3							
Magnesium	mg/kg	NE	10,400	14400	7,770		621		1,680		58.6	J	910		270							
Manganese	mg/kg	180	3,506	1380	908		34.5		118		4.1		60.8		20.1							
Mercury	mg/kg	1	0.09	2.1	0.027	J	0.035	J	0.066	J	0.051	J	0.067	J	0.047	J						
Nickel	mg/kg	150	55.1	44.8	13.3		5.1		13.7		0.26	J	6.7		1.6	J						
Potassium	mg/kg	NE	3,390	2360	569		327	J	598		148	J	549	J	640							
Selenium	mg/kg	39	2	0.89	0.69	J	0.31	J	0.68	J	0.21	J	0.62	J	0.21	J						
Silver	mg/kg	39	11.1	0.16	0.1	J	-	-	-	-	0.063	J	-	-	-	-						
Sodium	mg/kg	NE	ND	268	68.9	J	-	-	120	J	63.2	J	67.9	J	166	J						
Vanadium	mg/kg	39	40.9	67.1	11.1		11.8		24.4		1.2	J	20.9		10.7							
Zinc	mg/kg	2,300	321.75	171	32.1		16.7		38.1		0.81	J	19.5		5.1	J						
GENERAL CHEMISTRY																						
pH	pH units	NE	NE	2.46													2.46		2.4		2.28	
Total organic carbon	mg/kg	NE	NE	3920													2,310		3,660		3,920	

Table 4-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

BSC - Background screening concentration.
GMA - Garage Maintenance Area.
MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).
mg/kg - Milligrams per kilogram.
ND - Not detected (BSCs).
NE - Not established (RBSCs), not evaluated (BSCs).
VOLATILES

Shaded cell indicates value is greater than RBSC.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.
Blank cell means that parameter was not analyzed.
"-" - Not detected.

Validation Qualifiers (VQ)
J - The analyte was positively identified, the reported value is estimated.

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB01								FSB-SB02				FSB-SB03			
				SAMPLE NUMBER	FSB0017		FSB0018		FSB0019		FSB0035		FSB0020		FSB0036		FSB0021		FSB0037	
				SAMPLE DATE	19-May-11		19-May-11		19-May-11		19-May-11		17-May-11		17-May-11		20-May-11		20-May-11	
				DEPTH	3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																				
Acetone	mg/kg	6,100	NE	0.105	0.0729	J	0.0281	J	0.068		0.0393	J	-	-	0.0748		0.0183	J	-	-
Benzene	mg/kg	1.1	NE	0.0042	-	-	-	-	-	-	-	-	0.0014	J	0.0017	J	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.012	0.0078	J	0.0064	J	0.0089		-	-	0.0099	B	0.0074	J	-	-	0.0039	J
Toluene	mg/kg	500	NE	0.0101	-	-	0.00093	J	-	-	-	-	0.0019	J	0.0019	J	-	-	0.0018	J
Xylenes, total	mg/kg	63	NE	0.0049	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																				
Acenaphthene	mg/kg	340	NE	0.0364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	NE	NE	0.196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.411	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.439	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	NE	NE	0.0942	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.015	NE	0.116	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.0565	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	230	NE	0.191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.513	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB01								FSB-SB02				FSB-SB03			
				SAMPLE NUMBER	FSB0017		FSB0018		FSB0019		FSB0035		FSB0020		FSB0036		FSB0021		FSB0037	
				SAMPLE DATE	19-May-11		19-May-11		19-May-11		19-May-11		17-May-11		17-May-11		20-May-11		20-May-11	
				DEPTH	3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
PCBs																				
Aroclor 1254	mg/kg	0.11	NE	0.462	-	-	-	-	-	-			-	-			-	-		
Aroclor 1260	mg/kg	0.22	NE	0.0281	-	-	-	-	-	-			-	-			-	-		
Aroclor 1268	mg/kg	0.22	NE	0.0298	-	-	-	-									-	-		
METALS																				
Aluminum	mg/kg	7,700	15,500	19,700	2,390	J	4,710	J	7,000		5,440		7,080		6,930		10,600		5,290	
Antimony	mg/kg	3.1	9.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/kg	0.39	36.5	23.2	5.5		3.6		5		2.3		13.9		7		11.5		7.2	
Barium	mg/kg	1,500	826	113	18		24.6		54		61.5		65.2		55.2		71.9		51	
Beryllium	mg/kg	16	1	1	0.16	J	0.24	J	-	-	0.28		0.42	J	0.51	J	0.56	J	0.27	J
Cadmium	mg/kg	7	ND	0.66	0.14	J	-	-	-	-	0.3		0.34	J	-	-	-	-	0.27	
Calcium	mg/kg	NE	52,300	61,400	44,800	J	11,600	J	34,000		43,900		47,400		50,100		3,030		39,700	
Chromium	mg/kg	0.29	29	20.1	6.2		8.8		12		11.4		12.1		16.2		16.9		10.5	
Cobalt	mg/kg	2.3	116	12.8	3.1		3.6	J	6.6		5.4		12.8		11.2	J	7.7	J	6.1	
Copper	mg/kg	310	56.2	28.6	8.7		6.2		14		17.8		20.2		23.8		19.1		17.4	
Iron	mg/kg	5,500	234,000	33,600	7,350		8,180		15,000		10,600		22,200		16,300		22,400		11,700	
Lead	mg/kg	400	48.6	63.4	5		5.5		6.9		11.4		11.9		11.9		12.4		10.3	
Magnesium	mg/kg	NE	10,400	19,300	10,000	J	3,690	J	**12,000**		**13,500**		**17,500**		**15,200**		3,110		**11,800**	
Manganese	mg/kg	180	3,506	1,220	449		332		520		384		702		596		304		535	
Mercury	mg/kg	1	0.09	0.05	0.015	J	0.015	J	-	-	0.011	J	0.027	J	0.036	J	0.029	J	0.019	J
Nickel	mg/kg	150	55.1	30	7.8		9.4		18		14.7		28.6		30		22.7		14.5	
Potassium	mg/kg	NE	3,390	1800	350	J	381	J	740		958		862	J	1,660	J	853	J	885	
Selenium	mg/kg	39	2	0.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/kg	39	11.1	0.092	-	-	-	-	-	-	0.05	J	-	-	-	-	-	-	0.058	J
Sodium	mg/kg	NE	ND	700	140	J	174	J	-	-	281	J	-	-	-	-	381	J	401	J
Thallium	mg/kg	0.078	1.3	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	38.3	7.8	J	16.2	J	17		12.6		19.8		21.3		26.5		12.7	
Zinc	mg/kg	2,300	321.75	98.6	22.4		19.9		40		39.4		49		62		50.1		38.8	

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB04				FSB-SB05								FSB-SB06			
				SAMPLE NUMBER	FSB0022		FSB0038		FSB0023		FSB0039		FSB0040		FSB0041		FSB0024		FSB0042	
				SAMPLE DATE	16-May-11		16-May-11		20-May-11		20-May-11		20-May-11		20-May-11		16-May-11		16-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																				
Acetone	mg/kg	6,100	NE	0.105	0.0201	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	mg/kg	1.1	NE	0.0042	0.0015	J	-	-	0.0022	J	-	-	-	-	-	-	0.0011	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.012	0.0107	B	0.0063	J	0.0059	J	-	-	0.0037	J	-	-	0.0051	J	0.0102	B
Toluene	mg/kg	500	NE	0.0101	0.0017	J	-	-	0.0029	J	0.0012	J	0.0016	J	-	-	0.0016	J	-	-
Xylenes, total	mg/kg	63	NE	0.0049	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																				
Acenaphthene	mg/kg	340	NE	0.0364	-	-	-	-	-	-	-	-	-	-	-	-	0.0364	J	-	-
Acenaphthylene	mg/kg	NE	NE	0.196	-	-	-	-	-	-	-	-	-	-	-	-	0.196		-	-
Anthracene	mg/kg	1,700	NE	0.59	-	-	-	-	-	-	-	-	-	-	-	-	0.59		-	-
Benzo(a)anthracene	mg/kg	0.15	NE	1.06	-	-	-	-	-	-	-	-	-	-	-	-	1.06		-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-	0.885		-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.15	-	-	-	-	-	-	-	-	-	-	-	-	1.15		-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.411	-	-	-	-	-	-	-	-	-	-	0.013		0.411		-	-
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.439	-	-	-	-	-	-	-	-	-	-	-	-	0.439		-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.23	-	-	-	-	0.23	J	-	-	0.158	J	-	-	-	-	-	-
Carbazole	mg/kg	NE	NE	0.0942	-	-	-	-	-	-	-	-	-	-	-	-	0.0942	J	-	-
Chrysene	mg/kg	15	NE	0.885	-	-	-	-	-	-	-	-	-	-	0.023		0.885		-	-
Dibenz(a,h)anthracene	mg/kg	0.015	NE	0.116	-	-	-	-	-	-	-	-	-	-	-	-	0.116	J	-	-
Dibenzofuran	mg/kg	7.8	NE	0.0565	-	-	-	-	-	-	-	-	-	-	-	-	0.0565	J	-	-
Fluoranthene	mg/kg	230	NE	1.99	-	-	-	-	-	-	-	-	-	-	-	-	1.99		-	-
Fluorene	mg/kg	230	NE	0.191	-	-	-	-	-	-	-	-	-	-	-	-	0.191		-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.513	-	-	-	-	-	-	-	-	-	-	-	-	0.513		-	-
Phenanthrene	mg/kg	NE	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-	1.52		-	-
Pyrene	mg/kg	170	NE	1.85	-	-	-	-	-	-	-	-	-	-	0.014		1.85		-	-

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB04				FSB-SB05								FSB-SB06			
				SAMPLE NUMBER	FSB0022		FSB0038		FSB0023		FSB0039		FSB0040		FSB0041		FSB0024		FSB0042	
				SAMPLE DATE	16-May-11		16-May-11		20-May-11		20-May-11		20-May-11		20-May-11		16-May-11		16-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
PCBs																				
Aroclor 1254	mg/kg	0.11	NE	0.462	0.0116	J			0.0346	J							0.462			
Aroclor 1260	mg/kg	0.22	NE	0.0281	-	-			0.0281	J							-	-		
Aroclor 1268	mg/kg	0.22	NE	0.0298					0.0105	J										
METALS																				
Aluminum	mg/kg	7,700	15,500	19,700	12,000		5,620		7,080		4,570		6,270		8,500		7,040		4,370	
Antimony	mg/kg	3.1	9.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/kg	0.39	36.5	23.2	9.3		3.9		5.3		8.2	J	2.4	J	2.7		5.2		15.5	
Barium	mg/kg	1,500	826	113	69.7		34.3		48.5		62.5		39.8		58		46.8		51.3	
Beryllium	mg/kg	16	1	1	0.62	J	0.44	J	0.38		0.26	J	0.32		-	-	0.36	J	0.32	J
Cadmium	mg/kg	7	ND	0.66	0.28	J	-	-	0.32		0.33		0.32		-	-	-	-	0.23	J
Calcium	mg/kg	NE	52,300	61,400	10,100		**55,400**		**61,400**		46,900		46,600		44,000		12,600		**52,700**	
Chromium	mg/kg	0.29	29	20.1	17.8		13.7		15		9.3		12.5		15		10.2		10.1	
Cobalt	mg/kg	2.3	116	12.8	10.5	J	9.8	J	8		6.7		6		9.5		7	J	7.1	J
Copper	mg/kg	310	56.2	28.6	20.5		20.1		16.1		26.8		19.3		21		11.9		17.1	
Iron	mg/kg	5,500	234,000	33,600	24,600		10,600		12,100		12,300		11,800		18,000		13,400		11,200	
Lead	mg/kg	400	48.6	63.4	11		11.4		11.1		12.1		12.3		11		**63.4**		9.4	
Magnesium	mg/kg	NE	10,400	19,300	4,430		**19,300**		9,610		**14,600**		**15,700**		**17,000**		3,930		**16,500**	
Manganese	mg/kg	180	3,506	1,220	434		522		405		693		444		560		419		484	
Mercury	mg/kg	1	0.09	0.05	0.03	J	0.04	J	0.01	J	0.025	J	0.014	J	-	-	0.048	J	0.026	J
Nickel	mg/kg	150	55.1	30	25.7		25.6		17.5		18		16.4		25		15.6		17.5	
Potassium	mg/kg	NE	3,390	1800	619	J	1,360	J	956		720		1,090		1,800		377	J	946	J
Selenium	mg/kg	39	2	0.98	-	-	-	-	-	-	0.5	J	0.51	J	-	-	-	-	-	-
Silver	mg/kg	39	11.1	0.092	-	-	-	-	-	-	0.06	J	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	ND	700	-	-	-	-	81.9	J	481	J	603	J	700		-	-	348	J
Thallium	mg/kg	0.078	1.3	0.38	-	-	-	-	-	-	0.38	J	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	38.3	26.9		20.2		15.5		12.4		14.7		21		16.5		15.9	
Zinc	mg/kg	2,300	321.75	98.6	47.1		51.6		73.9		41.1		43.8		58		34		43.9	

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB07				FSB-SB08				FSB-SB09			
				SAMPLE NUMBER	FSB0025		FSB0043		FSB0026		FSB0044		FSB0027		FSB0045	
				SAMPLE DATE	16-May-11		16-May-11		17-May-11		17-May-11		20-May-11		20-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.105	-	-	-	-	0.0237	J	0.105		-	-	-	-
Benzene	mg/kg	1.1	NE	0.0042	-	-	0.0014	J	-	-	-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.014	-	-	-	-	-	-	0.014	J	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0026	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.012	0.0042	J	0.0099	B	-	-	0.0071	J	-	-	-	-
Toluene	mg/kg	500	NE	0.0101	-	-	0.0022	J	-	-	0.0016	J	-	-	0.0012	J
Xylenes, total	mg/kg	63	NE	0.0049	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Acenaphthene	mg/kg	340	NE	0.0364	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	NE	NE	0.196	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.59	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	1.06	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.15	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.411	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.439	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.23	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	NE	NE	0.0942	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.015	NE	0.116	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.0565	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.99	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	230	NE	0.191	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.513	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.85	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB07				FSB-SB08				FSB-SB09			
				SAMPLE NUMBER	FSB0025		FSB0043		FSB0026		FSB0044		FSB0027		FSB0045	
				SAMPLE DATE	16-May-11		16-May-11		17-May-11		17-May-11		20-May-11		20-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
PCBs																
Aroclor 1254	mg/kg	0.11	NE	0.462	-	-			-	-			0.0127	J		
Aroclor 1260	mg/kg	0.22	NE	0.0281	-	-			-	-			0.0273	J		
Aroclor 1268	mg/kg	0.22	NE	0.0298									0.0298	J		
METALS																
Aluminum	mg/kg	7,700	15,500	19,700	10,800		3,400		5,430		6,140		10,700		5,670	J
Antimony	mg/kg	3.1	9.3	0.5	-	-	-	-	-	-	0.5	J	-	-	-	-
Arsenic	mg/kg	0.39	36.5	23.2	10.9		6.7		5.9		19.8		6.2		2.9	J
Barium	mg/kg	1,500	826	113	84.9		30		40.1		51.8		47.7		41	J
Beryllium	mg/kg	16	1	1	0.61	J	0.25	J	0.31		0.43	J	0.3		0.29	J
Cadmium	mg/kg	7	ND	0.66	0.27	J	0.25		0.27		-	-	0.19		0.4	J
Calcium	mg/kg	NE	52,300	61,400	20,600		**57,800**		**55,100**		50,900		1,760		39,300	J
Chromium	mg/kg	0.29	29	20.1	16.1		8.1		12.6		13.1		19.1		11.7	J
Cobalt	mg/kg	2.3	116	12.8	10.4	J	4.7		5.8		9.7	J	4.1		5.8	J
Copper	mg/kg	310	56.2	28.6	21.6		13.8		18.1		19.8		25		17.4	J
Iron	mg/kg	5,500	234,000	33,600	23,800		8,690		12,600		14,600		19,700		11,200	J
Lead	mg/kg	400	48.6	63.4	12.8		7.6		10.2		9.8		14.5		11.6	
Magnesium	mg/kg	NE	10,400	19,300	9,030		**16,500**		**12,600**	J	**14,500**		2,540		**13,700**	J
Manganese	mg/kg	180	3,506	1,220	1,220		340		338		503		88.9		470	J
Mercury	mg/kg	1	0.09	0.05	0.02	J	0.035	J	0.034	J	0.026	J	0.014	J	0.013	J
Nickel	mg/kg	150	55.1	30	27.8		10.8		15.4		23.9		17.3		14.9	J
Potassium	mg/kg	NE	3,390	1800	631	J	710	J	988		1,510	J	734		933	J
Selenium	mg/kg	39	2	0.98	-	-	-	-	-	-	-	-	0.19	J	0.56	J
Silver	mg/kg	39	11.1	0.092	-	-	-	-	-	-	-	-	-	-	0.071	J
Sodium	mg/kg	NE	ND	700	-	-	-	-	103	J	-	-	93.8	J	198	J
Thallium	mg/kg	0.078	1.3	0.38	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	38.3	27		9.8		17.2		18.5		23.7		13.1	J
Zinc	mg/kg	2,300	321.75	98.6	44.7		32.7		47.2		49.2		45		40.8	J

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB10								FSB-SB11				FSB-SB12			
				SAMPLE NUMBER	FSB0028		FSB0029		FSB0030		FSB0046		FSB0031		FSB0047		FSB0032		FSB0048	
				SAMPLE DATE	20-May-11		20-May-11		20-May-11		20-May-11		17-May-11		17-May-11		17-May-11		17-May-11	
				DEPTH	3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																				
Acetone	mg/kg	6,100	NE	0.105	-	-	-	-	0.034	U	0.0349	J	-	-	0.0292	J	-	-	0.0277	J
Benzene	mg/kg	1.1	NE	0.0042	-	-	-	-	-	-	-	-	0.0042		-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.014	-	-	-	-	-	-	0.0044	J	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0026	-	-	-	-	-	-	-	-	0.0026	J	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.012	0.0055	J	0.0065	J	0.012		-	-	0.0046	J	-	-	0.0046	J	-	-
Toluene	mg/kg	500	NE	0.0101	-	-	-	-	-	-	0.00094	J	0.0101		-	-	0.0015	J	-	-
Xylenes, total	mg/kg	63	NE	0.0049	-	-	-	-	-	-	-	-	0.0049	J	-	-	-	-	-	-
SEMIVOLATILES																				
Acenaphthene	mg/kg	340	NE	0.0364	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	NE	NE	0.196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.411	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.439	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.23	-	-	-	-	0.074	B	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	NE	NE	0.0942	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.015	NE	0.116	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.0565	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	230	NE	0.191	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.513	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB10								FSB-SB11				FSB-SB12			
				SAMPLE NUMBER	FSB0028		FSB0029		FSB0030		FSB0046		FSB0031		FSB0047		FSB0032		FSB0048	
				SAMPLE DATE	20-May-11		20-May-11		20-May-11		20-May-11		17-May-11		17-May-11		17-May-11		17-May-11	
				DEPTH	3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
PCBs																				
Aroclor 1254	mg/kg	0.11	NE	0.462	-	-	-	-	-	-			-	-			-	-		
Aroclor 1260	mg/kg	0.22	NE	0.0281	-	-	-	-	-	-			-	-			-	-		
Aroclor 1268	mg/kg	0.22	NE	0.0298	-	-	-	-												
METALS																				
Aluminum	mg/kg	7,700	15,500	19,700	14,200		8,980		12,000		5,080		13,500		6,830		9,210		5,650	
Antimony	mg/kg	3.1	9.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.29	J
Arsenic	mg/kg	0.39	36.5	23.2	10	J	4.5	J	8		23.2		17.1		2.8		6.7		9.9	
Barium	mg/kg	1,500	826	113	87.1	J	47.2	J	49		65.6		85.3		41.1		71.9		37.9	
Beryllium	mg/kg	16	1	1	0.84	J	0.56	J	-	-	0.3		0.74	J	0.39	J	0.53	J	0.33	J
Cadmium	mg/kg	7	ND	0.66	0.26	J	0.31	J	-	-	0.65		-	-	0.14	J	-	-	0.15	J
Calcium	mg/kg	NE	52,300	61,400	6,710	J	2,150	J	2,400		50,100		6,370		45,000		17,700		49,000	
Chromium	mg/kg	0.29	29	20.1	18.6	J	10.4	J	20		11.7		20.1		11.9		15.9		10	
Cobalt	mg/kg	2.3	116	12.8	7.3	J	5.3	J	-	-	9		8.3	J	7.5		8.7	J	5.7	
Copper	mg/kg	310	56.2	28.6	19	J	9.1	J	27		19.2		27.9		17.6		17.2		19.5	
Iron	mg/kg	5,500	234,000	33,600	24,300	J	11,200	J	23,000		15,100		33,600		12,700		18,400		15,400	
Lead	mg/kg	400	48.6	63.4	14.2	J	7.8	J	11		10.7		14.7		9.7		8.3		10.5	
Magnesium	mg/kg	NE	10,400	19,300	4,050	J	1,520	J	2,600		**13,300**		3,680		**16,700**		**10,800**		**15,500**	
Manganese	mg/kg	180	3,506	1,220	199	J	67.6	J	120		1,060		234		377		813		416	
Mercury	mg/kg	1	0.09	0.05	0.032	J	0.043	J	-	-	0.02	J	0.049	J	0.038	J	0.035	J	0.035	J
Nickel	mg/kg	150	55.1	30	27.4	J	15.2	J	19		23.4		27.7		19.6		25.7		15	
Potassium	mg/kg	NE	3,390	1800	831	J	440	J	-	-	801		878	J	1,300		1,000	J	1,130	J
Selenium	mg/kg	39	2	0.98	-	-	-	-	-	-	0.98	J	-	-	0.42	J	-	-	-	-
Silver	mg/kg	39	11.1	0.092	-	-	-	-	-	-	0.092	J	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	ND	700	-	-	-	-	-	-	93	J	-	-	124	J	-	-	135	J
Thallium	mg/kg	0.078	1.3	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	38.3	29.6	J	17.3	J	29		13.2		34.1		17.8		19.3		14.5	
Zinc	mg/kg	2,300	321.75	98.6	55		48.6		51		46.1		98.6		38.8		56.2		43.6	

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB13				FSB-SB14				FSB-SB15			
				SAMPLE NUMBER	FSB0033		FSB0049		FSB0034		FSB0050		FSB0052		FSB0053	
				SAMPLE DATE	17-May-11		17-May-11		17-May-11		17-May-11		30-Jun-11		30-Jun-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.105	-	-	0.0289	J	-	-	0.0529	J	0.0345	J	0.0508	
Benzene	mg/kg	1.1	NE	0.0042	-	-	-	-	-	-	-	-	-	-	0.0026	J
Butanone, 2-	mg/kg	2,800	NE	0.014	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0026	-	-	-	-	-	-	-	-	-	-	0.0016	J
Methylene chloride	mg/kg	11	NE	0.012	-	-	0.0051	J	0.005	J	-	-	0.0069	J	0.0053	J
Toluene	mg/kg	500	NE	0.0101	-	-	-	-	-	-	0.001	J	-	-	0.0057	
Xylenes, total	mg/kg	63	NE	0.0049	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Acenaphthene	mg/kg	340	NE	0.0364	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	NE	NE	0.196	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.59	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	1.06	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.15	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.411	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	1.5	NE	0.439	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.23	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	NE	NE	0.0942	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.885	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.015	NE	0.116	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.0565	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.99	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	230	NE	0.191	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.513	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	1.52	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.85	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-SB13				FSB-SB14				FSB-SB15			
				SAMPLE NUMBER	FSB0033		FSB0049		FSB0034		FSB0050		FSB0052		FSB0053	
				SAMPLE DATE	17-May-11		17-May-11		17-May-11		17-May-11		30-Jun-11		30-Jun-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
PCBs																
Aroclor 1254	mg/kg	0.11	NE	0.462	-	-			-	-			-	-		
Aroclor 1260	mg/kg	0.22	NE	0.0281	-	-			-	-			-	-		
Aroclor 1268	mg/kg	0.22	NE	0.0298												
METALS																
Aluminum	mg/kg	7,700	15,500	19,700	3,840		**19,700**		11,700		6,470		9,950		10,900	
Antimony	mg/kg	3.1	9.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/kg	0.39	36.5	23.2	21.5		4.9		12.3		4.7		11		7	
Barium	mg/kg	1,500	826	113	87.5		47		113		50.9		65.2		67.9	J
Beryllium	mg/kg	16	1	1	0.13	J	**1**		0.64		0.38	J	0.62		0.59	J
Cadmium	mg/kg	7	ND	0.66	-	-	0.66		-	-	0.13	J	-	-	-	-
Calcium	mg/kg	NE	52,300	61,400	2,470		30,800		7,730		39,000		1,460	J	**75,900**	J
Chromium	mg/kg	0.29	29	20.1	5.6		17.8		16.2		11.1		15.6		13.4	
Cobalt	mg/kg	2.3	116	12.8	0.99	J	9.1		7.3		6.1		11		8	J
Copper	mg/kg	310	56.2	28.6	6.4		16.8		28.6		17.9		17.5	J	13	J
Iron	mg/kg	5,500	234,000	33,600	7,840		13,600		25,200		13,700		20,000		15,900	
Lead	mg/kg	400	48.6	63.4	9.5		10		12.7		11.1		12.8		8.1	
Magnesium	mg/kg	NE	10,400	19,300	461		7,510		2,950		**17,300**		2,310		**11,000**	
Manganese	mg/kg	180	3,506	1,220	24.2		205		154		391		408		740	
Mercury	mg/kg	1	0.09	0.05	0.05	J	0.026	J	0.037	J	0.03	J	0.051	J	0.015	J
Nickel	mg/kg	150	55.1	30	3.8		28		25.9		16.8		22.5		29.3	
Potassium	mg/kg	NE	3,390	1800	803		757	J	1,100	J	1,220		622	J	744	J
Selenium	mg/kg	39	2	0.98	0.23	J	-	-	0.69	J	0.48	J	**2.4**		1.9	J
Silver	mg/kg	39	11.1	0.092	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	ND	700	62.7	J	-	-	-	-	156	J	-	-	-	-
Thallium	mg/kg	0.078	1.3	0.38	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	38.3	13.1		38.3		22.5		17.7		25		18.6	J
Zinc	mg/kg	2,300	321.75	98.6	8.7		76.2		63.8		41		50.7	J	39.6	J

Table 4-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

BSC - Background screening concentration.

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

mg/kg - Milligrams per kilograms.

ND - Not detected (BSCs).

NE - Not established (RBSCs), not evaluated (BSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.

Blank cell means that parameter was not analyzed.

"-" - Not detected.

Validation Qualifiers (VQ)

J - The analyte was positively identified, the reported value is estimated.

Table 4-3

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater Samples - Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	FSB-PZ01						FSB-PZ02		FSB-PZ03		FSB-PZ04		FSB-PZ05		FSB-PZ06	
				SAMPLE NUMBER	FSB3000		FSB3001		FSB3002		FSB3003		FSB3004		FSB3005		FSB3006		FSB3007	
				SAMPLE DATE	9-Jun-11		9-Jun-11		9-Jun-11		9-Jun-11		8-Jun-11		2-Jun-11		14-Jun-11		13-Jun-11	
				DEPTH	6.96 - 7.17 Ft		6.96 - 7.17 Ft		6.96 - 7.17 Ft		4.44 - 26.5 Ft		4.42 - 5.28 Ft		14.58 - 14.58 Ft		3.19 - 23.35 Ft		4.59 - 4.64 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG		REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
METALS (UNFILTERED)																				
Aluminum	µg/L	1,600	309	6,580	**5,900**		**6,580**		**2,800**		147	J	**454**		**537**		**584**		**1,090**	
Antimony	µg/L	0.6	ND	6.8	6.8		5.4	J	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	µg/L	0.045	7.4	10.6	**9.9**	J	**10.3**		-	-	**10.6**		6.2	J	**9.1**	J	3.2	J	2.3	J
Barium	µg/L	290	11,800	391	129	J	122	J	93		391		333	J	321		167	J	261	
Calcium	µg/L	NE	316,000	317,000	290,000		297,000		**317,000**		49,400		54,800	J	83,900		102,000		94,800	
Chromium	µg/L	0.031	ND	15.2	15		15.2		-	-	-	-	1	J	1.4	J	1.2	J	1.8	J
Cobalt	µg/L	0.47	12.1	11.8	10.8	J	11.8	J	7.9		-	-	-	-	1.3	J	-	-	4.6	J
Copper	µg/L	62	19.8	25.6	**22.4**	J	**25.6**		12		-	-	-	-	-	-	2.1	J	8.5	J
Iron	µg/L	1,100	1,550	19,500	**17,600**		**19,500**		**8,300**		1,040		**2,000**		**1,930**		**3,280**		**5,480**	
Lead	µg/L	15	ND	169	169		150		160		-	-	-	-	-	-	1.1	J	3.5	J
Magnesium	µg/L	NE	217,000	99,100	93,900		95,900		99,100		30,000		28,400	J	33,700		46,400		39,200	
Manganese	µg/L	32	636	2,370	**2,370**		**2,330**		**2,300**		20.4		75.8	J	238		**741**		**832**	
Nickel	µg/L	30	8.6	22.1	**18.8**	J	**22.1**	J	**9.5**		-	-	-	-	2.6	J	2.4	J	8.1	J
Potassium	µg/L	NE	116,000	9,060	4,380	J	4,470	J	3,900		5,280	J	3,860	J	5,450	J	7,690	J	9,060	J
Selenium	µg/L	7.8	ND	2.4	2.4	J	2.1	J	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	263,000	250,000		254,000		263,000	J	35,400		34,400		38,900		35,600		46,700	
Vanadium	µg/L	7.8	ND	22	15.2	J	16.9	J	22		-	-	-	-	2.4	J	1.4	J	2.5	J
Zinc	µg/L	470	507	85.8	81.5		85.8		50		12	J	7.7	J	11.9	J	10.9	J	22.1	
METALS (FILTERED)																				
Arsenic	µg/L	0.045	7.4	8.9	-	-	-	-	-	-	**8.9**	J	5.5	J	**8.7**	J	2.7	J	-	-
Barium	µg/L	290	11,800	388	67.1	J	66.4	J	72		388		344		336		153	J	248	
Calcium	µg/L	NE	316,000	267,000	243,000		239,000		267,000		46,900		58,400		75,900		98,200		68,200	
Cobalt	µg/L	0.47	12.1	3.9	3.9	J	3.8	J	-	-	-	-	-	-	-	-	-	-	-	-
Iron	µg/L	1,100	1,550	1,230	791		771		900		347		812		630		1,230		710	
Magnesium	µg/L	NE	217,000	89,500	80,000		78,000		89,500		29,600		30,700		31,500		46,300		31,300	
Manganese	µg/L	32	636	2,100	**1,940**		**1,930**		**2,100**		9.4	J	85.3		201		**717**		106	
Potassium	µg/L	NE	116,000	9,230	2,960	J	2,940	J	3,300		4,740	J	4,140	J	5,350	J	7,390	J	9,230	J
Sodium	µg/L	NE	1,390,000	246,000	241,000		246,000		246,000		35,100		36,700		38,400		34,600		48,400	
Vanadium	µg/L	7.8	ND	14	-	-	-	-	14		-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	470	507	7.7	7.7	J	7.4	J	-	-	5.1	J	-	-	6.1	J	7.2	J	-	-
WATER QUALITY PARAMETERS																				
Alkalinity	µg/L	NE	NE	371,000					371,000											
Alkalinity, Carbonate	µg/L	NE	NE	410,000	361,000		372,000				321,000		332,000		360,000		410,000		338,000	
Chloride	µg/L	NE	NE	18,100	-	-	-	-	-	-	12,200		11,600		12,700		9,500	J	18,100	
Hardness (as CaCO3)	µg/L	NE	NE	1,200,000	1,110,000		1,140,000		1,200,000		247,000		254,000		348,000		446,000		398,000	
Sulfate	µg/L	NE	NE	1,140,000	1,130,000		1,140,000		1,090,000		2,800		36,000		92,300	J	266,000		92,600	
Total dissolved solids	µg/L	NE	NE	2,050,000	1,890,000		1,860,000		2,050,000		305,000		313,000	J	451,000		758,000		491,000	
Total suspended solids	µg/L	NE	NE	1,170,000	710,000	J	1,170,000	J	1,040,000	J	179,000		55,000		94,000		260,000		480,000	
Turbidity	NTU	NE	NE	430	358		303		430		121		32		17.2		179		227	

Table 4-3

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater Samples - Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works
Sandusky, Ohio

BSC - Background screening concentration.
MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).
µg/L - Micrograms per liter.
ND - Not detected (BSCs).
NE - Not established (RBSCs), not evaluated (BSCs).
Shaded cell indicates value is greater than RBSC.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.
Blank cell means that parameter was not analyzed.
"-" - Not detected.

Validation Qualifiers (VQ)
J - The analyte was positively identified, the reported value is estimated.

Table 4-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples – Former Sellite Area GMA RIR Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	FSB-MW01		FSB-MW01		FSB-MW02	
				SAMPLE NUMBER	FSB3010		FSB3015		FSB3011	
				SAMPLE DATE	6-Dec-11		19-Apr-12		12-Dec-11	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES										
Bis(2-ethylhexyl)phthalate	µg/L	0.071	NE	1.4	-	-	-	-	-	-
Phenol	µg/L	450	NE	0.8	-	-	-	-	-	-
METALS (UNFILTERED)										
Aluminum	µg/L	1,600	309	360	114	J	66.2	J	272	
Antimony	µg/L	0.6	ND	16.4	-	-	-	-	-	-
Arsenic	µg/L	0.045	7.4	64.5	2.4	J	2.6	J	-	-
Barium	µg/L	290	11,800	290	41.8	J	26.5	J	23.1	J
Beryllium	µg/L	1.6	ND	1.6	-	-	-	-	-	-
Cadmium	µg/L	0.69	ND	1.3	-	-	-	-	-	-
Calcium	µg/L	NE	316,000	341,000	75,200		118,000		**318,000**	
Chromium	µg/L	0.031	ND	6.6	1.3	J	-	-	-	-
Cobalt	µg/L	0.47	12.1	15.6	1.5	J	2.6	J	3.1	J
Copper	µg/L	62	19.8	9	9	J	2	J	-	-
Iron	µg/L	1,100	1,550	3,000	970		**1,600**		906	
Lead	µg/L	15	ND	14.5	-	-	-	-	-	-
Magnesium	µg/L	NE	217,000	137,000	37,000		63,900		126,000	
Manganese	µg/L	32	636	1,360	76.2		126		**1,310**	
Nickel	µg/L	30	8.6	16.1	7.6	J	6.3	J	4	J
Potassium	µg/L	NE	116,000	19,100	19,100		15,700		4,490	J
Selenium	µg/L	7.8	ND	60.8	-	-	-	-	-	-
Silver	µg/L	7.1	ND	1.2	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	1,240,000	1,240,000		1,240,000		212,000	
Thallium	µg/L	0.016	ND	56.9	-	-	-	-	-	-
Vanadium	µg/L	7.8	ND	15.7	-	-	-	-	1	J
Zinc	µg/L	470	507	19.7	8.7	J	-	-	-	-
METALS (FILTERED)										
Aluminum	µg/L	1,600	309	36.1	30.5	J	-	-	-	-
Antimony	µg/L	0.6	ND	8.8	-	-	-	-	2	J
Arsenic	µg/L	0.045	7.4	5.5	-	-	-	-	-	-
Barium	µg/L	290	11,800	280	43.3	J	22.1	J	21.8	J
Calcium	µg/L	NE	316,000	323,000	73,400		120,000		**320,000**	
Cobalt	µg/L	0.47	12.1	3.1	1.2	J	2.5	J	3	J
Copper	µg/L	62	19.8	8	8	J	-	-	-	-
Iron	µg/L	1,100	1,550	2,600	-	-	-	-	356	
Lead	µg/L	15	ND	1.7	-	-	-	-	-	-
Magnesium	µg/L	NE	217,000	130,000	36,900		66,900		128,000	
Manganese	µg/L	32	636	1,310	68.1		119		**1,310**	
Mercury	µg/L	0.063	ND	0.11	-	-	-	-	0.097	J
Nickel	µg/L	30	8.6	6.9	6.9	J	6.2	J	3.2	J
Potassium	µg/L	NE	116,000	18,500	18,500		16,400		4,430	J
Selenium	µg/L	7.8	ND	2.3	-	-	2.3	J	-	-
Sodium	µg/L	NE	1,390,000	1,280,000	1,190,000		1,280,000		208,000	
Zinc	µg/L	470	507	5.9	5.9	J	-	-	-	-
WATER QUALITY PARAMETERS										
Alkalinity	µg/L	NE	NE	625,000			625,000			
Alkalinity, Carbonate	µg/L	NE	NE	603,000	603,000				379,000	
Chloride	µg/L	NE	NE	37,800	37,800		23,500		4,200	
Cyanide, total	µg/L	31	NE	5.1	-	-	-	-	-	-
Hardness (as CaCO3)	µg/L	NE	NE	1,420,000	340,000		558,000		1,310,000	
Nitrate-Nitrite	µg/L	NE	NE	140	140		-	-	-	-
Sulfate	µg/L	NE	NE	2,370,000	1,910,000		2,370,000		1,150,000	
Total dissolved solids	µg/L	NE	NE	4,420,000	3,240,000		4,420,000		3,900,000	
Total suspended solids	µg/L	NE	NE	28,000	14,000	J	16,000		27,000	
Turbidity	NTU	NE	NE	36	10.4		7.6		4.2	

Table 4-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	FSB-MW02		FSB-MW03		FSB-MW03	
				SAMPLE NUMBER	FSB3016		FSB3012		FSB3013	
				SAMPLE DATE	20-Apr-12		7-Dec-11		7-Dec-11	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		FD	
				LOW-FLOW SAMPLED	Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES										
Bis(2-ethylhexyl)phthalate	µg/L	0.071	NE	1.4	-	-	-	-	-	-
Phenol	µg/L	450	NE	0.8	-	-	-	-	-	-
METALS (UNFILTERED)										
Aluminum	µg/L	1,600	309	360	**360**		65	J	48.8	J
Antimony	µg/L	0.6	ND	16.4	-	-	-	-	-	-
Arsenic	µg/L	0.045	7.4	64.5	2.8	J	2.2	J	2.7	J
Barium	µg/L	290	11,800	290	22	J	256		259	
Beryllium	µg/L	1.6	ND	1.6	-	-	-	-	-	-
Cadmium	µg/L	0.69	ND	1.3	-	-	-	-	-	-
Calcium	µg/L	NE	316,000	341,000	**341,000**		123,000		120,000	
Chromium	µg/L	0.031	ND	6.6	-	-	-	-	-	-
Cobalt	µg/L	0.47	12.1	15.6	3.6	J	-	-	-	-
Copper	µg/L	62	19.8	9	-	-	-	-	-	-
Iron	µg/L	1,100	1,550	3,000	1,410		**2,670**		**2,490**	
Lead	µg/L	15	ND	14.5	-	-	-	-	-	-
Magnesium	µg/L	NE	217,000	137,000	137,000		51,000		48,600	
Manganese	µg/L	32	636	1,360	**1,360**		76		76.4	
Nickel	µg/L	30	8.6	16.1	3.6	J	-	-	-	-
Potassium	µg/L	NE	116,000	19,100	3,720	J	3,060	J	3,140	J
Selenium	µg/L	7.8	ND	60.8	-	-	-	-	-	-
Silver	µg/L	7.1	ND	1.2	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	1,240,000	156,000		48,200		49,200	
Thallium	µg/L	0.016	ND	56.9	-	-	-	-	-	-
Vanadium	µg/L	7.8	ND	15.7	1.1	J	-	-	-	-
Zinc	µg/L	470	507	19.7	8.5	J	-	-	-	-
METALS (FILTERED)										
Aluminum	µg/L	1,600	309	36.1	36.1	J	-	-	-	-
Antimony	µg/L	0.6	ND	8.8	-	-	-	-	-	-
Arsenic	µg/L	0.045	7.4	5.5	-	-	2.4	J	-	-
Barium	µg/L	290	11,800	280	20.4	J	263		269	
Calcium	µg/L	NE	316,000	323,000	**323,000**		126,000		122,000	
Cobalt	µg/L	0.47	12.1	3.1	3.1	J	-	-	-	-
Copper	µg/L	62	19.8	8	-	-	-	-	-	-
Iron	µg/L	1,100	1,550	2,600	798		**2,520**		**2,340**	
Lead	µg/L	15	ND	1.7	-	-	-	-	-	-
Magnesium	µg/L	NE	217,000	130,000	130,000		52,400		49,700	
Manganese	µg/L	32	636	1,310	**1,310**		77.4		75.3	
Mercury	µg/L	0.063	ND	0.11	-	-	0.11	J	0.053	J
Nickel	µg/L	30	8.6	6.9	3.2	J	-	-	-	-
Potassium	µg/L	NE	116,000	18,500	3,430	J	3,210	J	3,290	J
Selenium	µg/L	7.8	ND	2.3	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	1,280,000	149,000		49,800		51,300	
Zinc	µg/L	470	507	5.9	-	-	-	-	-	-
WATER QUALITY PARAMETERS										
Alkalinity	µg/L	NE	NE	625,000	426,000					
Alkalinity, Carbonate	µg/L	NE	NE	603,000			347,000		294,000	
Chloride	µg/L	NE	NE	37,800	4,600		6,300	J	6,400	J
Cyanide, total	µg/L	31	NE	5.1	-	-	-	-	-	-
Hardness (as CaCO3)	µg/L	NE	NE	1,420,000	1,420,000		517,000		500,000	
Nitrate-Nitrite	µg/L	NE	NE	140	-	-	-	-	-	-
Sulfate	µg/L	NE	NE	2,370,000	1,300,000		269,000	J	391,000	J
Total dissolved solids	µg/L	NE	NE	4,420,000	2,580,000		767,000		902,000	
Total suspended solids	µg/L	NE	NE	28,000	28,000		15,000	J	28,000	J
Turbidity	NTU	NE	NE	36	12.8		31.9		28	

Table 4-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples – Former Sellite Area GMA RIR Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	FSB-MW03		FSB-MW03	
				SAMPLE NUMBER	FSB3014		FSB3017	
				SAMPLE DATE	7-Dec-11		26-Apr-12	
				DEPTH	0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	FS		REG	
				LOW-FLOW SAMPLED	Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
SEMIVOLATILES								
Bis(2-ethylhexyl)phthalate	µg/L	0.071	NE	1.4	0.89	B	-	-
Phenol	µg/L	450	NE	0.8	-	-	-	-
METALS (UNFILTERED)								
Aluminum	µg/L	1,600	309	360	160	J	37.3	J
Antimony	µg/L	0.6	ND	16.4	-	-	-	-
Arsenic	µg/L	0.045	7.4	64.5	7.4	J	-	-
Barium	µg/L	290	11,800	290	270		231	
Beryllium	µg/L	1.6	ND	1.6	-	-	-	-
Cadmium	µg/L	0.69	ND	1.3	-	-	-	-
Calcium	µg/L	NE	316,000	341,000	130,000		126,000	
Chromium	µg/L	0.031	ND	6.6	-	-	-	-
Cobalt	µg/L	0.47	12.1	15.6	-	-	-	-
Copper	µg/L	62	19.8	9	-	-	-	-
Iron	µg/L	1,100	1,550	3,000	**3,000**		**2,780**	
Lead	µg/L	15	ND	14.5	-	-	-	-
Magnesium	µg/L	NE	217,000	137,000	56,000	J	55,900	
Manganese	µg/L	32	636	1,360	84		77.6	
Nickel	µg/L	30	8.6	16.1	-	-	-	-
Potassium	µg/L	NE	116,000	19,100	3,000	J	3,410	J
Selenium	µg/L	7.8	ND	60.8	-	-	-	-
Silver	µg/L	7.1	ND	1.2	-	-	-	-
Sodium	µg/L	NE	1,390,000	1,240,000	49,000		38,400	
Thallium	µg/L	0.016	ND	56.9	-	-	-	-
Vanadium	µg/L	7.8	ND	15.7	-	-	-	-
Zinc	µg/L	470	507	19.7	-	-	-	-
METALS (FILTERED)								
Aluminum	µg/L	1,600	309	36.1	-	-		
Antimony	µg/L	0.6	ND	8.8	8.8	J		
Arsenic	µg/L	0.045	7.4	5.5	5.5	J		
Barium	µg/L	290	11,800	280	280			
Calcium	µg/L	NE	316,000	323,000	130,000			
Cobalt	µg/L	0.47	12.1	3.1	-	-		
Copper	µg/L	62	19.8	8	-	-		
Iron	µg/L	1,100	1,550	2,600	**2,600**			
Lead	µg/L	15	ND	1.7	1.7	J		
Magnesium	µg/L	NE	217,000	130,000	56,000	J		
Manganese	µg/L	32	636	1,310	83			
Mercury	µg/L	0.063	ND	0.11	-	-		
Nickel	µg/L	30	8.6	6.9	-	-		
Potassium	µg/L	NE	116,000	18,500	2,900	J		
Selenium	µg/L	7.8	ND	2.3	-	-		
Sodium	µg/L	NE	1,390,000	1,280,000	49,000			
Zinc	µg/L	470	507	5.9	-	-		
WATER QUALITY PARAMETERS								
Alkalinity	µg/L	NE	NE	625,000	360,000		348,000	
Alkalinity, Carbonate	µg/L	NE	NE	603,000				
Chloride	µg/L	NE	NE	37,800	4,900		5,900	
Cyanide, total	µg/L	31	NE	5.1	5.1	J	-	-
Hardness (as CaCO3)	µg/L	NE	NE	1,420,000	480,000			
Nitrate-Nitrite	µg/L	NE	NE	140	29	J	-	-
Sulfate	µg/L	NE	NE	2,370,000	310,000		230,000	J
Total dissolved solids	µg/L	NE	NE	4,420,000	820,000		785,000	
Total suspended solids	µg/L	NE	NE	28,000	11,000		11,000	J
Turbidity	NTU	NE	NE	36	36		28.8	

Table 4-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples – Former Sellite Area GMA RIR Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION CODE	FSB-MW03		FSB-MW03	
				SAMPLE NUMBER	FSB3018		FSB3019	
				SAMPLE DATE	26-Apr-12		26-Apr-12	
				DEPTH	0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
SEMIVOLATILES								
Bis(2-ethylhexyl)phthalate	µg/L	0.071	NE	1.4	-	-	1.4	J
Phenol	µg/L	450	NE	0.8	-	-	0.8	J
METALS (UNFILTERED)								
Aluminum	µg/L	1,600	309	360	106	J	-	-
Antimony	µg/L	0.6	ND	16.4	16.4		-	-
Arsenic	µg/L	0.045	7.4	64.5	**64.5**		4	J
Barium	µg/L	290	11,800	290	290		230	
Beryllium	µg/L	1.6	ND	1.6	1.6	J	-	-
Cadmium	µg/L	0.69	ND	1.3	1.3	J	-	-
Calcium	µg/L	NE	316,000	341,000	123,000		120,000	
Chromium	µg/L	0.031	ND	6.6	6.6	J	-	-
Cobalt	µg/L	0.47	12.1	15.6	**15.6**	J	-	-
Copper	µg/L	62	19.8	9	8.5	J	-	-
Iron	µg/L	1,100	1,550	3,000	**2,820**		**2,700**	
Lead	µg/L	15	ND	14.5	14.5		-	-
Magnesium	µg/L	NE	217,000	137,000	54,600		54,000	
Manganese	µg/L	32	636	1,360	93.3		76	
Nickel	µg/L	30	8.6	16.1	**16.1**	J	-	-
Potassium	µg/L	NE	116,000	19,100	3,250	J	3,600	J
Selenium	µg/L	7.8	ND	60.8	60.8		-	-
Silver	µg/L	7.1	ND	1.2	1.2	J	-	-
Sodium	µg/L	NE	1,390,000	1,240,000	37,100		36,000	
Thallium	µg/L	0.016	ND	56.9	56.9		-	-
Vanadium	µg/L	7.8	ND	15.7	15.7	J	-	-
Zinc	µg/L	470	507	19.7	19.7	J	-	-
METALS (FILTERED)								
Aluminum	µg/L	1,600	309	36.1			-	-
Antimony	µg/L	0.6	ND	8.8			-	-
Arsenic	µg/L	0.045	7.4	5.5			-	-
Barium	µg/L	290	11,800	280			230	
Calcium	µg/L	NE	316,000	323,000			120,000	
Cobalt	µg/L	0.47	12.1	3.1			-	-
Copper	µg/L	62	19.8	8			-	-
Iron	µg/L	1,100	1,550	2,600			**2,400**	
Lead	µg/L	15	ND	1.7			-	-
Magnesium	µg/L	NE	217,000	130,000			55,000	
Manganese	µg/L	32	636	1,310			75	
Mercury	µg/L	0.063	ND	0.11			-	-
Nickel	µg/L	30	8.6	6.9			-	-
Potassium	µg/L	NE	116,000	18,500			3,700	J
Selenium	µg/L	7.8	ND	2.3			-	-
Sodium	µg/L	NE	1,390,000	1,280,000			36,000	
Zinc	µg/L	470	507	5.9			-	-
WATER QUALITY PARAMETERS								
Alkalinity	µg/L	NE	NE	625,000	347,000		360,000	
Alkalinity, Carbonate	µg/L	NE	NE	603,000				
Chloride	µg/L	NE	NE	37,800	5,900		4,200	
Cyanide, total	µg/L	31	NE	5.1	-	-	-	-
Hardness (as CaCO3)	µg/L	NE	NE	1,420,000			550,000	
Nitrate-Nitrite	µg/L	NE	NE	140	-	-	-	-
Sulfate	µg/L	NE	NE	2,370,000	239,000		220,000	
Total dissolved solids	µg/L	NE	NE	4,420,000	787,000		740,000	
Total suspended solids	µg/L	NE	NE	28,000	10,000		5,000	
Turbidity	NTU	NE	NE	36	29.4		30	

Table 4-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

BSC - Background screening concentration.

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

µg/L - Micrograms per liter.

ND - Not detected (BSCs).

NE - Not established (RBSCs), not evaluated (BSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.

Blank cell means that parameter was not analyzed.

"-" - Not detected.

Validation Qualifiers (VQ)

B - The analyte was detected in a lab or field blank.

J - The analyte was positively identified, the reported value is estimated.

U - Not detected. The analyte was analyzed for, but not detected above the associated reporting limit.

Table 4-5

Detections Above RBSCs in Surface Water Samples – Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

			LOCATION CODE	FSB-SW01		FSB-SW02		FSB-SW02	
			SAMPLE NUMBER	FSB2000		FSB2001		FSB2002	
			SAMPLE DATE	9-Jan-12		9-Jan-12		9-Jan-12	
			DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
			SAMPLE PURPOSE	REG		REG		FD	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES									
Bis(2-ethylhexyl)phthalate	µg/L	0.071	3.1	3.1	J	-	-	-	-
METALS									
Aluminum	µg/L	16,000	27,300	27,300		39.4	J	44.6	J
Arsenic	µg/L	0.045	9.9	9.9	J	-	-	-	-
Barium	µg/L	2,900	273	273		35.7	J	37.3	J
Beryllium	µg/L	16	1.9	1.9	J	-	-	-	-
Calcium	µg/L	NE	129,000	110,000		106,000		110,000	
Chromium	µg/L	NE	40.3	40.3		-	-	-	-
Cobalt	µg/L	4.7	21.6	21.6	J	-	-	-	-
Copper	µg/L	620	61.2	61.2		-	-	-	-
Iron	µg/L	11,000	41,100	41,100		55.3	J	55.6	J
Lead	µg/L	15	60.8	60.8		-	-	-	-
Magnesium	µg/L	NE	32,500	32,500		25,100		25,800	
Manganese	µg/L	320	1,900	1,220		14	J	24.4	J
Mercury	µg/L	0.63	0.12	0.12	J	-	-	-	-
Nickel	µg/L	300	60.1	60.1		-	-	-	-
Potassium	µg/L	NE	3150	3,150	J	631	J	647	J
Selenium	µg/L	78	2.3	2.3	J	-	-	-	-
Sodium	µg/L	NE	8,320	4,950	J	6,020	J	6,340	J
Vanadium	µg/L	78	54.8	54.8		-	-	-	-
Zinc	µg/L	4,700	190	190		-	-	-	-
WATER QUALITY PARAMETERS									
Hardness (as $CaCO_3$)	µg/L	NE	456,000	409,000		368,000		381,000	

Table 4-5

Detections Above RBSCs in Surface Water Samples – Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

			LOCATION CODE	FSB-SW02		FSB-SW03		FSB-SW04	
			SAMPLE NUMBER	FSB2003		FSB2004		FSB2005	
			SAMPLE DATE	9-Jan-12		9-Jan-12		9-Jan-12	
			DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
			SAMPLE PURPOSE	FS		REG		REG	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES									
Bis(2-ethylhexyl)phthalate	µg/L	0.071	3.1	1.7	J	-	-	-	-
METALS									
Aluminum	µg/L	16,000	27,300	96	J	48.4	J	75.2	J
Arsenic	µg/L	0.045	9.9	-	-	-	-	-	-
Barium	µg/L	2,900	273	37	J	35.3	J	40	J
Beryllium	µg/L	16	1.9	-	-	-	-	-	-
Calcium	µg/L	NE	129,000	110,000		109,000		120,000	
Chromium	µg/L	NE	40.3	-	-	-	-	-	-
Cobalt	µg/L	4.7	21.6	-	-	-	-	-	-
Copper	µg/L	620	61.2	-	-	-	-	-	-
Iron	µg/L	11,000	41,100	85	J	300		561	
Lead	µg/L	15	60.8	-	-	-	-	-	-
Magnesium	µg/L	NE	32,500	25,000	J	25,800		28,700	
Manganese	µg/L	320	1,900	17		99.3		131	
Mercury	µg/L	0.63	0.12	-	-	-	-	-	-
Nickel	µg/L	300	60.1	-	-	-	-	-	-
Potassium	µg/L	NE	3150	720	J	1,030	J	1,420	J
Selenium	µg/L	78	2.3	-	-	-	-	-	-
Sodium	µg/L	NE	8,320	5,100		7,370	J	8,320	J
Vanadium	µg/L	78	54.8	-	-	-	-	-	-
Zinc	µg/L	4,700	190	-	-	-	-	-	-
WATER QUALITY PARAMETERS									
Hardness (as $CaCO_3$)	µg/L	NE	456,000	390,000		378,000		418,000	

Table 4-5

Detections Above RBSCs in Surface Water Samples – Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

			LOCATION CODE	FSB-SW05		FSB-SW06	
			SAMPLE NUMBER	FSB2006		FSB2007	
			SAMPLE DATE	9-Jan-12		9-Jan-12	
			DEPTH	0 - 0 Ft		0 - 0 Ft	
			SAMPLE PURPOSE	REG		REG	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ
SEMIVOLATILES							
Bis(2-ethylhexyl)phthalate	µg/L	0.071	3.1	-	-	-	-
METALS							
Aluminum	µg/L	16,000	27,300	2,930		2,060	
Arsenic	µg/L	0.045	9.9	6	J	-	-
Barium	µg/L	2,900	273	75.4	J	49.5	J
Beryllium	µg/L	16	1.9	-	-	-	-
Calcium	µg/L	NE	129,000	122,000		129,000	
Chromium	µg/L	NE	40.3	3.7	J	2.7	J
Cobalt	µg/L	4.7	21.6	8.8	J	1.8	J
Copper	µg/L	620	61.2	4.6	J	3.7	J
Iron	µg/L	11,000	41,100	20,800		3,250	
Lead	µg/L	15	60.8	3.5	J	4.6	J
Magnesium	µg/L	NE	32,500	28,400		32,500	
Manganese	µg/L	320	1,900	1,900		229	
Mercury	µg/L	0.63	0.12	-	-	-	-
Nickel	µg/L	300	60.1	5.6	J	4.4	J
Potassium	µg/L	NE	3150	1,660	J	1,580	J
Selenium	µg/L	78	2.3	-	-	-	-
Sodium	µg/L	NE	8,320	8,080	J	8,000	J
Vanadium	µg/L	78	54.8	6	J	4.8	J
Zinc	µg/L	4,700	190	37.7		12.3	J
WATER QUALITY PARAMETERS							
Hardness (as $CaCO_3$)	µg/L	NE	456,000	422,000		456,000	

Table 4-5

Detections Above RBSCs in Surface Water Samples – Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

µg/L - Micrograms per liter.

NE - Not established (RBSCs), not evaluated (BSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Blank cell means that parameter was not analyzed.

"-" - Not detected.

Blank cell means that parameter was not analyzed.

Validation Qualifiers (VQ)

J - The analyte was positively identified, the reported value is estimated.

Table 4-6

Detections Above RBSCs in Sediment Samples – Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

			LOCATION CODE	FSB-SD01		FSB-SD02		FSB-SD02		FSB-SD02	
			SAMPLE NUMBER	FSB1001		FSB1002		FSB1003		FSB1004	
			SAMPLE DATE	31-Aug-11		31-Aug-11		31-Aug-11		31-Aug-11	
			DEPTH	0 - 0.3 Ft		0 - 0.1 Ft		0 - 0.1 Ft		0 - 0.1 Ft	
RBSC - Values reflect an incremental lifetime risk			SAMPLE PURPOSE	REG		REG		FD		FS	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES											
Acenaphthylene	mg/kg	NE	0.16	-	-	0.128	J	0.109	J	0.16	
Anthracene	mg/kg	17,000	0.22	-	-	0.146	J	0.113	J	0.22	
Benzo(a)anthracene	mg/kg	0.15	0.79	-	-	0.448		0.344		0.79	
Benzo(a)pyrene	mg/kg	0.015	0.81	0.0241	J	0.498		0.393		0.81	
Benzo(b)fluoranthene	mg/kg	0.15	1.4	0.0318	J	0.895		0.703		1.4	
Benzo(ghi)perylene	mg/kg	NE	0.66	-	-	0.432		0.363		0.66	
Benzo(k)fluoranthene	mg/kg	1.5	0.54	-	-	0.35		0.28		0.54	
Carbazole	mg/kg	NE	0.0438	-	-	0.0438	J	0.0375	J	-	-
Chrysene	mg/kg	15	0.94	0.0269	J	0.668		0.516		0.94	
Dibenz(a,h)anthracene	mg/kg	0.015	0.2	-	-	0.105	J	0.0941	J	0.2	
Fluoranthene	mg/kg	2,300	1.2	0.0454	J	0.633		0.543		1.2	
Fluorene	mg/kg	2,300	0.02	-	-	-	-	-	-	0.02	
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	0.57	-	-	0.425		0.357		0.57	
Methylnaphthalene, 2-	mg/kg	310	0.0097	-	-	-	-	-	-	0.0097	
Naphthalene	mg/kg	3.6	0.014	-	-	-	-	-	-	0.014	
Phenanthrene	mg/kg	NE	0.18	-	-	0.132	J	0.0993	J	0.18	
Pyrene	mg/kg	1,700	1.1	0.0362	J	0.659		0.525		1.1	
PCBs											
Aroclor 1260	mg/kg	0.22	1.03	0.0179	J	0.0139	J	0.0143	J	-	-
Aroclor 1268	mg/kg	0.22	5.17								
METALS											
Aluminum	mg/kg	77,000	14,400	7,420		8,530		7,080		5,900	
Arsenic	mg/kg	0.39	18.5	4.6		8.2		7.7		9.1	
Barium	mg/kg	15,000	122	52.5	J	49.2		44.3		49	
Beryllium	mg/kg	160	0.82	0.43	J	0.42	J	0.35	J	-	-
Cadmium	mg/kg	70	1.2	-	-	-	-	0.21	J	-	-
Calcium	mg/kg	NE	38,000	3,940		10,800		11,700		38,000	
Chromium	mg/kg	NE	18.1	11.7		13		10.9		9.9	
Cobalt	mg/kg	23	15.1	5.1	J	6.5	J	5.7	J	6.9	
Copper	mg/kg	3,100	25.8	15.2		14.3		12.8		12	
Iron	mg/kg	55,000	38,000	12,900		16,000		13,800		15,000	
Lead	mg/kg	400	34.5	17.8		14		13.2		13	
Magnesium	mg/kg	NE	5,290	1,840		3,040		2,930		4,600	
Manganese	mg/kg	1,800	819	243		216		194		270	
Mercury	mg/kg	10	0.11	0.083	J	0.062	J	0.045	J	-	-
Nickel	mg/kg	1,500	29.3	13.7		16.3		14.4		14	
Potassium	mg/kg	NE	1,360	772	J	760	J	580	J	-	-
Selenium	mg/kg	390	3.3	-	-	-	-	0.9	J	0.77	
Vanadium	mg/kg	390	28.5	18.5		21		17.5		17	
Zinc	mg/kg	23,000	93.2	46.6		42.8		38.7		40	
GENERAL CHEMISTRY											
Total organic carbon	Percent	NE	3.5	3.5							

Table 4-6

Detections Above RBSCs in Sediment Samples – Former Sellite Area
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

			LOCATION CODE	FSB-SD03		FSB-SD04		FSB-SD05		FSB-SD06	
			SAMPLE NUMBER	FSB1005		FSB1006		FSB1007		FSB1008	
			SAMPLE DATE	31-Aug-11		31-Aug-11		31-Aug-11		31-Aug-11	
			DEPTH	0 - 0.1 Ft		0 - 0.2 Ft		0 - 0.2 Ft		0 - 0.2 Ft	
RBSC - Values reflect an incremental lifetime risk			SAMPLE PURPOSE	REG		REG		REG		REG	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES											
Acenaphthylene	mg/kg	NE	0.16	-	-	-	-	-	-	-	-
Anthracene	mg/kg	17,000	0.22	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	0.79	-	-	-	-	0.0512	J	0.0745	J
Benzo(a)pyrene	mg/kg	0.015	0.81	-	-	0.0269	J	0.0675	J	0.0845	J
Benzo(b)fluoranthene	mg/kg	0.15	1.4	0.11	J	0.0385	J	0.132	J	0.119	J
Benzo(ghi)perylene	mg/kg	NE	0.66	-	-	0.0231	J	0.0638	J	0.0563	J
Benzo(k)fluoranthene	mg/kg	1.5	0.54	-	-	-	-	0.048	J	0.0476	J
Carbazole	mg/kg	NE	0.0438	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	0.94	0.0811	J	0.0312	J	0.0924	J	0.11	J
Dibenz(a,h)anthracene	mg/kg	0.015	0.2	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	2,300	1.2	0.112	J	0.0419	J	0.126	J	0.17	J
Fluorene	mg/kg	2,300	0.02	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	0.57	-	-	0.0247	J	0.0697	J	0.0669	J
Methylnaphthalene, 2-	mg/kg	310	0.0097	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	0.014	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	0.18	-	-	-	-	0.0399	J	0.0857	J
Pyrene	mg/kg	1,700	1.1	0.0907	J	0.0339	J	0.101	J	0.133	J
PCBs											
Aroclor 1260	mg/kg	0.22	1.03	0.0283	J	0.015	J	0.0413	J	1.03	J
Aroclor 1268	mg/kg	0.22	5.17	0.0332	J	0.0132	J	0.164	J	5.17	J
METALS											
Aluminum	mg/kg	77,000	14,400	11,900		10,000		9,330		14,400	J
Arsenic	mg/kg	0.39	18.5	8.5		5.5		18.5		12	J
Barium	mg/kg	15,000	122	81.1		86.9		122		77.5	J
Beryllium	mg/kg	160	0.82	0.82	J	-	-	0.48	J	0.82	J
Cadmium	mg/kg	70	1.2	1.2		-	-	0.46	J	0.47	J
Calcium	mg/kg	NE	38,000	7,590		5,060		4,710		12,700	J
Chromium	mg/kg	NE	18.1	14.8		14.2		11.2		18.1	J
Cobalt	mg/kg	23	15.1	7.5	J	5.6	J	4.7	J	15.1	J
Copper	mg/kg	3,100	25.8	25.8		20.7		16.5		25.1	J
Iron	mg/kg	55,000	38,000	19,900		12,900		38,000		25,500	J
Lead	mg/kg	400	34.5	21.9		16.7		34.5		33.1	
Magnesium	mg/kg	NE	5,290	2,090		2,580		1,140	J	5,290	J
Manganese	mg/kg	1,800	819	226		111		142		819	J
Mercury	mg/kg	10	0.11	0.098		0.089	J	0.069	J	0.11	J
Nickel	mg/kg	1,500	29.3	24.5		16.2		10	J	29.3	J
Potassium	mg/kg	NE	1,360	1,360	J	1,110	J	963	J	941	J
Selenium	mg/kg	390	3.3	2	J	-	-	3.3	J	1.9	J
Vanadium	mg/kg	390	28.5	23.1		21.4		28.5		28.2	J
Zinc	mg/kg	23,000	93.2	92.1		46.5		42		93.2	J
GENERAL CHEMISTRY											
Total organic carbon	Percent	NE	3.5								

Table 4-6

Detections Above RBSCs in Sediment Samples – Former Sellite Area Garage Maintenance Area Remedial Investigation Report Former Plum Brook Ordnance Works Sandusky, Ohio

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

mg/kg - Milligrams per kilogram.

NE - Not established (RBSCs), not evaluated (BSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Blank cell means that parameter was not analyzed.

"-" - Not detected.

Validation Qualifiers (VQ)

J - The analyte was positively identified, the reported value is estimated.

Table 4-7

Background Surface Soil pH Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	pH
FSB-SS214	1916428.798	623852.310	7.55
FSB-SS215	1916376.997	623856.418	7.36
FSB-SS216	1916331.198	623839.988	7.68
FSB-SS217	1916266.510	623830.825	7.25
FSB-SS218	1916399.423	623872.531	7.83
FSB-SS219	1916347.938	623861.473	8.09
FSB-SS220	1916300.559	623856.102	7.54
FSB-SS221	1916263.035	623851.994	7.18
FSB-SS222	1916137.007	624139.831	7.34
FSB-SS223	1916162.908	624103.180	7.62
FSB-SS224	1916143.641	624067.477	7.67
FSB-SS225	1916157.538	624028.930	7.65
FSB-SS226	1916139.850	623990.699	7.52
FSB-SS227	1916160.697	623957.840	7.57
FSB-SS228	1916157.222	623907.350	7.61
FSB-SS229	1916125.637	623892.184	7.62
FSB-SS230	1916128.479	623632.151	6.62
FSB-SS231	1916155.643	623602.451	7.19
FSB-SS232	1916135.112	623517.775	6.73
FSB-SS233	1916171.120	623453.320	6.94
FSB-SS234	1916139.850	623385.705	7.03
FSB-SS235	1916178.385	623335.152	6.92
FSB-SS236	1916149.326	623263.430	6.89
FSB-SS237	1916179.333	623218.880	7.15
WTP1-SS01	1919650.397	623927.551	6.44
WTP1-SS02	1919695.521	623904.101	7.30
WTP1-SS03	1919740.352	623931.068	6.24
WTP1-SS04	1919698.158	623959.501	7.09
WTP2-SS01	1910732.683	623028.757	7.40
WTP2-SS02	1910726.226	622969.700	7.47
WTP2-SS03	1910781.572	622980.312	7.48
WTP2-SS04	1910776.729	623056.902	6.63

Notes:
[a] Ohio State Plane- North, NAD 1983.
FSB - Former Sellite Building.
WTP1 - Waste Water Treatment Plant No. 1.
WTP2 - Waste Water Treatment Plant No. 2.
GMA - Garage Maintenance Area.
RIR - Remedial investigation report.

Table 4-8

Surface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node	Comments
FSB-SS28	1916540	623755	13-May-2012	0-0.5	8.25	A-1	
FSB-SS29	1916540	623795	13-May-2012	0-0.5	8.39	E-1	
FSB-SS30	1916540	623835	13-May-2012	0-0.5	8.13	I-1	
FSB-SS31	1916540	623875	13-May-2012	0-0.5	7.76	M-1	
FSB-SS32	1916540	623915	4-Jun-2012	0-0.5	6.84	Q-1	
FSB-SS33	1916540	623955	4-Jun-2012	0-0.5	7.06	U-1	
FSB-SS34	1916540	623995	31-May-2012	0-0.5	7.45	Y-1	
FSB-SS35	1916540	624035	31-May-2012	0-0.5	5.67	CC-1	
FSB-SS36	1916540	624075	31-May-2012	0-0.5	6.23	GG-1	
FSB-SS37	1916540	624115	31-May-2012	0-0.5	5.96	KK-1	
FSB-SS38	1916560	624035	6-Jun-2012	0-0.5	4.99	CC-3	
FSB-SS39	1916560	624075	6-Jun-2012	0-0.5	5.80	GG-3	
FSB-SS40	1916580	623755	23-May-2012	0-0.5	7.95	A-5	
FSB-SS41	1916580	623795	23-May-2012	0-0.5	7.91	E-5	
FSB-SS42	1916580	623835	4-Jun-2012	0-0.5	6.14	I-5	
FSB-SS43	1916580	623875	4-Jun-2012	0-0.5	6.20	M-5	
FSB-SS44	1916580	623915	4-Jun-2012	0-0.5	7.23	Q-5	Sediment
FSB-SS45	1916580	623955	4-Jun-2012	0-0.5	5.69	U-5	
FSB-SS46	1916580	623995	31-May-2012	0-0.5	7.46	Y-5	
FSB-SS47	1916580	624035	31-May-2012	0-0.5	4.46	CC-5	
FSB-SS48	1916580	624045	6-Jun-2012	0-0.5	4.25	DD-5	
FSB-SS49	1916580	624055	6-Jun-2012	0-0.5	4.56	EE-5	
FSB-SS50	1916580	624065	6-Jun-2012	0-0.5	4.67	FF-5	
FSB-SS51	1916580	624075	31-May-2012	0-0.5	4.65	GG-5	
FSB-SS52	1916580	624095	6-Jun-2012	0-0.5	8.45	II-5	
FSB-SS53	1916580	624115	31-May-2012	0-0.5	7.53	KK-5	
FSB-SS54	1916590	624035	6-Jun-2012	0-0.5	5.00	CC-6	
FSB-SS55	1916590	624045	6-Jun-2012	0-0.5	3.65	DD-6	
FSB-SS56	1916600	624065	4-Jun-2012	0-0.5	2.45	FF-7	
FSB-SS57	1916600	624095	6-Jun-2012	0-0.5	6.08	II-7	
FSB-SS58	1916610	623955	5-Jun-2012	0-0.5	7.15	U-8	Sediment
FSB-SS59	1916620	623755	23-May-2012	0-0.5	7.91	A-9	
FSB-SS60	1916620	623795	23-May-2012	0-0.5	7.92	E-9	
FSB-SS61	1916620	623835	4-Jun-2012	0-0.5	7.47	I-9	
FSB-SS62	1916620	623875	4-Jun-2012	0-0.5	6.41	M-9	
FSB-SS63	1916620	623915	4-Jun-2012	0-0.5	6.72	Q-9	
FSB-SS64	1916620	623955	31-May-2012	0-0.5	6.30	U-9	
FSB-SS65	1916620	623995	31-May-2012	0-0.5	6.39	Y-9	
FSB-SS66	1916620	624035	31-May-2012	0-0.5	7.29	CC-9	
FSB-SS67	1916620	624075	31-May-2012	0-0.5	3.39	GG-9	
FSB-SS68	1916620	624095	6-Jun-2012	0-0.5	5.58	II-9	

Table 4-8

Surface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node	Comments
FSB-SS69	1916620	624115	31-May-2012	0-0.5	7.53	KK-9	
FSB-SS70	1916620	624155	31-May-2012	0-0.5	6.29	OO-9	
FSB-SS71	1916640	624085	4-Jun-2012	0-0.5	1.85	HH-11	
FSB-SS72	1916640	624095	6-Jun-2012	0-0.5	4.71	II-11	
FSB-SS73	1916660	623755	23-May-2012	0-0.5	8.11	A-13	
FSB-SS74	1916660	623795	23-May-2012	0-0.5	8.08	E-13	
FSB-SS75	1916660	623835	23-May-2012	0-0.5	7.92	I-13	
FSB-SS76	1916660	623875	23-May-2012	0-0.5	7.99	M-13	
FSB-SS77	1916660	623915	4-Jun-2012	0-0.5	6.94	Q-13	
FSB-SS78	1916660	623955	4-Jun-2012	0-0.5	6.45	U-13	
FSB-SS79	1916660	623995	31-May-2012	0-0.5	6.13	Y-13	
FSB-SS80	1916660	624015	6-Jun-2012	0-0.5	5.72	AA-13	
FSB-SS81	1916660	624035	31-May-2012	0-0.5	7.73	CC-13	Sediment
FSB-SS82	1916660	624075	31-May-2012	0-0.5	5.06	GG-13	
FSB-SS83	1916660	624085	4-Jun-2012	0-0.5	1.97	HH-13	
FSB-SS84	1916660	624095	4-Jun-2012	0-0.5	3.06	II-13	
FSB-SS85	1916660	624115	31-May-2012	0-0.5	4.41	KK-13	
FSB-SS86	1916660	624135	6-Jun-2012	0-0.5	8.14	MM-13	
FSB-SS87	1916660	624155	31-May-2012	0-0.5	7.59	OO-13	
FSB-SS88	1916680	624015	6-Jun-2012	0-0.5	6.10	AA-15	
FSB-SS89	1916680	624085	4-Jun-2012	0-0.5	2.28	HH-15	
FSB-SS90	1916680	624095	6-Jun-2012	0-0.5	5.20	II-15	
FSB-SS91	1916700	623755	23-May-2012	0-0.5	8.02	A-17	
FSB-SS92	1916700	623795	23-May-2012	0-0.5	7.92	E-17	
FSB-SS93	1916700	623835	23-May-2012	0-0.5	7.66	I-17	
FSB-SS94	1916700	623875	23-May-2012	0-0.5	6.72	M-17	
FSB-SS95	1916700	623915	4-Jun-2012	0-0.5	6.65	Q-17	
FSB-SS96	1916700	623955	4-Jun-2012	0-0.5	6.65	U-17	
FSB-SS97	1916700	623995	31-May-2012	0-0.5	6.35	Y-17	
FSB-SS98	1916700	624015	4-Jun-2012	0-0.5	2.37	AA-17	
FSB-SS99	1916700	624035	31-May-2012	0-0.5	4.19	CC-17	
FSB-SS100	1916700	624045	5-Jun-2012	0-0.5	7.29	DD-17	Sediment
FSB-SS101	1916700	624075	31-May-2012	0-0.5	4.24	GG-17	
FSB-SS102	1916700	624085	4-Jun-2012	0-0.5	3.18	HH-17	
FSB-SS103	1916700	624095	6-Jun-2012	0-0.5	5.08	II-17	
FSB-SS104	1916700	624115	31-May-2012	0-0.5	4.23	KK-17	
FSB-SS105	1916700	624135	6-Jun-2012	0-0.5	6.31	MM-17	
FSB-SS106	1916700	624155	31-May-2012	0-0.5	7.02	OO-17	
FSB-SS107	1916720	624015	4-Jun-2012	0-0.5	2.95	AA-19	
FSB-SS108	1916720	624085	4-Jun-2012	0-0.5	2.01	HH-19	
FSB-SS109	1916720	624095	6-Jun-2012	0-0.5	4.36	II-19	

Table 4-8

Surface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node	Comments
FSB-SS110	1916740	623755	23-May-2012	0-0.5	8.00	A-21	
FSB-SS111	1916740	623795	23-May-2012	0-0.5	7.81	E-21	
FSB-SS112	1916740	623835	23-May-2012	0-0.5	7.27	I-21	
FSB-SS113	1916740	623875	23-May-2012	0-0.5	7.46	M-21	
FSB-SS114	1916740	623915	23-May-2012	0-0.5	6.37	Q-21	
FSB-SS115	1916740	623955	29-May-2012	0-0.5	5.53	U-21	
FSB-SS116	1916740	623995	29-May-2012	0-0.5	7.34	Y-21	
FSB-SS117	1916740	624015	4-Jun-2012	0-0.5	5.47	AA-21	
FSB-SS118	1916740	624035	30-May-2012	0-0.5	5.01	CC-21	
FSB-SS119	1916740	624045	5-Jun-2012	0-0.5	5.12	DD-21	Sediment
FSB-SS120	1916740	624075	31-May-2012	0-0.5	5.78	GG-21	
FSB-SS121	1916740	624085	4-Jun-2012	0-0.5	3.11	HH-21	
FSB-SS122	1916740	624095	6-Jun-2012	0-0.5	4.34	II-21	
FSB-SS123	1916740	624115	31-May-2012	0-0.5	4.67	KK-21	
FSB-SS124	1916740	624135	6-Jun-2012	0-0.5	6.57	MM-21	
FSB-SS125	1916740	624155	31-May-2012	0-0.5	6.64	OO-21	
FSB-SS126	1916760	624015	4-Jun-2012	0-0.5	3.64	AA-23	
FSB-SS127	1916780	623755	23-May-2012	0-0.5	7.62	A-25	
FSB-SS128	1916780	623795	23-May-2012	0-0.5	7.43	E-25	
FSB-SS129	1916780	623835	23-May-2012	0-0.5	6.55	I-25	
FSB-SS130	1916780	623875	23-May-2012	0-0.5	7.47	M-25	
FSB-SS131	1916780	623915	23-May-2012	0-0.5	6.73	Q-25	
FSB-SS132	1916780	623955	29-May-2012	0-0.5	5.23	U-25	
FSB-SS133	1916780	623995	29-May-2012	0-0.5	5.45	Y-25	
FSB-SS134	1916780	624015	4-Jun-2012	0-0.5	5.14	AA-25	
FSB-SS135	1916780	624035	30-May-2012	0-0.5	3.08	CC-25	
FSB-SS136	1916780	624045	5-Jun-2012	0-0.5	5.00	DD-25	Sediment
FSB-SS137	1916780	624075	31-May-2012	0-0.5	6.25	GG-25	
FSB-SS138	1916780	624115	31-May-2012	0-0.5	6.22	KK-25	
FSB-SS139	1916800	624015	4-Jun-2012	0-0.5	2.25	AA-27	
FSB-SS140	1916820	623755	23-May-2012	0-0.5	7.61	A-29	
FSB-SS141	1916820	623795	23-May-2012	0-0.5	7.50	E-29	
FSB-SS142	1916820	623835	23-May-2012	0-0.5	4.53	I-29	
FSB-SS143	1916820	623855	6-Jun-2012	0-0.5	5.08	K-29	
FSB-SS144	1916820	623875	23-May-2012	0-0.5	5.36	M-29	
FSB-SS145	1916820	623895	6-Jun-2012	0-0.5	5.10	O-29	
FSB-SS146	1916820	623915	23-May-2012	0-0.5	5.08	Q-29	
FSB-SS147	1916820	623935	6-Jun-2012	0-0.5	6.19	S-29	
FSB-SS148	1916820	623955	29-May-2012	0-0.5	6.02	U-29	
FSB-SS149	1916820	623995	29-May-2012	0-0.5	6.43	Y-29	
FSB-SS150	1916820	624015	4-Jun-2012	0-0.5	3.67	AA-29	

Table 4-8

Surface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node	Comments
FSB-SS151	1916820	624035	30-May-2012	0-0.5	6.94	CC-29	
FSB-SS152	1916820	624045	5-Jun-2012	0-0.5	5.00	DD-29	Sediment
FSB-SS153	1916840	623795	6-Jun-2012	0-0.5	7.19	E-31	
FSB-SS154	1916840	623815	6-Jun-2012	0-0.5	6.23	G-31	
FSB-SS155	1916840	623835	4-Jun-2012	0-0.5	5.41	I-31	
FSB-SS156	1916840	623855	4-Jun-2012	0-0.5	1.20	K-31	
FSB-SS157	1916840	623875	4-Jun-2012	0-0.5	1.58	M-31	
FSB-SS158	1916840	623895	4-Jun-2012	0-0.5	2.14	O-31	
FSB-SS159	1916840	623915	4-Jun-2012	0-0.5	1.13	Q-31	
FSB-SS160	1916840	623935	4-Jun-2012	0-0.5	4.16	S-31	
FSB-SS161	1916840	623955	6-Jun-2012	0-0.5	6.14	U-31	
FSB-SS162	1916860	623755	23-May-2012	0-0.5	7.53	A-33	
FSB-SS163	1916860	623795	23-May-2012	0-0.5	6.77	E-33	
FSB-SS164	1916860	623835	23-May-2012	0-0.5	7.16	I-33	
FSB-SS165	1916860	623875	23-May-2012	0-0.5	4.18	M-33	
FSB-SS166	1916860	623915	23-May-2012	0-0.5	4.92	Q-33	
FSB-SS167	1916860	623955	23-May-2012	0-0.5	7.02	U-33	
FSB-SS168	1916860	623995	30-May-2012	0-0.5	5.36	Y-33	
FSB-SS169	1916860	624015	6-Jun-2012	0-0.5	5.50	AA-33	
FSB-SS170	1916860	624035	30-May-2012	0-0.5	7.25	CC-33	Sediment
FSB-SS171	1916880	623855	4-Jun-2012	0-0.5	2.65	K-35	
FSB-SS172	1916880	623875	4-Jun-2012	0-0.5	1.43	M-35	
FSB-SS173	1916880	623895	4-Jun-2012	0-0.5	1.16	O-35	
FSB-SS174	1916880	623935	4-Jun-2012	0-0.5	1.80	S-35	
FSB-SS175	1916900	623755	23-May-2012	0-0.5	6.93	A-37	
FSB-SS176	1916900	623795	23-May-2012	0-0.5	6.49	E-37	
FSB-SS177	1916900	623835	23-May-2012	0-0.5	3.88	I-37	
FSB-SS178	1916900	623855	4-Jun-2012	0-0.5	4.16	K-37	
FSB-SS179	1916900	623875	23-May-2012	0-0.5	3.45	M-37	
FSB-SS180	1916900	623895	5-Jun-2012	0-0.5	4.50	O-37	
FSB-SS181	1916900	623915	23-May-2012	0-0.5	3.98	Q-37	
FSB-SS182	1916900	623935	4-Jun-2012	0-0.5	2.26	S-37	
FSB-SS183	1916900	623955	29-May-2012	0-0.5	4.81	U-37	
FSB-SS184	1916900	623995	29-May-2012	0-0.5	4.97	Y-37	
FSB-SS185	1916900	624035	30-May-2012	0-0.5	7.08	CC-37	Sediment
FSB-SS186	1916910	623915	4-Jun-2012	0-0.5	2.99	Q-38	
FSB-SS187	1916920	623895	4-Jun-2012	0-0.5	2.77	O-39	
FSB-SS188	1916940	623755	23-May-2012	0-0.5	7.13	A-41	
FSB-SS189	1916940	623795	23-May-2012	0-0.5	7.07	E-41	
FSB-SS190	1916940	623835	23-May-2012	0-0.5	4.86	I-41	
FSB-SS191	1916940	623855	5-Jun-2012	0-0.5	5.26	K-41	

Table 4-8

Surface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node	Comments
FSB-SS192	1916940	623875	23-May-2012	0-0.5	4.09	M-41	
FSB-SS193	1916940	623895	5-Jun-2012	0-0.5	4.08	O-41	
FSB-SS194	1916940	623915	29-May-2012	0-0.5	3.85	Q-41	
FSB-SS195	1916940	623935	6-Jun-2012	0-0.5	7.20	S-41	
FSB-SS196	1916940	623955	29-May-2012	0-0.5	6.47	U-41	
FSB-SS197	1916940	623995	29-May-2012	0-0.5	6.48	Y-41	
FSB-SS198	1916940	624025	5-Jun-2012	0-0.5	6.09	BB-41	Sediment
FSB-SS199	1916940	624035	30-May-2012	0-0.5	7.51	CC-41	
FSB-SS200	1916980	623835	29-May-2012	0-0.5	6.59	I-45	
FSB-SS201	1916980	623855	5-Jun-2012	0-0.5	6.10	K-45	
FSB-SS202	1916980	623875	29-May-2012	0-0.5	5.54	M-45	
FSB-SS203	1916980	623895	5-Jun-2012	0-0.5	7.57	O-45	
FSB-SS204	1916980	623915	29-May-2012	0-0.5	3.87	Q-45	
FSB-SS205	1916980	623955	30-May-2012	0-0.5	7.13	U-45	Sediment
FSB-SS206	1916980	623995	30-May-2012	0-0.5	6.77	Y-45	
FSB-SS207	1916980	624035	30-May-2012	0-0.5	6.82	CC-45	
FSB-SS208	1917000	623925	5-Jun-2012	0-0.5	6.31	R-47	Sediment
FSB-SS209	1917020	623875	30-May-2012	0-0.5	7.88	M-49	Sediment
FSB-SS210	1917020	623915	30-May-2012	0-0.5	7.07	Q-49	
FSB-SS211	1917020	623955	30-May-2012	0-0.5	7.05	U-49	
FSB-SS212	1917060	623875	30-May-2012	0-0.5	6.92	M-53	
FSB-SS213	1917060	623915	30-May-2012	0-0.5	6.94	Q-53	

Notes:

[a] Ohio State Plane- North, NAD 1983.
bgs - Below ground surface.
FSB - Former Sellite Building.
GMA - Garage Maintenance Area.
RIR - Remedial investigation report.

Table 4-9

Subsurface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node
FSB-HB01	1916660	624085	12-Jun-2012	0-1	3.43	HH-13
				1-2	3.65	
				2-3	4.15	
				3-4	4.45	
				4-5	7.13	
				5-6	7.39	
				6-7	7.64	
				7-8	7.91	
				8-9	7.78	
				9-10	7.96	
FSB-HB02	1916720	624085	13-Jun-2012	0-1	4.06	HH-19
				1-2	4.30	
				2-3	4.72	
				3-4	7.66	
				4-5	7.98	
				5-6	7.98	
				6-7	7.91	
FSB-HB03	1916720	624015	13-Jun-2012	0-1	3.92	AA-19
				1-2	4.59	
				2-3	4.70	
				3-4	7.72	
				4-5	7.57	
FSB-HB04	1916800	624015	13-Jun-2012	0-1	3.09	AA-27
				1-2	6.96	
				2-3	7.53	
				3-4	7.74	
				4-5	7.59	
FSB-HB05	1916840	623915	13-Jun-2012	0-1	2.27	Q-31
				1-2	2.84	
				2-3	3.36	
				3-4	3.44	
				4-5	3.25	

Table 4-9

Subsurface Soil pH Field Screening Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Easting[a]	Northing[a]	Date	Depth (feet bgs)	pH Reading	Grid Node
FSB-HB06	1916840	623855	14-Jun-2012	0-1	2.28	K-31
				1-2	2.78	
				2-3	2.85	
				3-4	3.31	
				4-5	4.25	
FSB-HB07	1916880	623935	14-Jun-2012	0-1	3.54	S-35
				1-2	3.44	
				2-3	4.92	
				3-4	5.84	
				4-5	6.67	
FSB-HB08	1916880	623875	14-Jun-2012	0-1	3.04	M-35
				1-2	3.01	
				2-3	3.16	
				3-4	3.79	

Notes:

[a] Ohio State Plane- North, NAD 1983.
bgs - Below ground surface.
FSB - Former Sellite Building.
GMA - Garage Maintenance Area.
RIR - Remedial investigation report.

Table 4-10

Confirmation Soil pH Results – Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Location ID	Sample ID	Easting[a]	Northing[a]	Field pH Result[b]	Laboratory pH Result[b]	Collection Depth (ft bgs)	Grid Node
FSB-SS238	FSB-0086	1916580	623795	6.19	8.39	0-0.5	E-5
FSB-SS239	FSB-0087	1916620	623995	6.65	7.19	0-0.5	Y-9
FSB-SS240	FSB-0088	1916590	624045	3.17	2.91	0-0.5	DD-6
FSB-SS241	FSB-0089	1916600	624065	3.84	3.10	0-0.5	FF-7
FSB-SS242	FSB-0090	1916660	624085	3.67	2.27	0-0.5	HH-13
FSB-SS243	FSB-0091	1916660	624115	2.44	2.24	0-0.5	HH-13
FSB-SS244	FSB-0092	1916680	624085	3.12	2.75	0-0.5	HH-15
FSB-SS245	FSB-0093	1916720	624085	3.58	2.90	0-0.5	HH-19
FSB-SS246	FSB-0094	1916720	624015	2.69	2.71	0-0.5	AA-19
FSB-SS247	FSB-0095	1916760	624015	5.62	3.16	0-0.5	AA-23
FSB-SS248	FSB-0096	1916800	624015	4.17	2.11	0-0.5	AA-27
FSB-SS249	FSB-0097	1916900	623995	5.41	4.77	0-0.5	Y-37
FSB-SS250	FSB-0098	1916840	623915	1.89	1.76	0-0.5	Q-31
FSB-SS251	FSB-0099	1916820	623955	2.54	1.70	0-0.5	Q-31
FSB-SS252	FSB-0100	1916840	623875	2.12	1.90	0-0.5	M-31
FSB-SS253	FSB-0101	1916840	623855	2.29	2.09	0-0.5	K-31
FSB-SS254	FSB-0102	1916880	623935	2.84	2.21	0-0.5	S-35
FSB-SS255	FSB-0103	1916880	623875	1.87	1.71	0-0.5	M-35
FSB-SS256	FSB-0104	1916920	623895	3.09	2.62	0-0.5	O-39
FSB-SS257	FSB-0105	1916980	623875	5.77	5.39	0-0.5	M-45
FSB-HB01	FSB-0106	1916660	624085	3.65	2.94	1-2	HH-13
FSB-HB02	FSB-0107	1916720	624085	7.66	7.27	3-4	HH-19
FSB-HB05	FSB-0108	1916840	623915	3.25	2.83	4-5	Q-31
FSB-HB06	FSB-0109	1916840	623855	2.78	2.28	1-2	K-31
FSB-HB07	FSB-0110	1916880	623935	6.67	7.44	4-5	S-35
FSB-HB08	FSB-0111	1916880	623875	3.01	2.10	1-2	M-35

Notes:
[a] Ohio State Plane- North, NAD 1983.
[b] pH measured in standard units.

ft bgs - Feet below ground surface.
GMA - Garage Maintenance Area.
RIR - Remedial investigation report.

Table 4-11

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Surface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Detected Concentrations Maximum	VQ	Reporting Limits Minimum	Reporting Limits Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics															
Aluminum	15 / 15	100	4.24E+02		8.77E+03		9.40E-01	2.40E+01	3.99E+03	1.55E+04	7700		N (b)		
Antimony	4 / 15	27	5.20E-01	J	1.17E+01		4.30E-02	1.00E+00	1.24E+00	9.30E+00	3.1		Y	4.33E+00	4.33E+00
Arsenic	15 / 15	100	4.00E-01	J	1.29E+01	J	4.30E-02	1.00E+00	5.28E+00	3.65E+01	0.39		N (b)		
Barium	15 / 15	100	1.44E+01		1.07E+02		4.70E-02	4.10E+00	4.84E+01	8.26E+02	1500		N (b)		
Beryllium	12 / 15	80	8.00E-02	J	3.90E-01		4.30E-03	1.00E-01	1.66E-01	1.00E+00	16		N (b)		
Cadmium	6 / 15	40	1.30E-01	J	6.60E+00	J	4.30E-03	1.00E-01	6.80E-01	NA	7		N (a)		
Calcium	15 / 15	100	4.92E+02		9.94E+04		2.20E+00	5.10E+01	2.08E+04	5.23E+04	Nutrient		N (c)		
Chromium	15 / 15	100	7.90E-01		3.99E+01		4.30E-02	1.00E+00	1.01E+01	2.90E+01	0.29		Y	1.53E+01	1.53E+01
Cobalt	14 / 15	93	5.70E-01	J	3.10E+01	J	4.30E-02	1.00E+00	4.67E+00	1.16E+02	2.3		N (b)		
Copper	15 / 15	100	7.60E-01	J	3.75E+01		4.30E-02	1.00E+00	1.00E+01	5.62E+01	310		N (b)		
Iron	15 / 15	100	4.31E+02		2.81E+04		1.00E+00	2.30E+01	1.20E+04	2.34E+05	5500		N (b)		
Lead	15 / 15	100	4.40E+00		4.06E+03		4.30E-02	2.20E+00	2.98E+02	4.86E+01	400	g	Y		2.98E+02
Magnesium	15 / 15	100	5.86E+01	J	1.44E+04		2.20E+00	5.10E+01	3.47E+03	1.04E+04	Nutrient		N (c)		
Manganese	15 / 15	100	4.10E+00		1.38E+03		4.30E-02	1.00E+00	3.22E+02	3.51E+03	180		N (b)		
Mercury	15 / 15	100	1.05E-02	J	2.10E+00		6.30E-03	7.30E-02	1.98E-01	8.50E-02	2.3		N (a)		
Nickel	15 / 15	100	2.60E-01	J	4.48E+01		4.30E-02	1.00E+00	1.06E+01	5.51E+01	150		N (b)		
Potassium	15 / 15	100	1.48E+02	J	2.36E+03		2.20E+00	5.10E+01	5.62E+02	3.39E+03	Nutrient		N (c)		
Selenium	9 / 15	60	2.10E-01	J	8.90E-01	J	8.70E-02	2.00E+00	5.27E-01	2.00E+00	39		N (b)		
Silver	3 / 15	20	6.30E-02	J	1.60E-01	J	4.30E-02	1.00E+00	1.38E-01	1.11E+01	39		N (b)		
Sodium	8 / 15	53	6.32E+01	J	2.68E+02	J	3.50E+01	8.70E+02	1.47E+02	NA	Nutrient		N (c)		
Vanadium	15 / 15	100	1.20E+00	J	6.71E+01		4.30E-02	1.00E+00	1.67E+01	4.09E+01	39		Y	2.47E+01	2.47E+01
Zinc	15 / 15	100	8.10E-01	J	1.71E+02		4.30E-02	1.00E+00	3.85E+01	3.22E+02	2300		N (b)		
Polychlorinated biphenyls (PCB)															
Aroclor 1254	27 / 39	69	1.42E-02	J	1.21E+01	J	7.60E-03	5.80E+00	1.90E+00		0.11		Y	2.49E+00	2.49E+00
Aroclor 1260	33 / 39	85	1.37E-02	J	4.11E+01	J	7.60E-03	5.80E+00	4.00E+00		0.22		Y	9.27E+00	9.27E+00
Aroclor 1268	24 / 28	86	1.93E-02	J	9.59E+01	J	7.60E-03	5.80E+00	9.45E+00		0.22	h	Y	2.56E+01	2.56E+01
Semivolatile Organic Compounds															
Acenaphthylene	1 / 15	7	2.52E-02	J	2.52E-02	J	1.90E-02	2.20E-02	2.07E-02		340	i	N (a)		
Anthracene	2 / 15	13	2.25E-02	J	7.54E-02	J	1.90E-02	2.20E-02	2.42E-02		1700		N (a)		
Benzo(a)anthracene	4 / 15	27	3.17E-02	J	8.92E-02	J	1.90E-02	2.20E-02	2.79E-02		0.15		N (a)		
Benzo(a)pyrene	4 / 15	27	2.73E-02	J	9.44E-02	J	1.90E-02	2.20E-02	2.82E-02		0.015		Y	5.12E-02	5.12E-02
Benzo(b)fluoranthene	6 / 15	40	2.02E-02	J	1.32E-01	J	1.90E-02	2.20E-02	3.46E-02		0.15		N (a)		
Benzo(ghi)perylene	2 / 15	13	4.60E-02	J	5.27E-02	J	1.90E-02	2.20E-02	2.42E-02		170	j	N (a)		
Benzo(k)fluoranthene	3 / 15	20	1.97E-02	J	4.54E-02	J	1.90E-02	2.20E-02	2.24E-02		1.5		N (a)		
Chrysene	6 / 15	40	2.06E-02	J	9.11E-02	J	1.90E-02	2.20E-02	2.96E-02		15		N (a)		
Fluoranthene	8 / 15	53	2.18E-02	J	1.79E-01	J	1.90E-02	2.20E-02	4.54E-02		230		N (a)		
Indeno(1,2,3-cd)pyrene	4 / 15	27	2.16E-02	J	6.37E-02	J	1.90E-02	2.20E-02	2.52E-02		0.15		N (a)		
Phenanthrene	4 / 15	27	2.66E-02	J	9.34E-02	J	1.90E-02	2.20E-02	2.72E-02		170	j	N (a)		
Pyrene	7 / 15	47	2.06E-02	J	1.78E-01	J	1.90E-02	2.20E-02	4.16E-02		170		N (a)		
Volatile Organic Compounds															
Acetone	7 / 9	78	2.63E-02	J	9.85E-02	J	1.40E-02	1.90E-02	5.33E-02		6100		N (a)		

Table 4-11

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Surface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

			Range of Values, mg/kg											
	Detection	Percent	Detected Concentrations				Reporting Limits		Mean	BSC [a]	RBSC [b]		95% UCL [e]	EPC [f]
Chemical	Frequency	Detection	Minimum	VQ	Maximum	VQ	Minimum	Maximum	mg/kg	mg/kg	mg/kg	COPC? [c,d]	mg/kg	mg/kg
Benzene	1 / 15	7	1.70E-03	J	1.70E-03	J	1.00E-03	1.70E-03	1.29E-03		1.1	N (a)		
Butanone, 2-	1 / 13	8	5.35E-03	J	5.35E-03	J	4.10E-03	7.00E-03	5.24E-03		2800	N (a)		
Ethylbenzene	1 / 15	7	1.30E-03	J	1.30E-03	J	6.80E-04	1.20E-03	8.73E-04		5.4	N (a)		
Hexanone, 2-	4 / 15	27	2.03E-02		5.56E-02		3.70E-03	6.20E-03	1.24E-02		21	N (a)		
Methylene chloride	10 / 11	91	4.20E-03	J	9.00E-03		3.10E-03	4.30E-03	5.67E-03		36	N (a)		
Toluene	6 / 15	40	9.40E-04	J	4.30E-03		8.10E-04	1.40E-03	1.39E-03		500	N (a)		
Xylenes, total	1 / 15	7	3.40E-03	J	3.40E-03	J	2.20E-03	3.70E-03	2.73E-03		63	N (a)		

BSC - Background screening criterion.
COPC - Chemical of potential concern.
EPC - Exposure point concentration.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - Milligrams per kilogram.
RBSC - Risk based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas* , *Plum Brook Ordnance Works, Sandusky, Ohio* , August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.
[e] 95% UCL determined using ProUCL Version 4.1 (EPA, 2011, *ProUCL Version 4.1.01* , Technical Support Center, Office of Science Policy, Atlanta, Georgia, July, http://www.epa.gov/osp/hstl/tsc/software.htm). Calculated only for COPCs.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] Because the average lead concentration exceeds 250 mg/kg, lead is identified as a COPC. The EPC equals the mean concentration (Section 2.4.1).
[h] RBSC based on Aroclor 1260.
[i] RBSC based on acenapthene.
[j] RBSC based on pyrene.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-12

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Subsurface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]
Inorganics													
Aluminum	30 / 30	100	3.40E+03		1.97E+04		8.90E-01	9.30E+00	7.90E+03	1.55E+04	7700		Y
Antimony	2 / 30	7	2.90E-01	J	5.00E-01	J	4.40E-02	4.60E-01	2.05E-01	9.30E+00	3.1		N (b)
Arsenic	30 / 30	100	2.30E+00		2.32E+01		4.40E-02	4.60E-01	9.06E+00	3.65E+01	0.39		N (b)
Barium	30 / 30	100	2.13E+01		1.13E+02		4.40E-02	1.30E+00	5.75E+01	8.26E+02	1500		N (b)
Beryllium	30 / 30	100	1.30E-01	J	1.00E+00		4.40E-03	4.60E-02	4.40E-01	1.00E+00	16		N (a)
Cadmium	19 / 30	63	7.55E-02	J	6.60E-01		4.40E-03	4.60E-02	1.93E-01	NA	7		N (a)
Calcium	30 / 30	100	1.46E+03	J	7.59E+04	J	2.20E+00	2.30E+01	3.36E+04	5.23E+04	Nutrient		N (c)
Chromium	30 / 30	100	5.60E+00		2.01E+01		4.40E-02	4.60E-01	1.32E+01	2.90E+01	0.29		N (b)
Cobalt	30 / 30	100	9.90E-01	J	1.28E+01		4.40E-02	4.60E-01	7.46E+00	1.16E+02	2.3		N (b)
Copper	30 / 30	100	6.40E+00		2.86E+01		4.40E-02	4.60E-01	1.82E+01	5.62E+01	310		N (b)
Iron	30 / 30	100	7.77E+03		3.36E+04		1.00E+00	1.60E+01	1.58E+04	2.34E+05	5500		N (b)
Lead	30 / 30	100	5.25E+00		6.34E+01		4.40E-02	2.80E-01	1.26E+01	4.86E+01	400		N (a)
Magnesium	30 / 30	100	4.61E+02		1.93E+04		2.20E+00	2.30E+01	1.03E+04	1.04E+04	Nutrient		N (c)
Manganese	30 / 30	100	2.42E+01		1.22E+03		4.40E-02	5.10E-01	4.55E+02	3.51E+03	180		N (b)
Mercury	30 / 30	100	1.00E-02	J	5.10E-02	J	6.10E-03	7.60E-03	2.92E-02	8.50E-02	2.3		N (b)
Nickel	30 / 30	100	3.80E+00		3.00E+01		4.40E-02	4.60E-01	2.02E+01	5.51E+01	150		N (b)
Potassium	30 / 30	100	3.66E+02	J	1.66E+03	J	2.20E+00	2.30E+01	9.08E+02	3.39E+03	Nutrient		N (c)
Selenium	10 / 30	33	1.90E-01	J	2.40E+00		8.80E-02	9.30E-01	5.65E-01	2.00E+00	39		N (a)
Silver	5 / 30	17	5.00E-02	J	9.20E-02	J	4.40E-02	4.60E-01	1.56E-01	1.11E+01	39		N (b)
Sodium	15 / 30	50	6.27E+01	J	5.42E+02	J	3.30E+01	3.50E+02	2.03E+02	NA	Nutrient		N (c)
Thallium	1 / 30	3	2.80E-01	J	2.80E-01	J	5.25E-02	4.10E-01	1.83E-01	1.30E+00	0.078		N (b)
Vanadium	30 / 30	100	9.80E+00		3.83E+01		4.40E-02	4.60E-01	1.93E+01	4.09E+01	39		N (b)
Zinc	30 / 30	100	8.70E+00		9.86E+01		4.40E-02	4.60E-01	4.76E+01	3.22E+02	2300		N (b)
Polychlorinated biphenyls (PCB)													
Aroclor 1254	4 / 15	27	1.16E-02	J	4.62E-01		7.70E-03	3.70E-02	4.07E-02		0.11		Y
Aroclor 1260	2 / 15	13	2.73E-02	J	2.81E-02	J	7.70E-03	9.20E-02	1.64E-02		0.22		N (a)
Aroclor 1268	2 / 5	40	1.05E-02	J	2.98E-02	J	7.70E-03	8.10E-03	1.28E-02		0.22	e	N (a)
Semivolatile Organic Compounds													
Acenaphthene	1 / 30	3	3.64E-02	J	3.64E-02	J	1.80E-02	2.20E-02	2.12E-02		340		N (a)
Acenaphthylene	1 / 30	3	1.96E-01		1.96E-01		1.80E-02	2.20E-02	2.65E-02		340	f	N (a)
Anthracene	1 / 30	3	5.90E-01		5.90E-01		1.80E-02	2.20E-02	3.97E-02		1700		N (a)
Benzo(a)anthracene	1 / 30	3	1.06E+00		1.06E+00		1.80E-02	2.20E-02	5.53E-02		0.15		N (d)
Benzo(a)pyrene	1 / 30	3	8.85E-01		8.85E-01		1.80E-02	2.20E-02	4.95E-02		0.015		N (d)
Benzo(b)fluoranthene	1 / 30	3	1.15E+00		1.15E+00		1.80E-02	2.20E-02	5.83E-02		0.15		N (d)
Benzo(ghi)perylene	1 / 30	3	4.11E-01		4.11E-01		1.80E-02	2.20E-02	3.37E-02		170	g	N (a)
Benzo(k)fluoranthene	1 / 30	3	4.39E-01		4.39E-01		1.80E-02	2.20E-02	3.46E-02		1.5		N (a)
Bis(2-ethylhexyl)phthalate	2 / 30	7	1.22E-01	J	2.30E-01	J	7.40E-02	8.80E-02	8.86E-02		35		N (a)
Carbazole	1 / 30	3	9.42E-02	J	9.42E-02	J	1.80E-02	2.20E-02	2.31E-02		NSV		N (a)
Chrysene	1 / 30	3	8.85E-01		8.85E-01		1.80E-02	2.20E-02	4.95E-02		15		N (a)
Dibenz(a,h)anthracene	1 / 30	3	1.16E-01	J	1.16E-01	J	1.80E-02	2.20E-02	2.39E-02		0.015		N (d)
Dibenzofuran	1 / 30	3	5.65E-02	J	5.65E-02	J	1.80E-02	2.20E-02	2.19E-02		7.8		N (a)
Fluoranthene	1 / 30	3	1.99E+00		1.99E+00		1.80E-02	2.20E-02	8.63E-02		230		N (a)

Table 4-12

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Subsurface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]
Fluorene	1 / 30	3	1.91E-01		1.91E-01		1.80E-02	2.20E-02	2.64E-02		230		N (a)
Indeno(1,2,3-cd)pyrene	1 / 30	3	5.13E-01		5.13E-01		1.80E-02	2.20E-02	3.71E-02		0.15		N (d)
Phenanthrene	1 / 30	3	1.52E+00		1.52E+00		1.80E-02	2.20E-02	7.07E-02		170	g	N (a)
Pyrene	1 / 30	3	1.85E+00		1.85E+00		1.80E-02	2.20E-02	8.17E-02		170		N (a)
Volatile Organic Compounds													
Acetone	14 / 23	61	1.83E-02	J	1.05E-01		1.30E-02	1.90E-02	3.20E-02		6100		N (a)
Benzene	8 / 30	27	1.10E-03	J	4.20E-03		7.70E-04	1.40E-03	1.39E-03		1.1		N (a)
Butanone, 2-	2 / 29	7	4.40E-03	J	1.40E-02	J	3.90E-03	5.80E-03	5.18E-03		2800		N (a)
Ethylbenzene	2 / 30	7	1.60E-03	J	2.60E-03	J	5.10E-04	9.60E-04	8.72E-04		5.4		N (a)
Methylene chloride	16 / 25	64	3.40E-03	J	7.40E-03	J	2.90E-03	4.40E-03	4.79E-03		36		N (a)
Toluene	16 / 30	53	9.40E-04	J	1.01E-02		6.10E-04	1.10E-03	1.76E-03		500		N (a)
Xylenes, total	1 / 30	3	4.90E-03	J	4.90E-03	J	1.60E-03	3.10E-03	2.60E-03		63		N (a)

BSC - Background screening criterion.
COPC - Chemical of potential concern.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - Milligrams per kilogram.
NSV - No RBSC established.
RBSC - Risk-based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas*, *Plum Brook Ordnance Works, Sandusky, Ohio*, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
(d) = frequency of detection is less than 5%.
[d] Y = Chemical is chosen as COPC.
[e] RBSC based on Aroclor 1268.
[f] RBSC based on acenaphthene.
[g] RBSC based on pyrene.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-13

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Total Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Detected Concentrations Maximum	VQ	Reporting Limits Minimum	Reporting Limits Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg		COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics															
Aluminum	45 / 45	100	4.24E+02		1.97E+04		8.90E-01	2.40E+01	6.60E+03	1.55E+04	7700		Y	7.67E+03	7.67E+03
Antimony	6 / 45	13	2.90E-01	J	1.17E+01		4.30E-02	1.00E+00	5.51E-01	9.30E+00	3.1		Y	1.12E+00	1.12E+00
Arsenic	45 / 45	100	4.00E-01	J	2.32E+01		4.30E-02	1.00E+00	7.80E+00	3.65E+01	0.39		N (b)		
Barium	45 / 45	100	1.44E+01		1.13E+02		4.40E-02	4.10E+00	5.44E+01	8.26E+02	1500		N (b)		
Beryllium	42 / 45	93	8.00E-02	J	1.00E+00		4.30E-03	1.00E-01	3.49E-01	1.00E+00	16		N (a)		
Cadmium	25 / 45	56	7.55E-02	J	6.60E+00	J	4.30E-03	1.00E-01	3.55E-01	NA	7		N (a)		
Calcium	45 / 45	100	4.92E+02		9.94E+04		2.20E+00	5.10E+01	2.93E+04	5.23E+04	Nutrient		N (c)		
Chromium	45 / 45	100	7.90E-01		3.99E+01		4.30E-02	1.00E+00	1.22E+01	2.90E+01	0.29		Y	1.63E+01	1.63E+01
Cobalt	44 / 45	98	5.70E-01	J	3.10E+01	J	4.30E-02	1.00E+00	6.53E+00	1.16E+02	2.3		N (b)		
Copper	45 / 45	100	7.60E-01	J	3.75E+01		4.30E-02	1.00E+00	1.55E+01	5.62E+01	310		N (b)		
Iron	45 / 45	100	4.31E+02		3.36E+04		1.00E+00	2.30E+01	1.46E+04	2.34E+05	5500		N (b)		
Lead	45 / 45	100	4.40E+00		4.06E+03		4.30E-02	2.20E+00	1.08E+02	4.86E+01	400	g	N		
Magnesium	45 / 45	100	5.86E+01	J	1.93E+04		2.20E+00	5.10E+01	8.05E+03	1.04E+04	Nutrient		N (c)		
Manganese	45 / 45	100	4.10E+00		1.38E+03		4.30E-02	1.00E+00	4.11E+02	3.51E+03	180		N (b)		
Mercury	45 / 45	100	1.00E-02	J	2.10E+00		6.10E-03	7.30E-02	8.56E-02	8.50E-02	2.3		N (a)		
Nickel	45 / 45	100	2.60E-01	J	4.48E+01		4.30E-02	1.00E+00	1.70E+01	5.51E+01	150		N (b)		
Potassium	45 / 45	100	1.48E+02	J	2.36E+03		2.20E+00	5.10E+01	7.93E+02	3.39E+03	Nutrient		N (c)		
Selenium	19 / 45	42	1.90E-01	J	2.40E+00		8.70E-02	2.00E+00	5.52E-01	2.00E+00	39		N (a)		
Silver	8 / 45	18	5.00E-02	J	1.60E-01	J	4.30E-02	1.00E+00	1.50E-01	1.11E+01	39		N (b)		
Sodium	23 / 45	51	6.27E+01	J	5.42E+02	J	3.30E+01	8.70E+02	1.84E+02	NA	Nutrient		N (c)		
Thallium	1 / 45	2	2.80E-01	J	2.80E-01	J	5.25E-02	4.10E-01	1.56E-01	1.30E+00	0.078		N (b)		
Vanadium	45 / 45	100	1.20E+00	J	6.71E+01		4.30E-02	1.00E+00	1.85E+01	4.09E+01	39		Y	2.12E+01	2.12E+01
Zinc	45 / 45	100	8.10E-01	J	1.71E+02		4.30E-02	1.00E+00	4.46E+01	3.22E+02	2300		N (b)		
Polychlorinated biphenyls (PCB)															
Aroclor 1254	31 / 54	57	1.16E-02	J	1.21E+01	J	7.60E-03	5.80E+00	1.38E+00		0.11		Y	1.90E+00	1.90E+00
Aroclor 1260	35 / 54	65	1.37E-02	J	4.11E+01	J	7.60E-03	5.80E+00	2.89E+00		0.22		Y	4.52E+00	4.52E+00
Aroclor 1268	26 / 33	79	1.05E-02	J	9.59E+01	J	7.60E-03	5.80E+00	8.02E+00		0.22	h	Y	2.26E+01	2.26E+01
Semivolatile Organic Compounds															
Acenaphthene	1 / 45	2	3.64E-02	J	3.64E-02	J	1.80E-02	2.20E-02	2.09E-02		340		N (a)		
Acenaphthylene	2 / 45	4	2.52E-02	J	1.96E-01		1.80E-02	2.20E-02	2.46E-02		340	i	N (a)		
Anthracene	3 / 45	7	2.25E-02	J	5.90E-01		1.80E-02	2.20E-02	3.45E-02		1700		N (a)		
Benzo(a)anthracene	5 / 45	11	3.17E-02	J	1.06E+00		1.80E-02	2.20E-02	4.62E-02		0.15		Y	1.32E-01	1.32E-01
Benzo(a)pyrene	5 / 45	11	2.73E-02	J	8.85E-01		1.80E-02	2.20E-02	4.24E-02		0.015		Y	8.38E-02	8.38E-02
Benzo(b)fluoranthene	7 / 45	16	2.02E-02	J	1.15E+00		1.80E-02	2.20E-02	5.04E-02		0.15		Y	9.52E-02	9.52E-02
Benzo(ghi)perylene	3 / 45	7	4.60E-02	J	4.11E-01		1.80E-02	2.20E-02	3.05E-02		170	j	N (a)		
Benzo(k)fluoranthene	4 / 45	9	1.97E-02	J	4.39E-01		1.80E-02	2.20E-02	3.05E-02		1.5		N (a)		
Bis(2-ethylhexyl)phthalate	2 / 45	4	1.22E-01	J	2.30E-01	J	7.40E-02	8.80E-02	8.63E-02		35		N (a)		
Carbazole	1 / 45	2	9.42E-02	J	9.42E-02	J	1.80E-02	2.20E-02	2.22E-02		NSV		N (a)		
Chrysene	7 / 45	16	2.06E-02	J	8.85E-01		1.80E-02	2.20E-02	4.28E-02		15		N (a)		
Dibenz(a,h)anthracene	1 / 45	2	1.16E-01	J	1.16E-01	J	1.80E-02	2.20E-02	2.27E-02		0.015		N (d)		
Dibenzofuran	1 / 45	2	5.65E-02	J	5.65E-02	J	1.80E-02	2.20E-02	2.13E-02		7.8		N (a)		
Fluoranthene	9 / 45	20	2.18E-02	J	1.99E+00		1.80E-02	2.20E-02	7.27E-02		230		N (a)		
Fluorene	1 / 45	2	1.91E-01		1.91E-01		1.80E-02	2.20E-02	2.43E-02		230		N (a)		
Indeno(1,2,3-cd)pyrene	5 / 45	11	2.16E-02	J	5.13E-01		1.80E-02	2.20E-02	3.31E-02		0.15		Y	5.43E-02	5.43E-02
Phenanthrene	5 / 45	11	2.66E-02	J	1.52E+00		1.80E-02	2.20E-02	5.62E-02		170	j	N (a)		
Pyrene	8 / 45	18	2.06E-02	J	1.85E+00		1.80E-02	2.20E-02	6.83E-02		170		N (a)		

Table 4-13

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Total Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Volatile Organic Compounds														
Acetone	21 / 32	66	1.83E-02	J	1.05E-01		1.30E-02	1.90E-02	3.80E-02		6100	N (a)		
Benzene	9 / 45	20	1.10E-03	J	4.20E-03		7.70E-04	1.70E-03	1.36E-03		1.1	N (a)		
Butanone, 2-	3 / 42	7	4.40E-03	J	1.40E-02	J	3.90E-03	7.00E-03	5.20E-03		2800	N (a)		
Ethylbenzene	3 / 45	7	1.30E-03	J	2.60E-03	J	5.10E-04	1.20E-03	8.73E-04		5.4	N (a)		
Hexanone, 2-	4 / 45	9	2.03E-02		5.56E-02		2.80E-03	6.20E-03	6.97E-03		21	N (a)		
Methylene chloride	26 / 36	72	3.40E-03	J	9.00E-03		2.90E-03	4.40E-03	5.06E-03		36	N (a)		
Toluene	22 / 45	49	9.40E-04	J	1.01E-02		6.10E-04	1.40E-03	1.64E-03		500	N (a)		
Xylenes, total	2 / 45	4	3.40E-03	J	4.90E-03	J	1.60E-03	3.70E-03	2.64E-03		63	N (a)		

BSC - Background screening criterion.
COPC - Chemical of potential concern.
EPC - Exposure point concentration.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - Milligrams per kilogram.
NA - Not available.
NSV - No RBSC established.
RBSC - Risk-based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas***, Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
(d) = frequency of detection is less than 5%.
[d] Y = Chemical is chosen as COPC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1 (U.S. Environmental Protection Agency (EPA), 2010, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/TSC_form.htm. Calculated only for COPCs.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] Because the average lead concentration is less than 250 mg/kg, lead is not identified as a COPC (Section 2.4.1).
[h] RBSC based on Aroclor 1268.
[i] RBSC based on acenaphthene.
[j] RBSC based on pyrene.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-14

Statistical Summary and COPC Selection for Chemicals Detected in Sellite Area Overburden Groundwater
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Arithmetic Mean µg/L	RBSC [a] µg/L		COPC? [b,c]	95% UCL [d] µg/L	EPC [e] µg/L
Inorganics - Unfiltered														
Aluminum	6 / 6	100	5.69E+01	J	3.60E+02		2.00E+01	2.40E+01	1.57E+02	1600		N (a)		---
Antimony	1 / 6	17	8.70E+00		8.70E+00		1.00E+00	1.00E+00	2.28E+00	0.6		Y	7.88E+00	7.88E+00
Arsenic	5 / 6	83	2.40E+00	J	3.28E+01		1.00E+00	1.00E+00	7.33E+00	0.045		Y	3.00E+01	3.00E+01
Barium	6 / 6	100	2.20E+01	J	2.61E+02		1.00E+00	4.00E+00	1.05E+02	290		N (a)		---
Beryllium	1 / 6	17	8.50E-01	J	8.50E-01	J	1.00E-01	1.00E-01	2.25E-01	1.6		N (a)		---
Cadmium	1 / 6	17	7.00E-01	J	7.00E-01	J	1.00E-01	1.00E-01	2.00E-01	0.69		Y	6.36E-01	6.36E-01
Calcium	6 / 6	100	7.52E+04		3.41E+05		5.00E+01	5.00E+01	1.83E+05	Nutrient		N (b)		---
Chromium	2 / 6	33	1.30E+00	J	3.80E+00	J	1.00E+00	1.00E+00	1.52E+00	0.031		Y	2.80E+00	2.80E+00
Cobalt	5 / 6	83	1.50E+00	J	8.30E+00	J	1.00E+00	1.00E+00	3.35E+00	0.47		Y	5.56E+00	5.56E+00
Copper	3 / 6	50	2.00E+00	J	9.00E+00	J	1.00E+00	1.00E+00	3.13E+00	62		N (a)		---
Iron	6 / 6	100	9.06E+02		2.80E+03		2.30E+01	3.40E+01	1.71E+03	1100		Y	2.37E+03	2.37E+03
Lead	1 / 6	17	7.75E+00		7.75E+00		1.00E+00	1.00E+00	2.13E+00	15	f	N (a)		---
Magnesium	6 / 6	100	3.70E+04		1.37E+05		5.00E+01	5.00E+01	7.82E+04	Nutrient		N (b)		---
Manganese	6 / 6	100	7.62E+01		1.36E+03		1.00E+00	1.00E+00	5.06E+02	32		Y	1.65E+03	1.36E+03
Nickel	5 / 6	83	3.60E+00	J	8.55E+00	J	1.00E+00	1.00E+00	5.18E+00	30		N (a)		---
Potassium	6 / 6	100	3.10E+03	J	1.91E+04		5.00E+01	5.00E+01	8.24E+03	Nutrient		N (b)		---
Selenium	1 / 6	17	3.14E+01		3.14E+01		2.00E+00	2.00E+00	6.90E+00	7.8		Y	NA	3.14E+01
Silver	1 / 6	17	1.10E+00	J	1.10E+00	J	1.00E+00	1.00E+00	1.02E+00	7.1		N (a)		---
Sodium	6 / 6	100	3.78E+04		1.24E+06		7.50E+02	4.30E+04	4.89E+05	Nutrient		N (b)		---
Thallium	1 / 6	17	2.90E+01		2.90E+01		1.00E+00	1.50E+00	5.83E+00	0.016		Y	NA	2.90E+01
Vanadium	3 / 6	50	1.00E+00	J	8.35E+00	J	1.00E+00	1.00E+00	2.24E+00	6.3		Y	NA	8.35E+00
Zinc	3 / 6	50	8.50E+00	J	1.04E+01	J	1.00E+00	1.00E+00	5.09E+00	470		N (a)		---
General Chemistry														
Chloride	6 / 6	100	4.20E+03		3.78E+04		1.00E+03	5.00E+03	1.37E+04	Nutrient		N (b)		---
Nitrate-Nitrite	1 / 6	17	1.40E+02		1.40E+02		5.00E+01	5.00E+01	6.50E+01	160	g	N (a)		---
Sulfate	6 / 6	100	2.35E+05	J	2.37E+06		5.00E+03	2.50E+04	1.22E+06	250,000	h	Y	1.91E+06	1.91E+06

µg/L - Micrograms per liter.
COPC - Chemical of potential concern.
EPC - Exposure point concentration
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
NA - Not applicable.
RBSC - Risk-based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) tap water values and

Table 4-14

Statistical Summary and COPC Selection for Chemicals Detected in Sellite Area Overburden Groundwater
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

are based on a risk level of 1.0E-06 and a hazard index of 0.1.

[b] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = essential nutrient.

[c] Y = Chemical is chosen as COPC.

[d] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1.01 (U.S. Environmental Protection Agency (EPA), 2011, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/TSC_form.htm. Calculated only for COPC.

[e] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.

[f] Screening criteria for lead based on the action level of 15 µg/L (EPA, 1996, *Drinking Water Regulations and Health Advisories* , Office of Water, Washington, DC, October).

[g] RBSC for nitrite is used for screening.

[h] US Environmental Protection Agency (EPA), 2009, *2009 Edition of the Drinking Water Standards and Health Advisories* , Office of Water, October, EPA 822-R-09-011.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-15

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Sediment
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Mean mg/kg	RBSC [a] mg/kg	COPC? [b,c]	95% UCL [d] mg/kg	EPC [e] mg/kg
Inorganics													
Aluminum	6 / 6	100	7.42E+03		1.44E+04	J	5.20E+00	8.10E+00	1.01E+04	7.70E+04	N (a)		---
Arsenic	6 / 6	100	4.60E+00		1.85E+01		2.20E-01	3.40E-01	9.51E+00	3.90E-01	Y	1.37E+01	1.37E+01
Barium	6 / 6	100	4.68E+01		1.22E+02		8.70E-01	1.30E+00	7.78E+01	1.50E+04	N (a)		---
Beryllium	5 / 6	83	3.85E-01	J	8.20E-01	J	2.20E-02	3.40E-02	4.95E-01	1.60E+02	N (a)		---
Cadmium	4 / 6	67	1.17E-01	J	1.20E+00		2.20E-02	3.40E-02	3.85E-01	7.00E+01	N (a)		---
Calcium	6 / 6	100	3.94E+03		1.27E+04	J	1.05E+01	1.70E+01	7.54E+03	Nutrient	N (b)		---
Chromium	6 / 6	100	1.12E+01		1.81E+01	J	2.20E-01	3.40E-01	1.37E+01	2.90E-01	Y	1.58E+01	1.58E+01
Cobalt	6 / 6	100	4.70E+00	J	1.51E+01	J	2.20E-01	3.40E-01	7.35E+00	2.30E+01	N (a)		---
Copper	6 / 6	100	1.36E+01		2.58E+01		2.20E-01	3.40E-01	1.95E+01	3.10E+03	N (a)		---
Iron	6 / 6	100	1.29E+04		3.80E+04		5.00E+00	7.80E+00	2.07E+04	5.50E+04	N (a)		---
Lead	6 / 6	100	1.36E+01		3.45E+01		4.35E-02	6.70E-02	2.29E+01	4.00E+02	N (a)		---
Magnesium	6 / 6	100	1.14E+03	J	5.29E+03	J	1.05E+01	1.70E+01	2.65E+03	Nutrient	N (b)		---
Manganese	6 / 6	100	1.11E+02		8.19E+02	J	2.20E-01	3.40E-01	2.91E+02	1.80E+03	N (a)		---
Mercury	6 / 6	100	5.35E-02	J	1.10E-01	J	6.60E-03	8.30E-03	8.38E-02	2.30E+01	N (a)		---
Nickel	6 / 6	100	1.00E+01	J	2.93E+01	J	2.20E-01	3.40E-01	1.82E+01	1.50E+03	N (a)		---
Potassium	6 / 6	100	6.70E+02	J	1.36E+03	J	1.05E+01	1.70E+01	9.69E+02	Nutrient	N (b)		---
Selenium	4 / 6	67	6.75E-01	J	3.30E+00	J	4.35E-01	6.70E-01	1.53E+00	3.90E+02	N (a)		---
Vanadium	6 / 6	100	1.85E+01		2.85E+01		2.20E-01	3.40E-01	2.32E+01	3.90E+02	N (a)		---
Zinc	6 / 6	100	4.08E+01		9.32E+01	J	2.20E-01	3.40E-01	6.02E+01	2.30E+04	N (a)		---
Polychlorinated Biphenyls (PCBs)													
Aroclor 1260	6 / 6	100	1.41E-02	J	1.03E+00	J	7.90E-03	2.00E-01	1.91E-01	2.20E-01	Y	6.75E+00	1.03E+00
Aroclor 1268	4 / 4	100	1.32E-02	J	5.17E+00	J	7.90E-03	2.00E-01	1.35E+00	2.20E-01 [f]	Y	NA	5.17E+00
Semivolatiles Organic Compounds													
Acenaphthylene	1 / 6	17	1.19E-01	J	1.19E-01	J	2.00E-02	7.90E-02	4.88E-02	3.40E+03	N (a)		---
Anthracene	1 / 6	17	1.30E-01	J	1.30E-01	J	2.00E-02	7.90E-02	5.06E-02	1.70E+04	N (a)		---
Benzo(a)anthracene	3 / 6	50	5.12E-02	J	3.96E-01		2.00E-02	7.90E-02	1.08E-01	1.50E-01	Y	2.41E-01	2.41E-01
Benzo(a)pyrene	5 / 6	83	2.41E-02	J	4.46E-01		2.00E-02	7.90E-02	1.21E-01	1.50E-02	Y	4.13E-01	4.13E-01
Benzo(b)fluoranthene	6 / 6	100	3.18E-02	J	7.99E-01		2.00E-02	7.90E-02	2.05E-01	1.50E-01	Y	6.70E-01	6.70E-01
Benzo(ghi)perylene	4 / 6	67	2.31E-02	J	3.98E-01		2.00E-02	7.90E-02	1.07E-01	1.70E+03 [g]	N (a)		---
Benzo(k)fluoranthene	3 / 6	50	4.76E-02	J	3.15E-01		2.00E-02	7.90E-02	8.93E-02	1.50E+00	N (a)		---
Carbazole	1 / 6	17	4.07E-02	J	4.07E-02	J	2.00E-02	7.90E-02	3.58E-02	NA	Y	NA	4.07E-02
Chrysene	6 / 6	100	2.69E-02	J	5.92E-01		2.00E-02	7.90E-02	1.56E-01	1.50E+01	N (a)		---
Dibenz(a,h)anthracene	1 / 6	17	9.96E-02	J	9.96E-02	J	2.00E-02	7.90E-02	4.56E-02	1.50E-02	Y	NA	9.96E-02
Fluoranthene	6 / 6	100	4.19E-02	J	5.88E-01		2.00E-02	7.90E-02	1.81E-01	2.30E+03	N (a)		---
Indeno(1,2,3-cd)pyrene	4 / 6	67	2.47E-02	J	3.91E-01		2.00E-02	7.90E-02	1.09E-01	1.50E-01	Y	2.30E-01	2.30E-01
Phenanthrene	3 / 6	50	3.99E-02	J	1.16E-01	J	2.00E-02	7.90E-02	6.10E-02	1.70E+03 [g]	N (a)		---
Pyrene	6 / 6	100	3.39E-02	J	5.92E-01		2.00E-02	7.90E-02	1.64E-01	1.70E+03	N (a)		---

Table 4-15

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Sediment
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

COPC - Chemical of potential concern.
EPC - Exposure point concentration.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - Milligrams per kilogram.
NA - Not available or not applicable.
RBSC - Risk-based screening concentration.
RIR - Remedial investigation reprot.
VQ - Validation qualifier.

[a] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) residential soil and are based on a risk level of 1.0E-06 and a hazard index of 1.
[b] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = essential nutrient.
[c] Y = Chemical is chosen as COPC.
[d] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1.01 (U.S. Environmental Protection Agency (EPA), 2011, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/TSC_form.htm. Calculated only for COPCs.
[e] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[f] Aroclor 1260 RBSC used as surrogate.
[g] Pyrene RBSC used as surrogate.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-16

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Surface Water
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentration Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Arithmetic Mean µg/L	RBSC [a] µg/L	COPEC? [b,c]	95% UCL [d] µg/L	EPC [e] µg/L
Inorganics													
Aluminum	6 / 6	100	4.20E+01	J	2.73E+04		2.00E+01	2.00E+01	5.41E+03	3.70E+04	N (a)		---
Arsenic	2 / 6	33	6.00E+00	J	9.90E+00	J	1.00E+00	1.00E+00	3.32E+00	4.50E-02	Y	8.34E+00	8.34E+00
Barium	6 / 6	100	3.53E+01	J	2.73E+02		1.00E+00	1.00E+00	8.50E+01	7.30E+03	N (a)		---
Beryllium	1 / 6	17	1.90E+00	J	1.90E+00	J	1.00E-01	1.00E-01	4.00E-01	7.30E+00	N (a)		---
Calcium	6 / 6	100	1.08E+05		1.29E+05		5.00E+01	5.00E+01	1.16E+05	Nutrient	N (b)		---
Chromium	3 / 6	50	2.70E+00	J	4.03E+01		1.00E+00	1.00E+00	8.28E+00	4.30E-02	Y	2.32E+01	2.32E+01
Cobalt	3 / 6	50	1.80E+00	J	2.16E+01	J	1.00E+00	1.00E+00	5.87E+00	1.10E+01	Y	1.36E+01	1.36E+01
Copper	3 / 6	50	3.70E+00	J	6.12E+01		1.00E+00	1.00E+00	1.21E+01	1.50E+02	N (a)		---
Iron	6 / 6	100	5.55E+01	J	4.11E+04		3.40E+01	3.40E+01	1.10E+04	2.60E+04	Y	1.56E+05	4.11E+04
Lead	3 / 6	50	3.50E+00	J	6.08E+01		1.00E+00	1.00E+00	1.20E+01	1.50E+01 [f]	Y	NA	1.20E+01
Magnesium	6 / 6	100	2.55E+04		3.25E+04		5.00E+01	5.00E+01	2.89E+04	Nutrient	N (b)		---
Manganese	6 / 6	100	1.92E+01	J	1.90E+03		1.00E+00	1.00E+00	6.00E+02	8.80E+02	Y	2.55E+03	1.90E+03
Mercury	1 / 6	17	1.20E-01	J	1.20E-01	J	7.10E-02	7.10E-02	7.92E-02	6.30E-01	N (a)		
Nickel	3 / 6	50	4.40E+00	J	6.01E+01		1.00E+00	1.00E+00	1.22E+01	3.00E+02	N (a)		---
Potassium	6 / 6	100	6.39E+02	J	3.15E+03	J	5.00E+01	5.00E+01	1.58E+03	Nutrient	N (b)		---
Selenium	1 / 6	17	2.30E+00	J	2.30E+00	J	2.00E+00	2.00E+00	2.05E+00	1.80E+01	N (a)		---
Sodium	6 / 6	100	4.95E+03	J	8.32E+03	J	7.50E+02	7.50E+02	7.15E+03	Nutrient	N (b)		---
Vanadium	3 / 6	50	4.80E+00	J	5.48E+01		1.00E+00	1.00E+00	1.14E+01	6.30E+01	N (a)		---
Zinc	3 / 6	50	1.23E+01	J	1.90E+02		1.00E+00	1.00E+00	4.05E+01	1.10E+04	N (a)		---
Semivolatile Organics													
Bis(2-ethylhexyl)phthalate	1 / 6	17	3.10E+00	J	3.10E+00	J	1.00E+00	1.10E+00	1.41E+00	4.80E+00	N (a)		---

µg/L - Micrograms per liter.
COPC - Chemical of potential concern.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
NA - Not available or not applicable.
RBSC - Risk-based screening concentration.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) tap water values are based on a risk level of 1.0E-06 and a hazard index of 1.
[b] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = essential nutrient.

Table 4-16

Statistical Summary and COPC Selection for Chemicals Detected in Former Sellite Area Surface Water
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

[c] Y = Chemical is chosen as COPC.

[d] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1.01 (U.S. Environmental Protection Agency (EPA), 2011, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/TSC_form.htm. Calculated only for COPC.

[e] Exposure point concentration (EPC) used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower. The EPC for lead is the mean.

[f] Screening criteria for lead based on the action level of 15 µg/L (EPA, 1996, *Drinking Water Regulations and Health Advisories* , Office of Water, Washington, DC, October).

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-17

Summary of Risk for All Receptors in the Former Sellite Area
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Groundskeeper [a]		Construction Worker		Indoor Worker		Resident			Hunter		Hunter's Child	
	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total Adult - HI	Total Child - HI	Total ILCR	Total HI	Total ILCR	Total HI
Exposure Media													
Surface Soil	5.55E-05	0.25	NE	NE	1.31E-05	0.07	NE	NE	NE	3.40E-06	0.01	2.86E-09	0.0001
Total Soil	4.47E-05	0.30	2.29E-06	0.86	NE	NE	1.24E-04	0.21	1.8	NE	NE	NE	NE
Overburden Groundwater	1.58E-04	6.2	NE	NE	1.58E-04	6.2	6.70E-04	17	40	NE	NE	NE	NE
Sediment	NE	NE	1.07E-06	0.16	NE	NE	6.09E-06	0.006	0.06	NE	NE	NE	NE
Surface Water	NE	NE	1.15E-08	0.15	NE	NE	2.69E-07	0.05	0.09	NE	NE	NE	NE
Total ILCR or HI	**2.E-04**	**6**	**3.E-06**	**1**	**2.E-04**	**6**	**8.E-04**	**17**	**42**	**3.E-06**	**0.01**	**3.E-09**	**0.0001**

GMA - Garage Maintenance Area.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
NE - Pathway not evaluated for this receptor.
RIR - Remedial investigation report.

Note:
[a]Total ILCR and total HI values for the groundskeeper reflect the respective totals for the future groundskeeper assumed to use overburden groundwater. The total ILCR and HI values for the current groundskeeper are simply those shown for surface soil. The rounded current groundskeeper ILCR is 6E-5 and the rounded HI is 0.3.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-18

Risk-Based Remediation Criteria for Chemicals of Concern in Former Sellite Area Surface Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Current Groundskeeper Exposure [a]						Future Indoor Worker Exposure [b]					
				Calculated RBRC (mg/kg)						Calculated RBRC (mg/kg)			
	EPC	Total	Total	Target ILCR		Target HI		Total	Total	Target ILCR		Target HI	
Chemical of Concern	mg/kg	ILCR	HI	1.E-06	1.E-05	0.1	1	ILCR	HI	1.00E-06	1.00E-05	0.1	1
Chromium, Total	15.32	4.5E-06	NA	3.41E+00	3.41E+01	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1254	2.49E+00	3.39E-06	0.235	7.36E-01	7.36E+00	1.06	10.62	NA	NA	NA	NA	NA	NA
Aroclor 1260	9.27E+00	1.26E-05	NA	7.36E-01	7.36E+00	NA	NA	3.24E-06	NA	2.86E+00	2.86E+01	NA	NA
Aroclor 1268	2.56E+01	3.48E-05	NA	7.36E-01	7.36E+00	NA	NA	8.94E-06	NA	2.86E+00	2.86E+01	NA	NA

[a] See Table E-1 in Appendix E.
[b] See Table E-2 in Appendix E.
GMA - Garage Maintenance Area.
HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
NA - Not applicable. Total ILCR or total HI does not meet chemical selection criteria (see Section 7.0, Appendix E).
RBRC - Risk-based remediation criteria
RIR - Remedial investigation report.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-19

Risk-Based Remediation Criteria for Chemicals of Concern in Former Sellite Area Total Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Future Groundskeeper Exposure [a]						Future On-Site Resident Exposure [b]					
				Calculated RBRC (mg/kg)						Calculated RBRC (mg/kg)			
	EPC	Total	Total	Target ILCR		Target HI		Total	Total	Target ILCR		Target HI	
Chemical of Concern	mg/kg	ILCR	HI	1.E-06	1.E-05	0.1	1	ILCR	HI [c]	1.00E-06	1.00E-05	0.1	1
Aroclor 1254	1.90E+00	2.57E-06	0.178	7.36E-01	7.36E+00	1.06E+00	1.06E+01	7.96E-06	1.565	2.38E-01	2.38E+00	1.21E-01	1.21E+00
Aroclor 1260	4.52E+00	6.13E-06	NA	7.36E-01	7.36E+00	NA	NA	1.90E-05	NA	2.38E-01	2.38E+00	NA	NA
Aroclor 1268	2.26E+01	3.07E-05	NA	7.36E-01	7.36E+00	NA	NA	9.49E-05	NA	2.38E-01	2.38E+00	NA	NA
Benzo(a)pyrene	8.38E-02	NA	NA	NA	NA	NA	NA	1.26E-06	NA	6.68E-02	6.68E-01	NA	NA

[a] See Table E-5 in Appendix E.

[b] See Tables E-2 through E-9 in Appendix E.

[c] Target HI values shown were calculated for the residential child receptor.

GMA - Garage Maintenance Area.

HI - Hazard index.

ILCR - Incremental lifetime cancer risk.

NA - Not applicable. Total ILCR or total HI does not meet chemical selection criteria (see Section 7.0, Appendix E).

RBRC - Risk-based remediation criteria

RIR - Remedial investigation report.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-20

Risk-Based Remediation Criteria for Chemicals of Concern in Former Sellite Area Sediment
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

		Future On-Site Resident Exposure [a]					
				Calculated RBRC (mg/kg)			
	EPC	Total	Total	Target ILCR		Target HI	
Chemical of Concern	mg/kg	ILCR	HI	1.00E-06	1.00E-05	0.1	1
Aroclor 1268	5.17E+00	1.73E-06	NA	3.00E+00	3.00E+01	NA	NA

[a] See Table E-16 in Appendix E

GMA - Garage Maintenance Area.

HI - Hazard index.

ILCR - Incremental lifetime cancer risk.

NA - Not applicable. Total ILCR or total HI does not meet chemical selection criteria (see Section 7.0, Appendix E).

RBRC - Risk-based remediation criteria

RIR - Remedial investigation report.

Source: Former Sellite Area Baseline Human Heath Risk Assessment (BHHRA) (CB&I, 2014)

Table 4-21

Statistical Summary and COPEC Selection for Chemicals Detected in Former Sellite Area Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 2)

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	ESV [b] mg/kg	COPEC? [c,d]		95% UCL [e] mg/kg	EPC [f] mg/kg	MDC 0-1' soil depth [g] (mg/kg)	UCL 0-1' soil depth [g] (mg/kg)	EPC 0-1' soil depth [g] (mg/kg)
Inorganics																		
Aluminum	30 / 30	100	4.24E+02		1.35E+04		9.40E-01	2.40E+01	6.47E+03	1.55E+04	pH Dependent	N (b)						
Antimony	4 / 30	13	5.20E-01	J	1.17E+01		4.30E-02	1.00E+00	7.19E-01	9.30E+00	0.27	N (d)						
Arsenic	30 / 30	100	4.00E-01	J	2.15E+01		4.30E-02	1.00E+00	7.59E+00	3.65E+01	18	N (b)						
Barium	30 / 30	100	1.44E+01		1.13E+02		4.70E-02	4.10E+00	5.71E+01	8.26E+02	330	N (b)						
Beryllium	27 / 30	90	8.00E-02	J	7.40E-01	J	4.30E-03	1.00E-01	3.21E-01	1.00E+00	21	N (b)						
Cadmium	14 / 30	47	7.55E-02	J	6.60E+00	J	4.30E-03	1.00E-01	4.12E-01	NA	0.36	Y		9.59E-01	9.59E-01	6.60E+00	1.55E+00	1.55E+00
Calcium	30 / 30	100	4.92E+02		9.94E+04		2.20E+00	5.10E+01	1.98E+04	5.23E+04	Nutrient	N (c)						
Chromium	30 / 30	100	7.90E-01		3.99E+01		4.30E-02	1.00E+00	1.22E+01	2.90E+01	26	N (d)						
Cobalt	29 / 30	97	5.70E-01	J	3.10E+01	J	4.30E-02	1.00E+00	6.08E+00	1.16E+02	13	N (b)						
Copper	30 / 30	100	7.60E-01	J	3.75E+01		4.30E-02	1.00E+00	1.41E+01	5.62E+01	28	N (b)						
Iron	30 / 30	100	4.31E+02		3.36E+04		1.00E+00	2.30E+01	1.54E+04	2.34E+05	pH Dependent	N (b)						
Lead	30 / 30	100	4.40E+00		4.06E+03		4.30E-02	2.20E+00	1.57E+02	4.86E+01	11	Y	h	7.44E+02	7.44E+02	4.06E+03	2.97E+03	2.97E+03
Magnesium	30 / 30	100	5.86E+01	J	1.75E+04		2.20E+00	5.10E+01	4.82E+03	1.04E+04	Nutrient	N (c)						
Manganese	30 / 30	100	4.10E+00		1.38E+03		4.30E-02	1.00E+00	3.63E+02	3.51E+03	220	N (b)						
Mercury	30 / 30	100	1.00E-02	J	2.10E+00		6.30E-03	7.30E-02	1.15E-01	8.50E-02	0.00051	Y	h	4.17E-01	4.17E-01	2.10E+00	7.97E-01	7.97E-01
Nickel	30 / 30	100	2.60E-01	J	4.48E+01		4.30E-02	1.00E+00	1.55E+01	5.51E+01	38	N (b)						
Potassium	30 / 30	100	1.48E+02	J	2.36E+03		2.20E+00	5.10E+01	6.62E+02	3.39E+03	Nutrient	N (c)						
Selenium	13 / 30	43	1.90E-01	J	2.40E+00		8.70E-02	2.00E+00	5.56E-01	2.00E+00	0.52	N (d)						
Silver	3 / 30	10	6.30E-02	J	1.60E-01	J	4.30E-02	1.00E+00	1.54E-01	1.11E+01	4.2	N (b)						
Sodium	14 / 30	47	6.27E+01	J	3.81E+02	J	3.50E+01	8.70E+02	1.57E+02	NA	Nutrient	N (c)						
Vanadium	30 / 30	100	1.20E+00	J	6.71E+01		4.30E-02	1.00E+00	1.91E+01	4.09E+01	7.8	N (d)						
Zinc	30 / 30	100	8.10E-01	J	1.71E+02		4.30E-02	1.00E+00	4.40E+01	3.22E+02	46	N (b)						
Polychlorinated biphenyls (PCB)																		
Aroclor 1254	31 / 54	57	1.16E-02	J	1.21E+01	J	7.60E-03	5.80E+00	1.38E+00		0.371	Y		1.84E+00	1.84E+00	1.21E+01	2.49E+00	2.49E+00
Aroclor 1260	35 / 54	65	1.37E-02	J	4.11E+01	J	7.60E-03	5.80E+00	2.89E+00		0.371	Y		4.47E+00	4.47E+00	4.11E+01	9.27E+00	9.27E+00
Aroclor 1268	26 / 33	79	1.05E-02	J	9.59E+01	J	7.60E-03	5.80E+00	8.02E+00		0.371	Y		2.13E+01	2.13E+01	9.59E+01	2.56E+01	2.56E+01
Semivolatile Organic Compounds																		
Acenaphthene	1 / 30	3	3.64E-02	J	3.64E-02	J	1.80E-02	2.20E-02	2.09E-02		29	N (a)						
Acenaphthylene	2 / 30	7	2.52E-02	J	1.96E-01		1.80E-02	2.20E-02	2.65E-02		29	N (a)						
Anthracene	3 / 30	10	2.25E-02	J	5.90E-01		1.80E-02	2.20E-02	4.13E-02		29	N (a)						
Benzo(a)anthracene	5 / 30	17	3.17E-02	J	1.06E+00		1.80E-02	2.20E-02	5.89E-02		1.1	N (a)						
Benzo(a)pyrene	5 / 30	17	2.73E-02	J	8.85E-01		1.80E-02	2.20E-02	5.32E-02		1.1	N (a)						
Benzo(b)fluoranthene	7 / 30	23	2.02E-02	J	1.15E+00		1.80E-02	2.20E-02	6.52E-02		1.1	Y		1.33E-01	1.33E-01	1.32E-01	5.63E-02	5.63E-02
Benzo(ghi)perylene	3 / 30	10	4.60E-02	J	4.11E-01		1.80E-02	2.20E-02	3.54E-02		1.1	N (a)						
Benzo(k)fluoranthene	4 / 30	13	1.97E-02	J	4.39E-01		1.80E-02	2.20E-02	3.54E-02		1.1	N (a)						
Bis(2-ethylhexyl)phthalate	1 / 30	3	2.30E-01	J	2.30E-01	J	7.40E-02	8.80E-02	8.65E-02		0.925	N (a)						
Carbazole	1 / 30	3	9.42E-02	J	9.42E-02	J	1.80E-02	2.20E-02	2.29E-02		NSV	N (e)						
Chrysene	7 / 30	23	2.06E-02	J	8.85E-01		1.80E-02	2.20E-02	5.39E-02		1.1	N (a)						
Dibenz(a,h)anthracene	1 / 30	3	1.16E-01	J	1.16E-01	J	1.80E-02	2.20E-02	2.36E-02		1.1	N (a)						
Dibenzofuran	1 / 30	3	5.65E-02	J	5.65E-02	J	1.80E-02	2.20E-02	2.16E-02		NSV	N (e)						
Fluoranthene	9 / 30	30	2.18E-02	J	1.99E+00		1.80E-02	2.20E-02	9.86E-02		1.1	Y		2.33E-01	2.33E-01	1.79E-01	6.64E-02	6.64E-02
Fluorene	1 / 30	3	1.91E-01		1.91E-01		1.80E-02	2.20E-02	2.61E-02		1.1	N (a)						
Indeno(1,2,3-cd)pyrene	5 / 30	17	2.16E-02	J	5.13E-01		1.80E-02	2.20E-02	3.93E-02		1.1	N (a)						
Phenanthrene	5 / 30	17	2.66E-02	J	1.52E+00		1.80E-02	2.20E-02	7.38E-02		29	N (a)						
Pyrene	8 / 30	27	2.06E-02	J	1.85E+00		1.80E-02	2.20E-02	9.21E-02		1.1	Y		2.21E-01	2.21E-01	1.78E-01	6.15E-02	6.15E-02

Table 4-21

Statistical Summary and COPEC Selection for Chemicals Detected in Former Sellite Area Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	ESV [b] mg/kg	COPEC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg	MDC 0-1' soil depth [g] (mg/kg)	UCL 0-1' soil depth [g] (mg/kg)	EPC 0-1' soil depth [g] (mg/kg)
Volatile Organic Compounds																	
Acetone	12 / 17	71	1.83E-02	J	9.85E-02	J	1.30E-02	1.90E-02	3.96E-02		2.5	N (a)					
Benzene	6 / 30	20	1.10E-03	J	4.20E-03		7.70E-04	1.70E-03	1.36E-03		0.255	N (a)					
Butanone, 2-	1 / 27	4	5.35E-03	J	5.35E-03	J	3.90E-03	7.00E-03	4.98E-03		89.6	N (a)					
Ethylbenzene	2 / 30	7	1.30E-03	J	2.60E-03	J	5.10E-04	1.20E-03	8.76E-04		5.16	N (a)					
Hexanone, 2-	4 / 30	13	2.03E-02		5.56E-02		2.80E-03	6.20E-03	8.25E-03		12.6	N (a)					
Methylene chloride	19 / 23	83	4.20E-03	J	9.00E-03		2.90E-03	4.30E-03	5.29E-03		4.05	N (a)					
Toluene	13 / 30	43	9.40E-04	J	1.01E-02		6.10E-04	1.40E-03	1.66E-03		200	N (a)					
Xylenes, total	2 / 30	7	3.40E-03	J	4.90E-03	J	1.60E-03	3.70E-03	2.66E-03		10	N (a)					

bgs - Below ground surface.
BSC - Background screening concentration.
COPEC - Chemical of potential ecological concern.
ESV - Ecological screening value.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - Milligrams per kilogram.
RIR - Remedial investigation report.
UCL - Upper confidence limit.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas*** , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] ESVs and their sources are presented in the full SLERA (Appendix F)
[c] N = Chemical is not identified as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
(d) = statistical test shows background and site data to be the same; see Appendix C.
(e) = infrequently detected (fewer than 5 percent of all samples)
[d] Y = Chemical is identified as a COPEC.
[e] 95% UCL determined using ProUCL Version 4.1 (EPA, 2011, *ProUCL Version 4.1.01* , Technical Support Center, Office of Science Policy, Atlanta, Georgia, July, http://www.epa.gov/osp/hstl/tsc/software.htm).
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] The EPC for the COPEC at the 0-1 foot soil depth range is used as the exposure concentration for some ecological receptors.
[h] Although the results of the statistical analysis indicate that this metal was not significantly different from background, it is retained as a COPEC due to a possible hot spot at sample location FSB-SB09.

Source: Former Sellite Area Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2014)

Table 4-22

Statistical Summary and COPEC Selection for Chemicals Detected in Former Sellite Area Surface Water
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentration Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Arithmetic Mean µg/L	ESV [a] µg/L	COPEC? [b,c]	95% UCL [d] µg/L	EPC [e] µg/L
Inorganics													
Aluminum	6 / 6	100	4.20E+01	J	2.73E+04		2.00E+01	2.00E+01	5.41E+03	87	Y	9.11E+04	2.73E+04
Arsenic	2 / 6	33	6.00E+00	J	9.90E+00	J	1.00E+00	1.00E+00	3.32E+00	3.1	Y	8.34E+00	8.34E+00
Barium	6 / 6	100	3.53E+01	J	2.73E+02		1.00E+00	1.00E+00	8.50E+01	4	Y	2.01E+02	2.01E+02
Beryllium	1 / 6	17	1.90E+00	J	1.90E+00	J	1.00E-01	1.00E-01	4.00E-01	0.66	Y	NA	1.90E+00
Calcium	6 / 6	100	1.08E+05		1.29E+05		5.00E+01	5.00E+01	1.16E+05	Nutrient	N (b)		---
Chromium	3 / 6	50	2.70E+00	J	4.03E+01		1.00E+00	1.00E+00	8.28E+00	42	N (a)		---
Cobalt	3 / 6	50	1.80E+00	J	2.16E+01	J	1.00E+00	1.00E+00	5.87E+00	23	N (a)		---
Copper	3 / 6	50	3.70E+00	J	6.12E+01		1.00E+00	1.00E+00	1.21E+01	1.58	Y	6.00E+01	6.00E+01
Iron	6 / 6	100	5.55E+01	J	4.11E+04		3.40E+01	3.40E+01	1.10E+04	Nutrient	N (b)		---
Lead	3 / 6	50	3.50E+00	J	6.08E+01		1.00E+00	1.00E+00	1.20E+01	1.17	Y	5.96E+01	5.96E+01
Magnesium	6 / 6	100	2.55E+04		3.25E+04		5.00E+01	5.00E+01	2.89E+04	Nutrient	N (b)		---
Manganese	6 / 6	100	1.92E+01	J	1.90E+03		1.00E+00	1.00E+00	6.00E+02	120	Y	2.55E+03	1.90E+03
Mercury	1 / 6	17	1.20E-01	J	1.20E-01	J	7.10E-02	7.10E-02	7.92E-02	0.0028	Y	9.70E-02	9.70E-02
Nickel	3 / 6	50	4.40E+00	J	6.01E+01		1.00E+00	1.00E+00	1.22E+01	28.9	Y	6.01E+01	6.01E+01
Potassium	6 / 6	100	6.39E+02	J	3.15E+03	J	5.00E+01	5.00E+01	1.58E+03	Nutrient	N (b)		---
Selenium	1 / 6	17	2.30E+00	J	2.30E+00	J	2.00E+00	2.00E+00	2.05E+00	0.39	Y	2.16E+00	2.16E+00
Sodium	6 / 6	100	4.95E+03	J	8.32E+03	J	7.50E+02	7.50E+02	7.15E+03	Nutrient	N (b)		---
Vanadium	3 / 6	50	4.80E+00	J	5.48E+01		1.00E+00	1.00E+00	1.14E+01	12	Y	3.20E+01	3.20E+01
Zinc	3 / 6	50	1.23E+01	J	1.90E+02		1.00E+00	1.00E+00	4.05E+01	65.7	Y	1.12E+02	1.12E+02
Semivolatile Organics													
Bis(2-ethylhexyl)phthalate	1 / 6	17	3.10E+00	J	3.10E+00	J	1.00E+00	1.10E+00	1.41E+00	0.12	Y	2.15E+00	2.15E+00

µg/L - Micrograms per liter.
COPEC - Chemical of potential ecological concern.
EPC - Exposure point concentration.
ESV - Ecological screening value.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] ESVs and their sources are presented in the full SLERA (Appendix F)
[b] N = Chemical is not identified as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = essential nutrient.
[c] Y = Chemical is identified as a COPEC.
[d] 95% UCL determined using ProUCL Version 4.1 (EPA, 2011, *ProUCL Version 4.1.01* , Technical Support Center, Office of Science Policy, Atlanta, Georgia, July, http://www.epa.gov/osp/hstl/tsc/software.htm).
[e] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.

Source: Former Sellite Area Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2014)

Table 4-23

Statistical Summary and COPEC Selection for Chemicals Detected in Former Sellite Area Sediment
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	ESV [b] mg/kg	COPEC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics														
Aluminum	6 / 6	100	7.42E+03		1.44E+04	J	5.20E+00	8.10E+00	1.01E+04	1.55E+04	NSV	N (b)		---
Arsenic	6 / 6	100	4.60E+00		1.85E+01		2.20E-01	3.40E-01	9.51E+00	3.65E+01	9.79E+00	N (b)		---
Barium	6 / 6	100	4.68E+01		1.22E+02		8.70E-01	1.30E+00	7.78E+01	8.26E+02	NSV	N (b)		---
Beryllium	5 / 6	83	3.85E-01	J	8.20E-01	J	2.20E-02	3.40E-02	4.95E-01	1.00E+00	NSV	N (b)		---
Cadmium	4 / 6	67	1.17E-01	J	1.20E+00		2.20E-02	3.40E-02	3.85E-01	NA	9.90E-01	Y	7.79E-01	7.79E-01
Calcium	6 / 6	100	3.94E+03		1.27E+04	J	1.05E+01	1.70E+01	7.54E+03	5.23E+04	Nutrient	N (c)		---
Chromium	6 / 6	100	1.12E+01		1.81E+01	J	2.20E-01	3.40E-01	1.37E+01	2.90E+01	4.34E+01	N (b)		---
Cobalt	6 / 6	100	4.70E+00	J	1.51E+01	J	2.20E-01	3.40E-01	7.35E+00	1.16E+02	5.00E+01	N (b)		---
Copper	6 / 6	100	1.36E+01		2.58E+01		2.20E-01	3.40E-01	1.95E+01	5.62E+01	3.16E+01	N (b)		---
Iron	6 / 6	100	1.29E+04		3.80E+04		5.00E+00	7.80E+00	2.07E+04	2.34E+05	Nutrient	N (c)		---
Lead	6 / 6	100	1.36E+01		3.45E+01		4.35E-02	6.70E-02	2.29E+01	4.86E+01	3.58E+01	N (b)		---
Magnesium	6 / 6	100	1.14E+03	J	5.29E+03	J	1.05E+01	1.70E+01	2.65E+03	1.04E+04	Nutrient	N (c)		---
Manganese	6 / 6	100	1.11E+02		8.19E+02	J	2.20E-01	3.40E-01	2.91E+02	3.51E+03	4.60E+02	N (b)		---
Mercury	6 / 6	100	5.35E-02	J	1.10E-01	J	6.60E-03	8.30E-03	8.38E-02	8.50E-02	1.80E-01	N (a)		---
Nickel	6 / 6	100	1.00E+01	J	2.93E+01	J	2.20E-01	3.40E-01	1.82E+01	5.51E+01	2.27E+01	N (b)		---
Potassium	6 / 6	100	6.70E+02	J	1.36E+03	J	1.05E+01	1.70E+01	9.69E+02	3.39E+03	Nutrient	N (c)		---
Selenium	4 / 6	67	6.75E-01	J	3.30E+00	J	4.35E-01	6.70E-01	1.53E+00	2.00E+00	NSV	Y	2.46E+00	2.46E+00
Vanadium	6 / 6	100	1.85E+01		2.85E+01		2.20E-01	3.40E-01	2.32E+01	4.09E+01	NSV	N (b)		---
Zinc	6 / 6	100	4.08E+01		9.32E+01	J	2.20E-01	3.40E-01	6.02E+01	3.22E+02	1.21E+02	N (b)		---
Polychlorinated Biphenyls (PCBs)														
Aroclor 1260	6 / 6	100	1.41E-02	J	1.03E+00	J	7.90E-03	2.00E-01	1.91E-01		5.98E-02	Y	6.75E+00	1.03E+00
Aroclor 1268	4 / 4	100	1.32E-02	J	5.17E+00	J	7.90E-03	2.00E-01	1.35E+00		5.98E-02	Y	NA	5.17E+00
Semivolatiles Organic Compounds														
Acenaphthylene	1 / 6	17	1.19E-01	J	1.19E-01	J	2.00E-02	7.90E-02	4.88E-02		5.87E-03	Y	1.21E-01	1.19E-01
Anthracene	1 / 6	17	1.30E-01	J	1.30E-01	J	2.00E-02	7.90E-02	5.06E-02		5.72E-02	Y	1.30E-01	1.30E-01
Benzo(a)anthracene	3 / 6	50	5.12E-02	J	3.96E-01		2.00E-02	7.90E-02	1.08E-01		1.08E-01	Y	2.41E-01	2.41E-01
Benzo(a)pyrene	5 / 6	83	2.41E-02	J	4.46E-01		2.00E-02	7.90E-02	1.21E-01		1.50E-01	Y	4.13E-01	4.13E-01
Benzo(b)fluoranthene	6 / 6	100	3.18E-02	J	7.99E-01		2.00E-02	7.90E-02	2.05E-01		1.04E+01	N (a)		---
Benzo(ghi)perylene	4 / 6	67	2.31E-02	J	3.98E-01		2.00E-02	7.90E-02	1.07E-01		1.70E-01	Y	2.31E-01	2.31E-01
Benzo(k)fluoranthene	3 / 6	50	4.76E-02	J	3.15E-01		2.00E-02	7.90E-02	8.93E-02		2.40E-01	Y	3.15E-01	3.15E-01
Carbazole	1 / 6	17	4.07E-02	J	4.07E-02	J	2.00E-02	7.90E-02	3.58E-02		NSV	Y	5.41E-02	4.07E-02
Chrysene	6 / 6	100	2.69E-02	J	5.92E-01		2.00E-02	7.90E-02	1.56E-01		1.66E-01	Y	4.91E-01	4.91E-01
Dibenz(a,h)anthracene	1 / 6	17	9.96E-02	J	9.96E-02	J	2.00E-02	7.90E-02	4.56E-02		3.30E-02	Y	1.07E-01	9.96E-02
Fluoranthene	6 / 6	100	4.19E-02	J	5.88E-01		2.00E-02	7.90E-02	1.81E-01		4.23E-01	Y	4.81E-01	4.81E-01
Indeno(1,2,3-cd)pyrene	4 / 6	67	2.47E-02	J	3.91E-01		2.00E-02	7.90E-02	1.09E-01		2.00E-01	Y	2.30E-01	2.30E-01
Phenanthrene	3 / 6	50	3.99E-02	J	1.16E-01	J	2.00E-02	7.90E-02	6.10E-02		2.04E-01	N (a)		---
Pyrene	6 / 6	100	3.39E-02	J	5.92E-01		2.00E-02	7.90E-02	1.64E-01		1.95E-01	Y	4.83E-01	4.83E-01

BSC - Background screening concentration.
COPEC - Chemical of potential ecological concern.
EPC - Exposure point concentration.
ESV - Ecological screening value.
GMA - Garage Maintenance Area.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.

Table 4-23

Statistical Summary and COPEC Selection for Chemicals Detected in Former Sellite Area Sediment
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

mg/kg - Milligrams per kilogram.
NA - Not available.
NSV - No screening value available.
RIR - Remedial investigation report.
VQ - Validation qualifier.

[a] Soil background screening concentrations are used for sediment. See SLERA text for details.
[b] ESVs and their sources are presented in the full SLERA (Appendix F)
[c] N = Chemical is not identified as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is identified as a COPEC.
[e] 95% UCL determined using ProUCL Version 4.1 (EPA, 2011, *ProUCL Version 4.1.01* , Technical Support Center, Office of Science Policy, Atlanta, Georgia, July, http://www.epa.gov/osp/hstl/tsc/software.htm).
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.

Source: Former Sellite Area Screening-Level Ecological Risk Assessment (SLERA) (Shaw, 2014)

Table 4-24

Wildlife Hazard Quotients for All Former Sellite Area Assessment Receptors
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

COPEC	Deer Mouse		Short-tailed Shrew		Cottontail Rabbit		Marsh Wren		White-tailed Deer		Raccoon		Red-Tailed Hawk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals														
Aluminum	**2.10E+00**	2.10E-01	**2.17E+00**	2.17E-01	3.59E-01	3.59E-02	6.70E-02	6.70E-03	1.45E-03	1.45E-04	6.20E-03	6.20E-04	1.42E-05	1.42E-06
Arsenic	9.84E-03	9.84E-04	1.02E-02	1.02E-03	1.68E-03	1.68E-04	4.38E-04	1.75E-04	6.78E-06	6.78E-07	2.90E-05	2.90E-06	9.29E-08	3.72E-08
Barium	5.85E-03	1.51E-03	6.03E-03	1.55E-03	9.98E-04	2.57E-04	2.61E-03	1.30E-03	4.03E-06	1.04E-06	1.72E-05	4.44E-06	5.53E-07	2.76E-07
Beryllium	4.28E-04	8.56E-05	4.41E-04	8.83E-05	7.30E-05	1.46E-05	NA	NA	2.95E-07	5.90E-08	1.26E-06	2.52E-07	NA	NA
Cadmium	9.65E-01	9.65E-02	1.19E+00	1.19E-01	1.97E-02	1.97E-03	**2.36E+00**	1.71E-01	3.21E-05	3.21E-06	1.07E-03	1.07E-04	1.51E-05	1.09E-06
Copper	7.62E-04	5.89E-04	7.86E-04	6.08E-04	1.30E-04	1.01E-04	3.45E-04	2.63E-04	5.25E-07	4.06E-07	2.25E-06	1.74E-06	7.31E-08	5.57E-08
Lead	**6.46E+00**	6.46E-01	**4.48E+00**	4.48E-01	5.84E-01	5.84E-02	**1.46E+02**	**1.46E+01**	1.65E-04	1.65E-05	9.93E-03	9.93E-04	1.44E-03	1.44E-04
Manganese	3.21E-03	9.94E-04	3.31E-03	1.03E-03	5.48E-04	1.70E-04	5.25E-04	5.25E-05	2.21E-06	6.85E-07	9.46E-06	2.93E-06	1.11E-07	1.11E-08
Mercury	8.68E-03	8.68E-04	9.48E-03	9.48E-04	6.30E-04	6.30E-05	6.57E-01	3.28E-01	9.23E-07	9.23E-08	1.10E-04	2.20E-05	2.15E-05	1.08E-05
Nickel	2.23E-04	1.12E-04	2.30E-04	1.15E-04	3.81E-05	1.91E-05	2.10E-04	1.52E-04	1.54E-07	7.70E-08	6.58E-07	3.29E-07	4.45E-08	3.22E-08
Selenium	1.60E-03	9.73E-04	1.66E-03	1.00E-03	2.74E-04	1.66E-04	1.17E-03	5.83E-04	1.11E-06	6.70E-07	4.41E-03	2.67E-03	2.81E-07	8.24E-08
Vanadium	2.27E-02	2.27E-03	2.34E-02	2.34E-03	3.87E-03	3.87E-04	7.60E-04	7.60E-05	1.56E-05	1.56E-06	6.68E-05	6.68E-06	1.61E-07	1.61E-08
Zinc	1.04E-04	5.18E-05	1.07E-04	5.35E-05	1.77E-05	8.85E-06	2.08E-03	2.30E-04	7.15E-08	3.57E-08	3.06E-07	1.53E-07	4.41E-07	4.88E-08
PCBs														
Aroclor 1254	**4.35E+01**	**4.35E+00**	**6.39E+01**	**6.39E+00**	5.83E-02	5.83E-03	**6.44E+01**	**6.44E+00**	4.00E-05	4.00E-06	2.29E-02	4.64E-03	1.69E-05	1.69E-06
Aroclor 1260	**1.75E+02**	**1.75E+01**	**1.68E+02**	**1.68E+01**	2.04E-01	2.04E-02	**2.59E+02**	**2.59E+01**	8.27E-05	8.27E-06	9.33E-02	1.89E-02	6.29E-05	6.29E-06
Aroclor 1268	**4.19E+02**	**4.19E+01**	**6.58E+02**	**6.58E+01**	**4.91E+00**	4.91E-01	**5.86E+02**	**5.86E+01**	8.78E-03	8.78E-04	2.22E-01	4.51E-02	1.74E-04	1.74E-05
All PCBs (summed)	**6.37E+02**	**6.37E+01**	**8.90E+02**	**8.90E+01**	**5.17E+00**	5.17E-01	**9.09E+02**	**9.09E+01**	8.90E-03	8.90E-04	3.38E-01	6.87E-02	2.53E-04	2.53E-05
Semivolatile Organics														
Acenaphthylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-07	1.03E-08	0.00E+00	0.00E+00
Anthracene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-04	2.94E-05	0.00E+00	0.00E+00
Benzo(a)anthracene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-04	2.94E-05	0.00E+00	0.00E+00
Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E-05	4.64E-06	0.00E+00	0.00E+00
Benzo(b)fluoranthene	7.75E-04	1.55E-04	1.53E-03	3.06E-04	1.16E-04	2.32E-05	2.68E-02	5.36E-03	5.62E-07	1.12E-07	6.53E-07	1.31E-07	4.61E-07	9.21E-08
Benzo(ghi)perylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-06	1.33E-07	0.00E+00	0.00E+00
Benzo(k)fluoranthene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.98E-06	4.98E-07	0.00E+00	0.00E+00
Bis(2-ethylhexyl)phthalate	1.74E-05	1.74E-06	1.80E-05	1.80E-06	2.97E-06	2.98E-07	5.80E-04	5.27E-05	1.20E-08	1.20E-09	5.13E-08	5.14E-09	1.23E-07	1.12E-08
Carbazole	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	0.00E+00	0.00E+00	2.42E-07	2.42E-08	NA	NA
Chrysene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-03	2.88E-04	0.00E+00	0.00E+00
Dibenz(a,h)anthracene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.49E-06	8.49E-07	0.00E+00	0.00E+00
Fluoranthene	4.09E-04	8.18E-05	8.58E-04	1.72E-04	6.62E-05	1.32E-05	1.12E-04	1.12E-05	4.97E-07	9.93E-08	2.30E-06	4.60E-07	1.93E-09	1.93E-10
Indeno(1,2,3-cd)pyrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E-06	7.18E-07	0.00E+00	0.00E+00
Pyrene	9.85E-04	1.97E-04	2.39E-03	4.79E-04	1.42E-04	2.84E-05	2.12E-04	2.12E-05	1.12E-06	2.23E-07	5.68E-06	1.14E-06	1.78E-09	1.78E-10

COPEC - Chemical of potential ecological concern
GMA - Garage Maintenance Area.
LOAEL - Lowest observed adverse effect level
NA - No toxicity data available; hazard quotients not calculated.
NOAEL - No observed adverse effect level
RIR - Remedial investigation report.

Shaded cells indicate a hazard quotient greater than 1, when rounded.

Source: Former Sellite Area Screening Level Ecological Risk Assessment (SLERA) (Shaw, 2014)

Table 5-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB01		ULA-SB02		ULA-SB02		ULA-SB02		ULA-SB03		ULA-SB04	
				SAMPLE NUMBER	ULA0001		ULA0002		ULA0003		ULA0004		ULA0005		ULA0006	
				SAMPLE DATE	18-May-11		19-May-11		19-May-11		19-May-11		19-May-11		18-May-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.251	0.0393	J	0.0441	J	-	-	0.24		0.251	J	0.0288	J
Butanone, 2-	mg/kg	2,800	NE	0.0238	-	-	-	-	-	-	-	-	0.0238	J	-	-
Methyl-2-pentanone, 4-	mg/kg	530	NE	0.0067	-	-	-	-	-	-	-	-	0.0067	J	-	-
Methylene chloride	mg/kg	11	NE	0.015	0.0097	J	0.0057	J	-	-	0.015		0.0097	J	0.0088	
SEMIVOLATILES																
Benzo(a)anthracene	mg/kg	0.15	NE	0.0329	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.0308	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	0.0444	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.0343	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	0.0811	-	-	-	-	-	-	-	-	0.0412	J	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	0.0301	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.0433	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	0.0555	-	-	-	-	-	-	-	-	0.0381	J	-	-
PCBs																
Aroclor 1254	mg/kg	0.11	NE	0.0129	-	-	-	-	-	-	-	-	-	-	-	-
METALS																
Aluminum	mg/kg	7,700	15,500	11,900	6,620		4,580	J	4,730		4,900		6,740		10,400	
Arsenic	mg/kg	0.39	36.5	9.5	4.3		2.8		2.5		3.4		3.6		9.5	
Barium	mg/kg	1,500	826	82.5	18.2	J	9.7	J	14.8		-	-	20.2		46	J
Beryllium	mg/kg	16	1	0.71	0.32	J	0.22	J	0.23	J	-	-	0.29	J	0.57	J
Cadmium	mg/kg	7	ND	0.95	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/kg	NE	52,300	2,990	1,420		544	J	550	J	850		930	J	2,990	
Chromium	mg/kg	0.29	29	17.4	9.7		6.9	J	6.2		7.8		9.1		17.4	
Cobalt	mg/kg	2.3	116	17.8	5.5	J	3.2	J	2.5		-	-	3.7		7.8	J
Copper	mg/kg	310	56.2	38.4	5.8		4.9	J	4.5		5.2		5.9		19.1	
Iron	mg/kg	5,500	234,000	22,600	12,400		7,650	J	6,630		10,000		9,670		21,000	
Lead	mg/kg	400	48.6	12.7	5.8		3.5		4.2		4.5		8.4		10.7	
Magnesium	mg/kg	NE	10,400	2,520	1,050	J	705	J	664		790		987		2,520	
Manganese	mg/kg	180	3,506	525	296		135	J	93.1		190		118		385	
Mercury	mg/kg	1	0.09	0.076	0.038	J	0.015	J	0.013	J	-	-	0.032	J	0.03	J
Nickel	mg/kg	150	55.1	32.6	9.4		5.4	J	5.1		6.4		7.4		23.3	
Potassium	mg/kg	NE	3,390	949	315	J	215	J	202	J	-	-	316	J	949	J
Selenium	mg/kg	39	2	0.54	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	25.8	20.1		15.5	J	12.7		16		19.7		25.8	
Zinc	mg/kg	2,300	321.75	170	22.2		13.8	J	16.1		18		21.5		52.7	
GENERAL CHEMISTRY																
Total organic carbon	mg/kg	NE	NE	0.053	0.053											

Table 5-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB05		ULA-SB06		ULA-SB07		ULA-SB08		ULA-SB09		ULA-SB10	
				SAMPLE NUMBER	ULA0007		ULA0008		ULA0009		ULA0010		ULA0011		ULA0012	
				SAMPLE DATE	19-May-11		18-May-11		18-May-11		19-May-11		18-May-11		19-May-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.251	0.0466	J	0.0457		0.021	J	0.0732	J	0.0406		0.0773	J
Butanone, 2-	mg/kg	2,800	NE	0.0238	0.006	J	-	-	-	-	0.0069	J	-	-	0.0076	J
Methyl-2-pentanone, 4-	mg/kg	530	NE	0.0067	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.015	0.0046	J	0.0037	J	0.0081	J	-	-	0.0036	J	-	-
SEMIVOLATILES																
Benzo(a)anthracene	mg/kg	0.15	NE	0.0329	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.0308	0.0239	J	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	0.0444	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.0343	0.0272	J	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	0.0811	0.0296	J	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	0.0301	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.0433	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	0.0555	0.0294	J	-	-	-	-	-	-	-	-	-	-
PCBs																
Aroclor 1254	mg/kg	0.11	NE	0.0129			-	-	-	-			-	-	-	-
METALS																
Aluminum	mg/kg	7,700	15,500	11,900	8,360		10,400		11,900		10,200		10,500		6,310	
Arsenic	mg/kg	0.39	36.5	9.5	6.4		6.1		6.3		7.8		4.4		3.2	
Barium	mg/kg	1,500	826	82.5	61.6		82.5		60.4	J	62.1		57.4		47.6	
Beryllium	mg/kg	16	1	0.71	0.47	J	0.69	J	0.52	J	0.53	J	0.59	J	0.35	J
Cadmium	mg/kg	7	ND	0.95	-	-	0.33	J	-	-	-	-	-	-	0.18	J
Calcium	mg/kg	NE	52,300	2,990	1,990		2,840		1,840		2,290		2,520		2,310	
Chromium	mg/kg	0.29	29	17.4	11		12.9		15.6		14.3		14.2		8.4	
Cobalt	mg/kg	2.3	116	17.8	5.7	J	6.1	J	5.3	J	9.9		7	J	3.3	J
Copper	mg/kg	310	56.2	38.4	10.1		10.1		10.8		18.1		8.6		9.4	
Iron	mg/kg	5,500	234,000	22,600	15,700		15,300		16,800		19,900		13,200		9,230	
Lead	mg/kg	400	48.6	12.7	12.5		12.7		8.6		11.4		10.4		9.1	
Magnesium	mg/kg	NE	10,400	2,520	1,610		1,720		2,120		2,450		2,070		1,300	
Manganese	mg/kg	180	3,506	525	360		525		109		434		168		148	
Mercury	mg/kg	1	0.09	0.076	0.033	J	0.039	J	0.029	J	0.076	J	0.04	J	0.044	J
Nickel	mg/kg	150	55.1	32.6	11		12.6		16		18.1		13.7		8.3	
Potassium	mg/kg	NE	3,390	949	627	J	596	J	580	J	701	J	586	J	516	J
Selenium	mg/kg	39	2	0.54	-	-	-	-	-	-	-	-	-	-	0.54	J
Vanadium	mg/kg	39	40.9	25.8	20.7		22.7		23.6		24.3		22.9		13.3	
Zinc	mg/kg	2,300	321.75	170	34.1		40.7		35.3		35.3		36.5		28.5	
GENERAL CHEMISTRY																
Total organic carbon	mg/kg	NE	NE	0.053												

Table 5-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB11		ULA-SB12	
				SAMPLE NUMBER	ULA0013		ULA0014	
				SAMPLE DATE	19-May-11		19-May-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
VOLATILES								
Acetone	mg/kg	6,100	NE	0.251	0.0362	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0238	-	-	-	-
Methyl-2-pentanone, 4-	mg/kg	530	NE	0.0067	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.015	-	-	0.0071	J
SEMIVOLATILES								
Benzo(a)anthracene	mg/kg	0.15	NE	0.0329	0.0286	J	0.0329	J
Benzo(a)pyrene	mg/kg	0.015	NE	0.0308	0.0241	J	0.0308	J
Benzo(b)fluoranthene	mg/kg	0.15	NE	0.0444	0.0383	J	0.0444	J
Chrysene	mg/kg	15	NE	0.0343	0.0338	J	0.0343	J
Fluoranthene	mg/kg	230	NE	0.0811	0.0616	J	0.0811	J
Methylnaphthalene, 2-	mg/kg	31	NE	0.0301	0.0301	J	-	-
Phenanthrene	mg/kg	NE	NE	0.0433	0.0433	J	0.0421	J
Pyrene	mg/kg	170	NE	0.0555	0.0465	J	0.0555	J
PCBs								
Aroclor 1254	mg/kg	0.11	NE	0.0129	-	-	0.0129	J
METALS								
Aluminum	mg/kg	7,700	15,500	11,900	9,010		3,760	
Arsenic	mg/kg	0.39	36.5	9.5	8.6		3	
Barium	mg/kg	1,500	826	82.5	67.3	J	19.2	
Beryllium	mg/kg	16	1	0.71	0.71	J	0.17	J
Cadmium	mg/kg	7	ND	0.95	0.95	J	0.18	J
Calcium	mg/kg	NE	52,300	2,990	1,280	J	427	J
Chromium	mg/kg	0.29	29	17.4	15.1		4.7	
Cobalt	mg/kg	2.3	116	17.8	17.8	J	1.5	J
Copper	mg/kg	310	56.2	38.4	12.4		38.4	
Iron	mg/kg	5,500	234,000	22,600	22,600		5,540	
Lead	mg/kg	400	48.6	12.7	7.9		7.4	
Magnesium	mg/kg	NE	10,400	2,520	1,620	J	480	
Manganese	mg/kg	180	3,506	525	157		43.1	
Mercury	mg/kg	1	0.09	0.076	0.012	J	0.016	J
Nickel	mg/kg	150	55.1	32.6	32.6		9.7	
Potassium	mg/kg	NE	3,390	949	516	J	235	J
Selenium	mg/kg	39	2	0.54	-	-	0.23	J
Vanadium	mg/kg	39	40.9	25.8	25.8		8.3	
Zinc	mg/kg	2,300	321.75	170	170		48.3	
GENERAL CHEMISTRY								
Total organic carbon	mg/kg	NE	NE	0.053				

Table 5-1

Detections Above RBSCs and/or BSCs in Surface Soil Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

BSC - Background screening concentration.
MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).
mg/kg - Milligrams per kilogram.
ND - Not detected (BSCs).
NE - Not established (RBSCs), not evaluated (BSCs).
Shaded cell indicates value is greater than RBSC.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.
Blank cell means that parameter was not analyzed.
"-" - Not detected.

Validation Qualifiers (VQ)
J - The analyte was positively identified, the reported value is estimated.

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB01				ULA-SB02							
				SAMPLE NUMBER	ULA0015		ULA0029		ULA0016		ULA0017		ULA0018		ULA0030	
				SAMPLE DATE	18-May-11		18-May-11		19-May-11		19-May-11		19-May-11		19-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		FD		FS		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.0585	-	-	0.041	J	-	-	-	-	-	-	-	-
Benzene	mg/kg	1.1	NE	0.0029	0.0016	J	-	-	0.002	J	-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	0.00081	J	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.203	0.005	J	0.203	J	-	-	0.0116	J	0.013		0.0342	J
Toluene	mg/kg	500	NE	0.0068	0.0018	J	0.0018	J	0.0036		-	-	0.0063		0.0017	J
Trichloroethane, 1,1,1-	mg/kg	870	NE	0.0026	-	-	-	-	0.0026	J	-	-	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0037	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Pyrene	mg/kg	170	NE	0.013	-	-	-	-	-	-	-	-	-	-	-	-
METALS																
Aluminum	mg/kg	7,700	15,500	12,400	5,530		4,510		7,080		4,500		6,800		5,600	
Antimony	mg/kg	3.1	9.3	0.44	-	-	0.18	J	-	-	0.13	J	-	-	-	-
Arsenic	mg/kg	0.39	36.5	20.4	6.5		7		5		3.4		10		3.6	
Barium	mg/kg	1,500	826	124	28.9		36		51.1		30.8		39		35.2	
Beryllium	mg/kg	16	1	0.78	0.33	J	0.27		0.38	J	0.24	J	-	-	0.32	
Cadmium	mg/kg	7	ND	0.48	0.15	J	0.25		0.21	J	0.17	J	-	-	0.18	J
Calcium	mg/kg	NE	52,300	80,700	28,000		**58,300**		35,200		48,300		45,000		47,100	
Chromium	mg/kg	0.29	29	20	10.3		7.7		11.6		7.4		12		12.1	
Cobalt	mg/kg	2.3	116	16	5.1	J	6.2		6.4		4.8		7.4		6.2	
Copper	mg/kg	310	56.2	58.4	14.8		16.7		15		10.4		18		18.8	
Iron	mg/kg	5,500	234,000	29,000	12,000		10,800		13,100	J	7,710	J	18,000		10,200	
Lead	mg/kg	400	48.6	69	7.7		10.9		9.5		6.7		8.4		11.3	
Magnesium	mg/kg	NE	10,400	19,800	8,350		**18,100**		**12,900**		**14,500**		**14,000**		**15,700**	
Manganese	mg/kg	180	3,506	1,680	259		564		332		339		410		429	
Mercury	mg/kg	1	0.09	0.062	0.021	J	-	-	-	-	-	-	-	-	0.026	J
Nickel	mg/kg	150	55.1	34.5	13.6		15.5		16		11.7		20		16.7	
Potassium	mg/kg	NE	3,390	1,700	736	J	899		909	J	667		940		1,090	
Selenium	mg/kg	39	2	1	-	-	0.38	J	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	ND	400	-	-	109	J	-	-	83.9	J	-	-	115	J
Thallium	mg/kg	0.078	1.3	0.43	-	-	0.41	J	-	-	0.14	J	-	-	-	-
Vanadium	mg/kg	39	40.9	31	14.3		12.3		16		11.3		19		13.9	
Zinc	mg/kg	2,300	321.75	76.2	32.8		34.6		36		24.7		45		45.1	

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB03								ULA-SB04			
				SAMPLE NUMBER	ULA0019		ULA0031		ULA0032		ULA0033		ULA0020		ULA0034	
				SAMPLE DATE	19-May-11		19-May-11		19-May-11		19-May-11		18-May-11		18-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.0585	-	-	-	-	-	-	0.031		-	-	-	-
Benzene	mg/kg	1.1	NE	0.0029	0.0011	J	-	-	-	-	-	-	0.001	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.203	-	-	0.0175	B	0.0187	J	-	-	-	-	0.135	J
Toluene	mg/kg	500	NE	0.0068	0.0017	J	-	-	-	-	-	-	0.0015	J	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	0.0026	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0037	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Pyrene	mg/kg	170	NE	0.013	-	-	-	-	-	-	0.013		-	-	-	-
METALS																
Aluminum	mg/kg	7,700	15,500	12,400	5,380		8,810		7,430		8,200		6,530		6,030	
Antimony	mg/kg	3.1	9.3	0.44	-	-	-	-	-	-	-	-	-	-	0.16	J
Arsenic	mg/kg	0.39	36.5	20.4	8.4		6.8	J	3.5	J	8.1		8.2		6.6	
Barium	mg/kg	1,500	826	124	28.7		66		40.5		55		43		44.9	
Beryllium	mg/kg	16	1	0.78	0.31	J	0.46	J	0.41	J	-	-	0.38	J	0.33	
Cadmium	mg/kg	7	ND	0.48	0.086	J	-	-	0.088	J	-	-	0.2	J	0.22	
Calcium	mg/kg	NE	52,300	80,700	32,800		49,200		48,800		48,000		30,000		49,000	
Chromium	mg/kg	0.29	29	20	8.5		14		12.7		14		10.9		10	
Cobalt	mg/kg	2.3	116	16	3.9		13.2	J	7.3	J	12		6.2		7.5	
Copper	mg/kg	310	56.2	58.4	13.4		20.9		21.8		22		16.6		17.2	
Iron	mg/kg	5,500	234,000	29,000	14,500		20,700		19,600		22,000		15,000		11,600	
Lead	mg/kg	400	48.6	69	9.2		11.8		11.9		11		8.6		11.4	
Magnesium	mg/kg	NE	10,400	19,800	**11,600**		**15,600**		**15,500**		**16,000**		8,390		**19,800**	
Manganese	mg/kg	180	3,506	1,680	187		725		465		600		316		536	
Mercury	mg/kg	1	0.09	0.062	0.024	J	0.026	J	0.016	J	-	-	-	-	0.014	J
Nickel	mg/kg	150	55.1	34.5	11.2		32.4	J	17.7	J	29		17.3		17.7	
Potassium	mg/kg	NE	3,390	1,700	694	J	1,410	J	1,300	J	1,700		917	J	1,150	
Selenium	mg/kg	39	2	1	-	-	-	-	1	J	-	-	-	-	0.38	J
Sodium	mg/kg	NE	ND	400	-	-	-	-	-	-	-	-	-	-	116	J
Thallium	mg/kg	0.078	1.3	0.43	-	-	0.27	J	-	-	-	-	-	-	0.31	J
Vanadium	mg/kg	39	40.9	31	13.8		20.1		12.3		19		17.8		15.5	
Zinc	mg/kg	2,300	321.75	76.2	30.9		51.3		54.4		61		38.7		36.2	

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB05				ULA-SB06				ULA-SB07			
				SAMPLE NUMBER	ULA0021		ULA0035		ULA0022		ULA0036		ULA0023		ULA0037	
				SAMPLE DATE	19-May-11		19-May-11		18-May-11		18-May-11		18-May-11		18-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.0585	0.0439	J	-	-	0.0207	J	-	-	-	-	0.0211	J
Benzene	mg/kg	1.1	NE	0.0029	-	-	-	-	-	-	-	-	0.0029	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0053	-	-	-	-	-	-	-	-	-	-	0.0053	J
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	-	-	-	-	0.0013	J	-	-
Methylene chloride	mg/kg	11	NE	0.203	-	-	0.0147	J	0.0061	J	0.0093	J	0.0056	J	0.0041	J
Toluene	mg/kg	500	NE	0.0068	-	-	-	-	-	-	-	-	0.0068		-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	0.0026	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0037	-	-	-	-	-	-	-	-	0.0037	J	-	-
SEMIVOLATILES																
Pyrene	mg/kg	170	NE	0.013	-	-	-	-	-	-	-	-	-	-	-	-
METALS																
Aluminum	mg/kg	7,700	15,500	12,400	12,400		8,180		9,330		6,270		3,890		4,090	
Antimony	mg/kg	3.1	9.3	0.44	-	-	0.44	J	-	-	0.11	J	0.14	J	0.18	J
Arsenic	mg/kg	0.39	36.5	20.4	7.8		17.7		5.7		6.9		20.4		4	
Barium	mg/kg	1,500	826	124	124		91.5		54.6	J	44		41.6		36.2	
Beryllium	mg/kg	16	1	0.78	0.78	J	0.51	J	0.49	J	0.36		0.26	J	0.25	
Cadmium	mg/kg	7	ND	0.48	-	-	0.48	J	-	-	0.26		0.22	J	0.12	J
Calcium	mg/kg	NE	52,300	80,700	6,400		40,400		2,990		50,100		49,700		49,900	
Chromium	mg/kg	0.29	29	20	15.3		14.1		16		10.5		7.4		7.4	
Cobalt	mg/kg	2.3	116	16	10.5	J	9.7		5.9	J	7.8		8.1		3	
Copper	mg/kg	310	56.2	58.4	15.7		21.9		18.5		18		15.3		12.4	
Iron	mg/kg	5,500	234,000	29,000	22,000		28,000		17,700		14,100		13,400		7,670	
Lead	mg/kg	400	48.6	69	12.2		12.5		8.5		10.9		8.4		9.3	
Magnesium	mg/kg	NE	10,400	19,800	2,490		**13,600**		2,780		**15,800**		**14,900**		**17,400**	
Manganese	mg/kg	180	3,506	1,680	848		1,680		146		443		587		256	
Mercury	mg/kg	1	0.09	0.062	0.062	J	0.018	J	0.033	J	0.02	J	0.013	J	0.016	J
Nickel	mg/kg	150	55.1	34.5	18.8		30.2		19.2		19.8		15.1		9.9	
Potassium	mg/kg	NE	3,390	1,700	841	J	1,050	J	928	J	1,090		614		730	
Selenium	mg/kg	39	2	1	-	-	-	-	-	-	0.99	J	0.33	J	0.22	J
Sodium	mg/kg	NE	ND	400	-	-	-	-	-	-	94.7	J	81.3	J	85.3	J
Thallium	mg/kg	0.078	1.3	0.43	-	-	-	-	-	-	-	-	0.33	J	-	-
Vanadium	mg/kg	39	40.9	31	29.1		14.7		20.4		16.1		13.6		13	
Zinc	mg/kg	2,300	321.75	76.2	44		53.2		53.4		41.8		34.7		25.6	

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB08				ULA-SB09			
				SAMPLE NUMBER	ULA0024		ULA0038		ULA0025		ULA0039	
				SAMPLE DATE	19-May-11		19-May-11		18-May-11		18-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES												
Acetone	mg/kg	6,100	NE	0.0585	-	-	-	-	0.012	J	-	-
Benzene	mg/kg	1.1	NE	0.0029	-	-	-	-	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0053	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.203	0.0113	J	0.0151	J	-	-	-	-
Toluene	mg/kg	500	NE	0.0068	-	-	-	-	0.0019	J	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	0.0026	-	-	-	-	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0037	-	-	-	-	-	-	-	-
SEMIVOLATILES												
Pyrene	mg/kg	170	NE	0.013	-	-	-	-	-	-	-	-
METALS												
Aluminum	mg/kg	7,700	15,500	12,400	7,020	J	6,360		4,020		5,760	
Antimony	mg/kg	3.1	9.3	0.44	-	-	-	-	0.21	J	0.19	J
Arsenic	mg/kg	0.39	36.5	20.4	3	J	7.9		14.7		9.2	
Barium	mg/kg	1,500	826	124	59.1		35.8		29.4		44.3	
Beryllium	mg/kg	16	1	0.78	0.34	J	0.35		0.26	J	0.33	
Cadmium	mg/kg	7	ND	0.48	0.14	J	-	-	0.27		0.21	J
Calcium	mg/kg	NE	52,300	80,700	**80,700**	J	29,900		**53,400**		49,800	
Chromium	mg/kg	0.29	29	20	11.5	J	10.5		6.6		9.9	
Cobalt	mg/kg	2.3	116	16	4	J	6.2		5.3		7.7	
Copper	mg/kg	310	56.2	58.4	12.2	J	16		14.4		16.9	
Iron	mg/kg	5,500	234,000	29,000	12,400	J	13,800		11,400		12,000	
Lead	mg/kg	400	48.6	69	8.5	J	11.2		9		10.9	
Magnesium	mg/kg	NE	10,400	19,800	**15,200**	J	**12,700**		**15,600**		**17,300**	
Manganese	mg/kg	180	3,506	1,680	329	J	206		692		523	
Mercury	mg/kg	1	0.09	0.062	0.035	J	0.018	J	-	-	0.01	J
Nickel	mg/kg	150	55.1	34.5	10.9	J	16.4		16.3		18.5	
Potassium	mg/kg	NE	3,390	1,700	930	J	1,080		604		1,120	
Selenium	mg/kg	39	2	1	-	-	0.39	J	-	-	0.42	J
Sodium	mg/kg	NE	ND	400	-	-	96.4	J	80.7	J	125	J
Thallium	mg/kg	0.078	1.3	0.43	-	-	-	-	0.43	J	0.32	J
Vanadium	mg/kg	39	40.9	31	10.5	J	15.6		12.2		14.7	
Zinc	mg/kg	2,300	321.75	76.2	35.3	J	38.1		31.7		39.1	

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB10								ULA-SB11			
				SAMPLE NUMBER	ULA0026		ULA0040		ULA0041		ULA0042		ULA0027		ULA0043	
				SAMPLE DATE	19-May-11		19-May-11		19-May-11		19-May-11		19-May-11		19-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft		3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	mg/kg	6,100	NE	0.0585	-	-	-	-	0.0146	J	0.047	U	-	-	0.0208	J
Benzene	mg/kg	1.1	NE	0.0029	-	-	0.0018	J	-	-	-	-	0.001	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-	-	-	-	-	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.203	0.0075		-	-	0.0035	J	0.008		-	-	-	-
Toluene	mg/kg	500	NE	0.0068	-	-	0.0024	J	-	-	-	-	0.0018	J	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	0.0026	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0037	-	-	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILES																
Pyrene	mg/kg	170	NE	0.013	-	-	-	-	-	-	-	-	-	-	-	-
METALS																
Aluminum	mg/kg	7,700	15,500	12,400	10,100		10,000		11,900		11,000		9,810		6,350	
Antimony	mg/kg	3.1	9.3	0.44	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/kg	0.39	36.5	20.4	8.1		13.8		10.6		16		5.7		5.9	
Barium	mg/kg	1,500	826	124	71.2		94.3		74.4		71		56.6		64.7	
Beryllium	mg/kg	16	1	0.78	0.5	J	0.56	J	0.62	J	0.7		0.56	J	0.35	
Cadmium	mg/kg	7	ND	0.48	-	-	0.41	J	-	-	-	-	0.39	J	0.19	J
Calcium	mg/kg	NE	52,300	80,700	3,070		3,160		3,350		3,600		20,400		51,500	
Chromium	mg/kg	0.29	29	20	16.4		17.4		19.9		20		16.4		13.5	
Cobalt	mg/kg	2.3	116	16	9	J	16		13.5	J	15		12	J	6.8	
Copper	mg/kg	310	56.2	58.4	16.9		26.9		25.9		30		17.6		20.6	
Iron	mg/kg	5,500	234,000	29,000	22,800		28,600		26,000		29,000		20,300		13,400	
Lead	mg/kg	400	48.6	69	9.2		15.9		14.5		20		10.1		12	
Magnesium	mg/kg	NE	10,400	19,800	3,200		3,470		4,140		4,600		9,100		**14,400**	
Manganese	mg/kg	180	3,506	1,680	478		870		530		370		547		436	
Mercury	mg/kg	1	0.09	0.062	0.02	J	0.03	J	0.026	J	-	-	0.014	J	0.015	J
Nickel	mg/kg	150	55.1	34.5	25.3		34.5		32.4		29		28		18.6	
Potassium	mg/kg	NE	3,390	1,700	1,140	J	1,080	J	1,370	J	1,400		1,010	J	1,240	
Selenium	mg/kg	39	2	1	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	ND	400	-	-	-	-	-	-	-	-	-	-	122	J
Thallium	mg/kg	0.078	1.3	0.43	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/kg	39	40.9	31	24.3		27		27		31		19.2		15.1	
Zinc	mg/kg	2,300	321.75	76.2	47.1		63.3		66.5		73		76.2		48.1	

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-SB12			
				SAMPLE NUMBER	ULA0028		ULA0044	
				SAMPLE DATE	19-May-11		19-May-11	
				DEPTH	3 - 5 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
VOLATILES								
Acetone	mg/kg	6,100	NE	0.0585	0.0585	J	-	-
Benzene	mg/kg	1.1	NE	0.0029	-	-	0.0015	J
Butanone, 2-	mg/kg	2,800	NE	0.0053	-	-	-	-
Ethylbenzene	mg/kg	5.4	NE	0.0013	-	-	-	-
Methylene chloride	mg/kg	11	NE	0.203	-	-	-	-
Toluene	mg/kg	500	NE	0.0068	-	-	0.0019	J
Trichloroethane, 1,1,1-	mg/kg	870	NE	0.0026	-	-	-	-
Xylenes, total	mg/kg	63	NE	0.0037	-	-	-	-
SEMIVOLATILES								
Pyrene	mg/kg	170	NE	0.013	-	-	-	-
METALS								
Aluminum	mg/kg	7,700	15,500	12,400	8,680		5,530	
Antimony	mg/kg	3.1	9.3	0.44	-	-	-	-
Arsenic	mg/kg	0.39	36.5	20.4	5.6		4.9	
Barium	mg/kg	1,500	826	124	35	J	49.2	
Beryllium	mg/kg	16	1	0.78	0.42	J	0.31	
Cadmium	mg/kg	7	ND	0.48	-	-	0.14	J
Calcium	mg/kg	NE	52,300	80,700	619	J	49,600	
Chromium	mg/kg	0.29	29	20	14.4		11.8	
Cobalt	mg/kg	2.3	116	16	5.2	J	7	
Copper	mg/kg	310	56.2	58.4	**58.4**		18.9	
Iron	mg/kg	5,500	234,000	29,000	18,500		11,700	
Lead	mg/kg	400	48.6	69	**69**		10.5	
Magnesium	mg/kg	NE	10,400	19,800	1,240		**11,100**	
Manganese	mg/kg	180	3,506	1,680	130		584	
Mercury	mg/kg	1	0.09	0.062	0.028	J	0.017	J
Nickel	mg/kg	150	55.1	34.5	14.7		15.6	
Potassium	mg/kg	NE	3,390	1,700	423	J	999	
Selenium	mg/kg	39	2	1	-	-	-	-
Sodium	mg/kg	NE	ND	400	-	-	400	J
Thallium	mg/kg	0.078	1.3	0.43	-	-	-	-
Vanadium	mg/kg	39	40.9	31	25.1		12.5	
Zinc	mg/kg	2,300	321.75	76.2	48.6		49.1	

Table 5-2

Detections Above RBSCs and/or BSCs in Subsurface Soil Samples - ULA
Garage Maintantence Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

BSC - Background screening concentration.

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

mg/kg - Milligrams per kilogram.

ND - Not detected (BSCs).

NE - Not established (RBSCs), not evaluated (BSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.

Blank cell means that parameter was not analyzed.

"-" - Not detected.

Validation Qualifiers (VQ)

J - The analyte was positively identified, the reported value is estimated.

Table 5-3

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-PZ01						ULA-PZ02		ULA-PZ03		ULA-PZ04	
				SAMPLE NUMBER	ULA3000		ULA3001		ULA3002		ULA3003		ULA3004		ULA3005	
				SAMPLE DATE	16-Jun-11		16-Jun-11		16-Jun-11		17-Jun-11		17-Jun-11		20-Jun-11	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		7.72 - 22 Ft		0 - 0 Ft		5.19 - 6.43 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		REG		REG	
				LOW-FLOW SAMPLED	No		No		No		No		No		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	µg/L	1,200	NE	26.2	-	-	-	-	-	-	22.3	B	26.2	B	-	-
Trichloroethane, 1,1,1-	µg/L	750	NE	7.9	-	-	-	-	-	-	-	-	-	-	7.9	
METALS (UNFILTERED)																
Aluminum	µg/L	1,600	309	7,820											**7,820**	J
Arsenic	µg/L	0.045	7.4	25.9											**25.9**	
Barium	µg/L	290	11,800	276											194	J
Calcium	µg/L	NE	316,000	221,000											221,000	J
Chromium	µg/L	0.031	NE	13.3											13.3	
Cobalt	µg/L	0.47	12.1	10											10	J
Copper	µg/L	62	19.8	27.6											**27.6**	
Iron	µg/L	1,100	1,550	28,900											**28,900**	J
Lead	µg/L	15	NE	16.5											16.5	
Magnesium	µg/L	NE	217,000	71,000											71,000	J
Manganese	µg/L	32	636	947											**947**	J
Mercury	µg/L	0.063	NE	0.14											0.14	J
Nickel	µg/L	30	8.6	25.8											**25.8**	J
Potassium	µg/L	NE	116,000	7,570											3,810	J
Selenium	µg/L	7.8	NE	2.1											2.1	J
Sodium	µg/L	NE	1,390,000	42,700											14,900	
Vanadium	µg/L	7.8	NE	20.6											20.6	J
Zinc	µg/L	470	507	71.9											71.9	J
METALS (FILTERED)																
Arsenic	µg/L	0.045	7.4	3.4											-	-
Barium	µg/L	290	11,800	274											128	J
Calcium	µg/L	NE	316,000	104,000											104,000	
Copper	µg/L	62	19.8	2.1											-	-
Iron	µg/L	1,100	1,550	874											874	
Magnesium	µg/L	NE	217,000	33,700											33,700	
Manganese	µg/L	32	636	751											191	
Potassium	µg/L	NE	116,000	7,520											1,470	J
Selenium	µg/L	7.8	NE	2.1											2.1	J
Sodium	µg/L	NE	1,390,000	45,000											14,900	
Zinc	µg/L	470	507	8.3											5.5	J
WATER QUALITY PARAMETERS																
Alkalinity, Carbonate	µg/L	NE	NE	361,000											361,000	
Chloride	µg/L	NE	NE	7,100											7,100	
Hardness (as CaCO3)	µg/L	NE	NE	844,000											844,000	
Sulfate	µg/L	NE	NE	94,800											94,800	J
Total dissolved solids	µg/L	NE	NE	496,000											496,000	
Total suspended solids	µg/L	NE	NE	5,920,000											5,920,000	
Turbidity	NTU	NE	NE	142											142	J

Table 5-3

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-PZ05		ULA-PZ06		ULA-PZ07		ULA-PZ08	
				SAMPLE NUMBER	ULA3006		ULA3007		ULA3008		ULA3009	
				SAMPLE DATE	17-Jun-11		16-Jun-11		16-Jun-11		17-Jun-11	
				DEPTH	7.93 - 29.45 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG	
				LOW-FLOW SAMPLED	No		No		No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES												
Acetone	µg/L	1,200	NE	26.2	-	-	17	B	10.4	B	-	-
Trichloroethane, 1,1,1-	µg/L	750	NE	7.9	-	-	-	-	-	-	-	-
METALS (UNFILTERED)												
Aluminum	µg/L	1,600	309	7,820	**2,030**							
Arsenic	µg/L	0.045	7.4	25.9	**9.8**	J						
Barium	µg/L	290	11,800	276	276							
Calcium	µg/L	NE	316,000	221,000	90,700							
Chromium	µg/L	0.031	NE	13.3	4.1	J						
Cobalt	µg/L	0.47	12.1	10	1.9	J						
Copper	µg/L	62	19.8	27.6	6.7	J						
Iron	µg/L	1,100	1,550	28,900	**4,220**							
Lead	µg/L	15	NE	16.5	2.2	J						
Magnesium	µg/L	NE	217,000	71,000	34,300							
Manganese	µg/L	32	636	947	**858**							
Mercury	µg/L	0.063	NE	0.14	-	-						
Nickel	µg/L	30	8.6	25.8	5.8	J						
Potassium	µg/L	NE	116,000	7,570	7,570	J						
Selenium	µg/L	7.8	NE	2.1	-	-						
Sodium	µg/L	NE	1,390,000	42,700	42,700							
Vanadium	µg/L	7.8	NE	20.6	5.3	J						
Zinc	µg/L	470	507	71.9	29.9							
METALS (FILTERED)												
Arsenic	µg/L	0.045	7.4	3.4	3.4	J						
Barium	µg/L	290	11,800	274	274							
Calcium	µg/L	NE	316,000	104,000	80,000							
Copper	µg/L	62	19.8	2.1	2.1	J						
Iron	µg/L	1,100	1,550	874	38.4	J						
Magnesium	µg/L	NE	217,000	33,700	31,300							
Manganese	µg/L	32	636	751	**751**							
Potassium	µg/L	NE	116,000	7,520	7,520	J						
Selenium	µg/L	7.8	NE	2.1	-	-						
Sodium	µg/L	NE	1,390,000	45,000	45,000							
Zinc	µg/L	470	507	8.3	8.3	J						
WATER QUALITY PARAMETERS												
Alkalinity, Carbonate	µg/L	NE	NE	361,000								
Chloride	µg/L	NE	NE	7,100								
Hardness (as CaCO3)	µg/L	NE	NE	844,000	368,000							
Sulfate	µg/L	NE	NE	94,800								
Total dissolved solids	µg/L	NE	NE	496,000								
Total suspended solids	µg/L	NE	NE	5,920,000								
Turbidity	NTU	NE	NE	142								

Table 5-3

Detections Above RBSCs and/or BSCs in Temporary Piezometer Groundwater - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

BSC - Background screening concentration.
MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).
µg/L - Micrograms per liter.
NE - Not established (RBSCs), not evaluated (BSCs).
Shaded cell indicates value is greater than RBSC.
RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.
Blank cell means that parameter was not analyzed.
"-" - Not detected.

Validation Qualifiers (VQ)
J - The analyte was positively identified, the reported value is estimated.
B - The analyte was not detected significantly above the levels found in the associated method blank or field blanks.

Table 5-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-MW01						ULA-MW01					
				SAMPLE NUMBER	ULA3010		ULA3011		ULA3012		ULA3015		ULA3016		ULA3017	
				SAMPLE DATE	9-Dec-11		9-Dec-11		9-Dec-11		1-May-12		1-May-12		1-May-12	
				DEPTH	4.3 - 4.36 Ft		4.3 - 4.36 Ft		4.3 - 4.36 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES																
Acetone	µg/L	1,200	NE	3.1	-	-	-	-	-	-	-	-	-	-	3.1	B
SEMIVOLATILES																
Di-n-butyl phthalate	µg/L	67	NE	1.6	-	-	1.6	J	-	-	-	-	-	-	-	-
Phenol	µg/L	450	NE	0.62	-	-	-	-	-	-	-	-	-	-	0.62	J
METALS (UNFILTERED)																
Aluminum	µg/L	1,600	309	107	62.3	J	70.7	J	95	J	31.3	J	46.1	J	-	-
Antimony	µg/L	0.6	NE	2.3	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	µg/L	0.045	7.4	5.8	-	-	-	-	4.8	J	-	-	-	-	-	-
Barium	µg/L	290	11,800	242	77.3	J	81.5	J	80	J	96.7	J	95	J	110	J
Calcium	µg/L	NE	316,000	142,000	127,000		132,000		130,000		142,000		140,000		140,000	
Chromium	µg/L	0.031	NE	1	1	J	-	-	-	-	-	-	-	-	-	-
Cobalt	µg/L	0.47	12.1	2	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	62	19.8	2.5	2.1	J	2.5	J	-	-	-	-	-	-	-	-
Iron	µg/L	1,100	1,550	3,640	403		405		420		1,200		1,200		1,500	
Lead	µg/L	15	NE	1.2	-	-	-	-	-	-	1.2	J	1	J	-	-
Magnesium	µg/L	NE	217,000	40,600	34,100		35,500		35,000	J	40,600		39,700		39,000	
Manganese	µg/L	32	636	281	120		127		120		189		183		220	
Nickel	µg/L	30	8.6	2.8	-	-	-	-	-	-	2	J	-	-	2.8	J
Potassium	µg/L	NE	116,000	6,360	1,820	J	1,870	J	1,700	J	2,020	J	1,920	J	2,800	J
Selenium	µg/L	7.8	NE	3.2	3.2	J	2.8	J	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	78,200	24,100		24,500		22,000		31,100		31,300		30,000	
Zinc	µg/L	470	507	9.6	-	-	-	-	-	-	9.6	J	-	-	-	-
METALS (FILTERED)																
Arsenic	µg/L	0.045	7.4	5.9	-	-	-	-	-	-	-	-	-	-	-	-
Barium	µg/L	290	11,800	231	76	J	74	J	77	J	92.7	J	93.2	J	92	J
Calcium	µg/L	NE	316,000	143,000	126,000		120,000		130,000		143,000		141,000		140,000	
Cobalt	µg/L	0.47	12.1	2	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	62	19.8	2.1	2.1	J	-	-	-	-	-	-	-	-	-	-
Iron	µg/L	1,100	1,550	3,270	286	J	277	J	280		954		931		930	
Magnesium	µg/L	NE	217,000	39,900	34,000		31,700		34,000	J	39,900		39,700		39,000	
Manganese	µg/L	32	636	254	116		115		120		167		167		170	
Mercury	µg/L	0.063	NE	0.18	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	µg/L	30	8.6	2.3	-	-	-	-	2.3	J	-	-	-	-	-	-
Potassium	µg/L	NE	116,000	6,040	1,710	J	1,600	J	1,600	J	1,800	J	1,750	J	1,900	J
Selenium	µg/L	7.8	NE	3.3	2.2	J	3.3	J	-	-	-	-	-	-	-	-
Sodium	µg/L	NE	1,390,000	70,100	23,100		22,400		21,000		29,700		29,400		27,000	
Zinc	µg/L	470	507	15	-	-	-	-	-	-	5.2	J	5.8	J	15	J

Table 5-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-MW01						ULA-MW01					
				SAMPLE NUMBER	ULA3010		ULA3011		ULA3012		ULA3015		ULA3016		ULA3017	
				SAMPLE DATE	9-Dec-11		9-Dec-11		9-Dec-11		1-May-12		1-May-12		1-May-12	
				DEPTH	4.3 - 4.36 Ft		4.3 - 4.36 Ft		4.3 - 4.36 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
WATER QUALITY PARAMETERS																
Alkalinity	µg/L	NE	NE	452,000					410,000		452,000	J	420,000		450,000	
Alkalinity, Carbonate	µg/L	NE	NE	428,000	370,000		390,000									
Chloride	µg/L	NE	NE	11,800	10,200	J	10,000	J	7,800		10,800		10,800		8,700	
Hardness (as CaCO3)	µg/L	NE	NE	560,000	458,000		476,000		410,000		522,000		513,000		560,000	
Nitrate-Nitrite	µg/L	NE	NE	280	-	-	-	-	77	J	-	-	-	-	-	-
Sulfate	µg/L	NE	NE	129,000	105,000	J	110,000	J	110,000		105,000		111,000		120,000	
Total dissolved solids	µg/L	NE	NE	639,000	547,000		525,000		590,000		598,000		639,000		610,000	
Total suspended solids	µg/L	NE	NE	18,000	-	-	4,000	J	2,000	J	8,000	J	5,000	J	4,000	
Turbidity	NTU	NE	NE	29.3	2.8	J	4.1	J	3.1		2.9		3.3		6.2	

Table 5-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-MW02				ULA-MW03			
				SAMPLE NUMBER	ULA3013		ULA3018		ULA3014		ULA3019	
				SAMPLE DATE	13-Dec-11		30-Apr-12		12-Dec-11		25-Apr-12	
				DEPTH	7.56 - 7.83 Ft		0 - 0 Ft		6.35 - 6.69 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES												
Acetone	µg/L	1,200	NE	3.1	-	-	-	-	-	-	-	-
SEMIVOLATILES												
Di-n-butyl phthalate	µg/L	67	NE	1.6	-	-	-	-	-	-	-	-
Phenol	µg/L	450	NE	0.62	-	-	-	-	-	-	-	-
METALS (UNFILTERED)												
Aluminum	µg/L	1,600	309	107	38.4	J	25.8	J	107	J	70.2	J
Antimony	µg/L	0.6	NE	2.3	2.3	J	-	-	-	-	2	J
Arsenic	µg/L	0.045	7.4	5.8	2.1	J	5.8	J	-	-	-	-
Barium	µg/L	290	11,800	242	239		242		153	J	197	J
Calcium	µg/L	NE	316,000	142,000	92,100		87,600		103,000		97,800	
Chromium	µg/L	0.031	NE	1	-	-	-	-	-	-	-	-
Cobalt	µg/L	0.47	12.1	2	1.8	J	2	J	-	-	-	-
Copper	µg/L	62	19.8	2.5	-	-	-	-	-	-	-	-
Iron	µg/L	1,100	1,550	3,640	**1,710**		**3,640**		228	J	156	J
Lead	µg/L	15	NE	1.2	-	-	-	-	-	-	-	-
Magnesium	µg/L	NE	217,000	40,600	38,100		39,200		37,800		40,200	
Manganese	µg/L	32	636	281	281		275		37.3		138	
Nickel	µg/L	30	8.6	2.8	-	-	-	-	-	-	-	-
Potassium	µg/L	NE	116,000	6,360	4,850	J	6,360	J	2,430	J	4,200	J
Selenium	µg/L	7.8	NE	3.2	-	-	-	-	3.2	J	-	-
Sodium	µg/L	NE	1,390,000	78,200	78,200		57,000		21,300		26,300	
Zinc	µg/L	470	507	9.6	-	-	-	-	-	-	5	J
METALS (FILTERED)												
Arsenic	µg/L	0.045	7.4	5.9	2.8	J	5.9	J	-	-		
Barium	µg/L	290	11,800	231	216		231		151	J		
Calcium	µg/L	NE	316,000	143,000	82,800		81,900		103,000			
Cobalt	µg/L	0.47	12.1	2	1.6	J	2	J	-	-		
Copper	µg/L	62	19.8	2.1	-	-	-	-	-	-		
Iron	µg/L	1,100	1,550	3,270	957		**3,270**		-	-		
Magnesium	µg/L	NE	217,000	39,900	34,300		36,700		37,500			
Manganese	µg/L	32	636	254	250		254		33.6			
Mercury	µg/L	0.063	NE	0.18	0.18	J	-	-	-	-		
Nickel	µg/L	30	8.6	2.3	-	-	-	-	-	-		
Potassium	µg/L	NE	116,000	6,040	4,470	J	6,040	J	2,430	J		
Selenium	µg/L	7.8	NE	3.3	-	-	-	-	2.8	J		
Sodium	µg/L	NE	1,390,000	70,100	70,100		54,000		21,200			
Zinc	µg/L	470	507	15	-	-	5.8	J	-	-		

Table 5-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

				LOCATION CODE	ULA-MW02				ULA-MW03			
				SAMPLE NUMBER	ULA3013		ULA3018		ULA3014		ULA3019	
				SAMPLE DATE	13-Dec-11		30-Apr-12		12-Dec-11		25-Apr-12	
				DEPTH	7.56 - 7.83 Ft		0 - 0 Ft		6.35 - 6.69 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG		REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ
WATER QUALITY PARAMETERS												
Alkalinity	µg/L	NE	NE	452,000			408,000				356,000	
Alkalinity, Carbonate	µg/L	NE	NE	428,000	428,000				391,000			
Chloride	µg/L	NE	NE	11,800	11,800		10,700		7,500		9,100	
Hardness (as CaCO3)	µg/L	NE	NE	560,000	387,000		380,000		413,000			
Nitrate-Nitrite	µg/L	NE	NE	280	-	-	-	-	280		-	-
Sulfate	µg/L	NE	NE	129,000	129,000		82,600	J	70,700		71,800	
Total dissolved solids	µg/L	NE	NE	639,000	603,000		511,000		487,000		462,000	
Total suspended solids	µg/L	NE	NE	18,000	12,000		10,000	J	8,000	J	18,000	
Turbidity	NTU	NE	NE	29.3	3.5		29.3		4.3		14.9	J

Table 5-4

Detections Above RBSCs and/or BSCs in Overburden/Shale Groundwater Samples - ULA
Garage Maintenance Area Remedial Investigation Report
Former Plum Brook Ordnance Works
Sandusky, Ohio

BSC - Background screening concentration.

MDC - Maximum detected concentration for the area of concern ("B" qualified data not included).

µg/L - Micrograms per liter.

NE - Not established (RBSCs), not evaluated (BSCs).

Shaded cell indicates value is greater than RBSC.

RBSC - Values reflect an incremental lifetime cancer risk (ILCR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. RBSCs derived from U.S. Enviromental Protection Agency (EPA), 2012, Regional Screening Level Table, April, online at http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/index.htm.

Bold text indicates value is greater than BSC.

Blank cell means that parameter was not analyzed.

"-" - Not detected.

Validation Qualifiers (VQ)

B - The analyte was detected in a lab or field blank.

J - The analyte was positively identified, the reported value is estimated.

Table 5-5

Statistical Summary and Selection of Chemicals of Potential Concern for Unloading Area Surface Soil
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics														
Aluminum	12 / 12	100	3.76E+03		1.19E+04		1.20E+00	1.10E+01	8.24E+03	1.55E+04	7700	N (b)		
Arsenic	12 / 12	100	2.65E+00		9.50E+00		5.20E-02	4.60E-01	5.49E+00	3.65E+01	0.61	N (b)		
Barium	12 / 12	100	1.23E+01	J	8.25E+01		2.10E-01	1.90E+00	4.62E+01	8.26E+02	1500	N (b)		
Beryllium	12 / 12	100	1.70E-01	J	7.10E-01	J	5.20E-03	4.60E-02	4.53E-01	1.00E+00	16	N (b)		
Cadmium	4 / 12	33	1.80E-01	J	9.50E-01	J	5.20E-03	4.60E-02	1.50E-01	NA	7	N (a)		
Calcium	12 / 12	100	4.27E+02	J	2.99E+03		2.60E+00	2.30E+01	1.78E+03	5.23E+04	Nutrient	N (c)		
Chromium	12 / 12	100	4.70E+00		1.74E+01		5.20E-02	4.60E-01	1.16E+01	2.90E+01	0.29	N (b)		
Cobalt	12 / 12	100	1.50E+00	J	1.78E+01	J	5.20E-02	4.60E-01	6.37E+00	1.16E+02	2.3	N (b)		
Copper	12 / 12	100	4.70E+00	J	3.84E+01		5.20E-02	4.60E-01	1.28E+01	5.62E+01	310	N (b)		
Iron	12 / 12	100	5.54E+03		2.26E+04		1.20E+00	1.10E+01	1.40E+04	2.34E+05	5500	N (b)		
Lead	12 / 12	100	3.85E+00		1.27E+01		4.40E-02	6.60E-02	9.06E+00	4.86E+01	400	N (b)		
Magnesium	12 / 12	100	4.80E+02		2.52E+03		2.60E+00	2.30E+01	1.55E+03	1.04E+04	Nutrient	N (c)		
Manganese	12 / 12	100	4.31E+01		5.25E+02		5.20E-02	4.60E-01	2.38E+02	3.51E+03	180	N (b)		
Mercury	12 / 12	100	1.20E-02	J	7.60E-02	J	5.80E-03	9.20E-03	3.36E-02	8.50E-02	2.3	N (b)		
Nickel	12 / 12	100	5.25E+00	J	3.26E+01		5.20E-02	4.60E-01	1.39E+01	5.51E+01	150	N (b)		
Potassium	12 / 12	100	2.09E+02	JJ	9.49E+02	J	2.60E+00	2.30E+01	5.12E+02	3.39E+03	Nutrient	N (c)		
Selenium	2 / 12	17	2.30E-01	J	5.40E-01	J	1.00E-01	9.30E-01	4.39E-01	2.00E+00	39	N (b)		
Vanadium	12 / 12	100	8.30E+00		2.58E+01		5.20E-02	4.60E-01	2.01E+01	4.09E+01	39	N (b)		
Zinc	12 / 12	100	1.50E+01	J	1.70E+02		5.20E-02	4.60E-01	4.50E+01	3.22E+02	2300	N (b)		
Polychlorinated biphenyls (PCB)														
Aroclor 1254	1 / 10	10	1.29E-02	J	1.29E-02	J	7.10E-03	1.10E-02	8.89E-03		0.11	N (a)		
Semivolatile Organic Compounds														
Benzo(a)anthracene	2 / 12	17	2.86E-02	J	3.29E-02	J	1.80E-02	2.80E-02	2.27E-02		0.15	N (a)		
Benzo(a)pyrene	3 / 12	25	2.39E-02	J	3.08E-02	J	1.80E-02	2.80E-02	2.24E-02		0.015	Y	2.57E-02	2.57E-02
Benzo(b)fluoranthene	2 / 12	17	3.83E-02	J	4.44E-02	J	1.80E-02	2.80E-02	2.44E-02		0.15	N (a)		
Chrysene	3 / 12	25	2.72E-02	J	3.43E-02	J	1.80E-02	2.80E-02	2.38E-02		15	N (a)		
Fluoranthene	4 / 12	33	2.96E-02	J	8.11E-02	J	1.80E-02	2.80E-02	3.13E-02		230	N (a)		
Methylnaphthalene, 2-	1 / 12	8	3.01E-02	J	3.01E-02	J	1.80E-02	2.80E-02	2.17E-02		23	N (a)		
Phenanthrene	2 / 12	17	4.21E-02	J	4.33E-02	J	1.80E-02	2.80E-02	2.47E-02		170 g	N (a)		
Pyrene	4 / 12	33	2.94E-02	J	5.55E-02	J	1.80E-02	2.80E-02	2.77E-02		170	N (a)		
Volatile Organic Compounds														
Acetone	11 / 12	92	2.10E-02	J	2.51E-01	J	1.20E-02	2.30E-02	5.86E-02		6100	N (a)		
Butanone, 2-	4 / 12	33	6.00E-03	J	2.38E-02	J	3.60E-03	7.00E-03	6.89E-03		2800	N (a)		
Methyl-2-pentanone, 4-	1 / 12	8	6.70E-03	J	6.70E-03	J	3.20E-03	6.30E-03	4.39E-03		530	N (a)		
Methylene chloride	9 / 12	75	3.60E-03	J	9.70E-03	J	2.70E-03	5.30E-03	5.78E-03		36	N (a)		

Table 5-5

Statistical Summary and Selection of Chemicals of Potential Concern for Unloading Area Surface Soil
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

			Range of Values, mg/kg											
	Detection	Percent	Detected Concentrations				Reporting Limits		Mean	BSC [a]	RBSC [b]		95% UCL [e]	EPC [f]
Chemical	Frequency	Detection	Minimum	VQ	Maximum	VQ	Minimum	Maximum	mg/kg	mg/kg	mg/kg	COPC? [c,d]	mg/kg	mg/kg

BSC - Background screening criterion.
COPC - Chemical of potential concern.
EPC - Exposure point concentration.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
Double letters indicate the combined qualifier for two samples, the target sample and field duplicate, that were combined (averaged) in the data set.
mg/kg - Milligrams per kilogram.
RBSC - Risk-based screening concentration.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas*** , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) residential soil values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N - Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y - Chemical is chosen as COPC.
[e] 95% UCL determined using ProUCL Version 4.1 (EPA, 2011, *ProUCL Version 4.1.01* , Technical Support Center, Office of Science Policy, Atlanta, Georgia, July, http://www.epa.gov/osp/hstl/tsc/software.htm). Calculated only for COPCs.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] RBSC based on pyrene.

Source: Unloading Area Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2014)

Table 5-6

Statistical Summary and Selection of Chemicals of Potential Concern for Unloading Area Subsurface Soil
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	RBSC [b] mg/kg	COPC? [c,d]
Inorganics												
Aluminum	24 / 24	100	3.89E+03		1.24E+04		1.10E+00	7.00E+00	6.93E+03	1.55E+04	7700	N (b)
Antimony	8 / 24	33	1.10E-01	J	4.40E-01	J	4.60E-02	2.90E-01	1.91E-01	9.30E+00	3.1	N (b)
Arsenic	24 / 24	100	3.00E+00	J	2.04E+01		4.40E-02	2.90E-01	7.89E+00	3.65E+01	0.61	N (b)
Barium	24 / 24	100	2.87E+01		1.24E+02		1.80E-01	1.20E+00	5.14E+01	8.26E+02	1500	N (b)
Beryllium	24 / 24	100	2.50E-01		7.80E-01	J	4.60E-03	2.90E-02	3.89E-01	1.00E+00	16	N (b)
Cadmium	18 / 24	75	8.60E-02	J	4.80E-01	J	4.40E-03	2.90E-02	1.68E-01	NA	7	N (a)
Calcium	24 / 24	100	6.19E+02	J	8.07E+04	J	3.10E+00	1.50E+01	3.66E+04	5.23E+04	Nutrient	N (c)
Chromium	24 / 24	100	6.60E+00		1.87E+01		4.60E-02	2.90E-01	1.18E+01	2.90E+01	0.29	N (b)
Cobalt	24 / 24	100	3.00E+00		1.48E+01	J	4.40E-02	2.90E-01	7.25E+00	1.16E+02	2.3	N (b)
Copper	24 / 24	100	1.22E+01	J	5.84E+01		4.60E-02	2.90E-01	1.88E+01	5.62E+01	310	N (a)
Iron	24 / 24	100	7.67E+03		2.80E+04		1.00E+00	6.70E+00	1.55E+04	2.34E+05	5500	N (b)
Lead	24 / 24	100	7.70E+00		6.90E+01		4.60E-02	2.20E-01	1.28E+01	4.86E+01	400	N (a)
Magnesium	24 / 24	100	1.24E+03		1.98E+04		2.60E+00	1.50E+01	1.17E+04	1.04E+04	Nutrient	N (c)
Manganese	24 / 24	100	1.30E+02		1.68E+03		5.70E-02	5.30E-01	4.92E+02	3.51E+03	180	N (b)
Mercury	20 / 24	83	1.00E-02	J	6.20E-02	J	6.40E-03	7.60E-03	2.01E-02	8.50E-02	2.3	N (b)
Nickel	24 / 24	100	9.90E+00		3.35E+01		4.40E-02	2.90E-01	1.84E+01	5.51E+01	150	N (b)
Potassium	24 / 24	100	4.23E+02	J	1.36E+03	J	2.30E+00	1.50E+01	9.44E+02	3.39E+03	Nutrient	N (c)
Selenium	7 / 24	29	2.20E-01	J	9.90E-01	J	9.10E-02	5.80E-01	3.94E-01	2.00E+00	39	N (b)
Sodium	11 / 24	46	8.07E+01	J	4.00E+02	J	3.90E+01	2.50E+02	1.49E+02	NA	Nutrient	N (c)
Thallium	6 / 24	25	2.75E-01	J	4.30E-01	J	6.80E-02	8.50E-01	2.29E-01	1.30E+00	0.078	N (b)
Vanadium	24 / 24	100	1.05E+01	J	2.91E+01		4.40E-02	2.90E-01	1.67E+01	4.09E+01	39	N (b)
Zinc	24 / 24	100	2.56E+01		7.62E+01		4.60E-02	2.90E-01	4.30E+01	3.22E+02	2300	N (b)
Volatile Organic Compounds												
Acetone	8 / 24	33	1.20E-02	J	5.85E-02	J	1.20E-02	9.90E-01	6.31E-02		6100	N (a)
Benzene	8 / 24	33	1.00E-03	J	2.90E-03	J	9.30E-04	7.40E-02	4.51E-03		1.1	N (a)
Butanone, 2-	1 / 24	4	5.30E-03	J	5.30E-03	J	3.80E-03	3.00E-01	1.78E-02		2800	N (a)
Ethylbenzene	2 / 24	8	1.30E-03	J	3.41E-03	J	6.20E-04	4.90E-02	3.03E-03		5.4	N (a)
Methylene chloride	13 / 24	54	4.10E-03	J	2.03E-01	J	2.80E-03	2.30E-01	3.05E-02		36	N (a)
Toluene	11 / 24	46	1.50E-03	J	6.80E-03		7.40E-04	5.90E-02	4.17E-03		500	N (a)
Trichloroethane, 1,1,1-	1 / 24	4	1.95E-03	J	1.95E-03	J	6.80E-04	5.40E-02	3.24E-03		870	N (a)
Xylenes, total	1 / 24	4	3.70E-03	J	3.70E-03	J	2.00E-03	1.60E-01	9.48E-03		63	N (a)

Table 5-6

Statistical Summary and Selection of Chemicals of Potential Concern for Unloading Area Subsurface Soil
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

BSC - Background screening criterion.
COPC - Chemical of potential concern.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - Milligrams per kilogram.
RBSC - Risk based screening concentration.
VQ - Validation qualifier.

[a] IT Corporation (IT), 1998, *Site Investigation of Acid Areas,Plum Brook Ordnance Works, Sandusky, Ohio* , August.
[b] Risk-Based Screening Concentrations based on USEPA Regional Screening Level Table (May 2013) residential soil values and based on a risk level of 1.0E-06 and a hazard index of 0.1.
[c] N = Chemical is not chosen as a COPC:
(a) = maximum detected concentration is less than the RBSC.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
[d] Y = Chemical is chosen as COPC.

Source: Unloading Area Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2014)

Table 5-7

Statistical Summary and Selection of Chemicals of Potential Concern for Unloading Area Overburden Monitoring Well Groundwater
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent hits	Range of values, µg/L: Detected Concentrations Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Arithmetic Mean µg/L	RBSC [a] µg/L		COPC? [b,c]	95% UCL [d] µg/L	EPC [e] µg/L	EPC mg/L
Inorganics - Unfiltered															
Aluminum	6 / 6	100	2.58E+01	J	1.07E+02	J	2.00E+01	2.00E+01	5.78E+01	1600		N (a)		---	
Antimony	2 / 6	33	2.00E+00	J	2.30E+00	J	1.00E+00	1.00E+00	1.38E+00	0.6		Y	2.18E+00	2.18E+00	2.18E-03
Arsenic	2 / 6	33	2.10E+00	J	5.80E+00	J	1.00E+00	1.00E+00	1.98E+00	0.045		Y	4.32E+00	4.32E+00	4.32E-03
Barium	6 / 6	100	7.94E+01	J	2.42E+02		1.00E+00	1.00E+00	1.68E+02	290		N (a)		---	
Calcium	6 / 6	100	8.76E+04		1.41E+05		5.00E+01	5.00E+01	1.09E+05	Nutrient		N (b)		---	
Chromium	1 / 6	17	1.00E+00	J	1.00E+00	J	1.00E+00	1.00E+00	1.00E+00	0.031		Y	NA	1.00E+00	1.00E-03
Cobalt	2 / 6	33	1.80E+00	J	2.00E+00	J	1.00E+00	1.00E+00	1.30E+00	0.47		Y	1.92E+00	1.92E+00	1.92E-03
Copper	1 / 6	17	2.30E+00	J	2.30E+00	J	1.00E+00	1.00E+00	1.22E+00	62		N (a)		---	
Iron	6 / 6	100	1.56E+02	J	3.64E+03		3.40E+01	3.40E+01	1.22E+03	1100		Y	2.32E+03	2.32E+03	2.32E+00
Lead	1 / 6	17	1.10E+00	J	1.10E+00	J	1.00E+00	1.00E+00	1.02E+00	15	f	N (a)		---	
Magnesium	6 / 6	100	3.48E+04		4.02E+04		5.00E+01	5.00E+01	3.84E+04	Nutrient		N (b)		---	
Manganese	6 / 6	100	3.73E+01		2.81E+02		1.00E+00	1.00E+00	1.73E+02	32		Y	2.51E+02	2.51E+02	2.51E-01
Nickel	1 / 6	17	1.50E+00	J	1.50E+00	J	1.00E+00	1.00E+00	1.08E+00	30		N (a)		---	
Potassium	6 / 6	100	1.85E+03	J	6.36E+03	J	5.00E+01	5.00E+01	3.61E+03	Nutrient		N (b)		---	
Selenium	2 / 6	33	3.00E+00	J	3.20E+00	J	2.00E+00	2.00E+00	2.37E+00	7.8		N (a)		---	
Sodium	6 / 6	100	2.13E+04		7.82E+04		7.50E+02	7.50E+02	3.97E+04	Nutrient		N (b)		---	
Zinc	2 / 6	33	5.00E+00	J	5.30E+00	J	1.00E+00	1.00E+00	2.38E+00	470		N (a)		---	
Semivolatile Organics															
Di-n-butyl phthalate	1 6	17	1.22E+00	J	1.22E+00	J	8.35E-01	8.50E-01	9.03E-01	67		N (a)		---	
General Chemistry															
Chloride	6 / 6	100	7.50E+03		1.18E+04		1.00E+03	2.00E+03	1.00E+04	Nutrient		N (b)		---	
Nitrate-Nitrite	1 / 6	17	2.80E+02		2.80E+02		5.00E+01	2.50E+04	2.80E+02	1000	g	N (a)		---	
Sulfate	6 / 6	100	7.07E+04		1.29E+05		1.00E+03	2.00E+03	9.49E+04	250,000	h	N (a)		---	

Table 5-7

Statistical Summary and Selection of Chemicals of Potential Concern for Unloading Area Overburden Monitoring Well Groundwater
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

COPC - Chemical of potential concern.
EPC - Exposure-point concentration.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
MCL - Maximum contaminant level established in the Safe Drinking Water Act.
µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
RBSC - Risk-based screening concentration.
VQ - Validation qualifier.

[a] Risk-Based Screening Concentrations based on EPA Regional Screening Level Table (May 2013) tap water values and are based on a risk level of 1.0E-06 and a hazard index of 0.1.
[b] N = Chemical is not chosen as a COPC:
(a) = Maximum detected concentration is less than the RBSC.
(b) = Essential nutrient.
[c] Y = Chemical is chosen as COPC.
[d] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.1.01 (U.S. Environmental Protection Agency [EPA], 2011, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/TSC_form.htm. Calculated only for COPCs.
[e] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[f] Screening criteria for lead based on the action level of 15 µg/L (U.S. Environmental Protection Agency [EPA], 2012 Edition of the Drinking Water Standards and Health Advisories, Office of Water, October, EPA 822-S-12-001).
[g] Because no Regional Screening Level exists for nitrate-nitrite, 0.1X the nitrate-nitrite MCL is used for screening.
[h] Source: EPA, 2012.

Source: Unloading Area Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2014)

Table 5-8

Summary of Risks for All Receptors in the Unloading Area
GMA RI Report
Former Plum Brook Ordnance Works, Sandusky, Ohio

	Groundskeeper [a]		Construction Worker		Indoor Worker		Resident			Hunter		Hunter's Child	
	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total HI	Total ILCR	Total Adult - HI	Total Child - HI	Total ILCR	Total HI	Total ILCR	Total HI
Exposure Media													
Surface Soil	1.22E-07	NA	NE	NE	3.28E-08	NA	NE	NE	NE	8.19E-09	NA	NA	NA
Total Soil	1.22E-07	NA	6.05E-09	NA	NE	NE	3.85E-07	NA	NA	NE	NE	NE	NE
Overburden Groundwater	2.27E-05	0.348	NE	NE	2.27E-05	0.348	9.66E-05	0.968	2.26	NE	NE	NE	NE
Total ILCR or HI	**2.E-05**	**0.3**	**6.E-09**	**NA**	**2.E-05**	**0.3**	**1.E-04**	**1**	**2**	**8.E-09**	**NA**	**NA**	**NA**

HI - Hazard index.
ILCR - Incremental lifetime cancer risk.
NA - Not applicable.
NE - Pathway not evaluated for this receptor.

Note:
[a]Total ILCR and total HI values for the groundskeeper reflect the respective totals for the future groundskeeper assumed to use overburden groundwater. The total ILCR and HI values for the current groundskeeper are simply those shown for surface soil. The rounded current groundskeeper ILCR is 1E-7.

Source: Unloading Area Baseline Human Heath Risk Assessment (BHHRA) (Shaw, 2014)

Table 5-9

Statistical Summary and COPEC Selection of Chemicals Detected in Unloading Area Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Method Detection Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	ESV [b] mg/kg	COPEC? [c,d]	95% UCL [e] mg/kg	EPC [f] mg/kg
Inorganics														
Aluminum	24 / 24	100	3.76E+03		1.24E+04		1.20E+00	1.10E+01	7.81E+03	1.55E+04	pH Dependent	N (b)		---
Antimony	2 / 24	8	1.40E-01	J	2.10E-01	J	5.20E-02	4.60E-01	1.90E-01	9.30E+00	0.27	N (b)		---
Arsenic	24 / 24	100	2.65E+00		2.04E+01		4.40E-02	4.60E-01	6.84E+00	3.65E+01	18	N (b)		---
Barium	24 / 24	100	1.23E+01	J	1.24E+02		2.10E-01	1.90E+00	4.87E+01	8.26E+02	330	N (b)		---
Beryllium	24 / 24	100	1.70E-01	J	7.80E-01	J	5.20E-03	4.60E-02	4.32E-01	1.00E+00	21	N (b)		---
Cadmium	12 / 24	50	8.60E-02	J	9.50E-01	J	4.40E-03	4.60E-02	1.48E-01	NA	0.36	Y	3.29E-01	3.29E-01
Calcium	24 / 24	100	4.27E+02	J	8.07E+04	J	2.60E+00	2.30E+01	1.55E+04	5.23E+04	Nutrient	N (c)		---
Chromium	24 / 24	100	4.70E+00		1.74E+01		5.20E-02	4.60E-01	1.18E+01	2.90E+01	26	N (b)		---
Cobalt	24 / 24	100	1.50E+00	J	1.78E+01	J	4.40E-02	4.60E-01	6.55E+00	1.16E+02	13	N (b)		---
Copper	24 / 24	100	4.70E+00	J	5.84E+01		5.20E-02	4.60E-01	1.58E+01	5.62E+01	28	N (d)		---
Iron	24 / 24	100	5.54E+03		2.28E+04		1.20E+00	1.10E+01	1.50E+04	2.34E+05	pH Dependent	N (b)		---
Lead	24 / 24	100	3.85E+00		6.90E+01		4.40E-02	1.80E-01	1.16E+01	4.86E+01	11	N (d)		---
Magnesium	24 / 24	100	4.80E+02		1.56E+04		2.60E+00	2.30E+01	5.22E+03	1.04E+04	Nutrient	N (c)		---
Manganese	24 / 24	100	4.31E+01		8.48E+02		5.20E-02	4.60E-01	3.21E+02	3.51E+03	220	N (b)		---
Mercury	21 / 24	88	1.20E-02	J	7.60E-02	J	5.80E-03	9.20E-03	2.81E-02	8.50E-02	0.00051	N (b)		---
Nickel	24 / 24	100	5.25E+00	J	3.26E+01		4.40E-02	4.60E-01	1.55E+01	5.51E+01	38	N (b)		---
Potassium	24 / 24	100	2.09E+02	J	1.14E+03	J	2.60E+00	2.30E+01	6.57E+02	3.39E+03	Nutrient	N (c)		---
Selenium	3 / 24	13	2.30E-01	J	5.40E-01	J	1.00E-01	9.30E-01	3.89E-01	2.00E+00	0.52	N (b)		---
Sodium	2 / 24	8	8.07E+01	J	8.13E+01	J	4.40E+01	3.90E+02	1.58E+02	NA	Nutrient	N (c)		---
Thallium	2 / 24	8	3.30E-01	J	4.30E-01	J	6.60E-02	8.50E-01	1.73E-01	1.30E+00	1	N (a)		
Vanadium	24 / 24	100	8.30E+00		2.91E+01		4.40E-02	4.60E-01	1.90E+01	4.09E+01	7.8	N (b)		---
Zinc	24 / 24	100	1.50E+01	J	1.70E+02		5.20E-02	4.60E-01	4.35E+01	3.22E+02	46	N (b)		---
Polychlorinated biphenyls (PCB)														
Aroclor 1254	1 / 21	5	1.29E-02	J	1.29E-02	J	7.10E-03	1.10E-02	8.49E-03		0.371	N (a)		---
Semivolatile Organic Compounds														
Benzo(a)anthracene	2 / 24	8	2.86E-02	J	3.29E-02	J	1.80E-02	2.80E-02	2.16E-02		1.1	N (a)		---
Benzo(a)pyrene	3 / 24	13	2.39E-02	J	3.08E-02	J	1.80E-02	2.80E-02	2.15E-02		1.1	N (a)		---
Benzo(b)fluoranthene	2 / 24	8	3.83E-02	J	4.44E-02	J	1.80E-02	2.80E-02	2.25E-02		1.1	N (a)		---
Chrysene	3 / 24	13	2.72E-02	J	3.43E-02	J	1.80E-02	2.80E-02	2.22E-02		1.1	N (a)		---
Fluoranthene	4 / 24	17	2.96E-02	J	8.11E-02	J	1.80E-02	2.80E-02	2.59E-02		1.1	N (a)		---
Methylnaphthalene, 2-	1 / 24	4	3.01E-02	J	3.01E-02	J	1.80E-02	2.80E-02	2.11E-02		3.24	N (a)		
Phenanthrene	2 / 24	8	4.21E-02	J	4.33E-02	J	1.80E-02	2.80E-02	2.26E-02		29	N (a)		---
Pyrene	4 / 24	17	2.94E-02	J	5.55E-02	J	1.80E-02	2.80E-02	2.41E-02		1.1	N (a)		---
Volatile Organic Compounds														
Acetone	15 / 24	63	1.20E-02	J	2.51E-01	J	1.20E-02	2.30E-02	4.03E-02		2.5	N (a)		---
Benzene	6 / 24	25	1.00E-03	J	2.90E-03	J	8.80E-04	1.70E-03	1.28E-03		0.255	N (a)		---
Butanone, 2-	4 / 24	17	6.00E-03	J	2.38E-02	J	3.60E-03	7.00E-03	5.78E-03		89.6	N (a)		---
Ethylbenzene	2 / 24	8	1.30E-03	J	3.41E-03	J	5.90E-04	1.20E-03	9.04E-04		5.16	N (a)		---
Methyl-2-pentanone, 4-	1 / 24	4	6.70E-03	J	6.70E-03	J	3.20E-03	6.30E-03	4.29E-03		443	N (a)		
Methylene chloride	14 / 24	58	3.60E-03	J	1.13E-02	J	2.70E-03	5.30E-03	5.33E-03		4.05	N (a)		---
Toluene	7 / 24	29	1.50E-03	J	6.80E-03		7.00E-04	1.40E-03	1.52E-03		200	N (a)		---
Trichloroethane, 1,1,1-	1 / 24	4	1.95E-03	J	1.95E-03	J	6.40E-04	1.30E-03	8.99E-04		29.8	N (a)		
Xylenes, total	1 / 24	4	3.70E-03	J	3.70E-03	J	1.90E-03	3.70E-03	2.55E-03		10	N (a)		---

BSC - Background screening concentration

Table 5-9

Statistical Summary and COPEC Selection of Chemicals Detected in Unloading Area Soil
GMA RIR
Former Plum Brook Ordnance Works, Sandusky, Ohio

COPEC - Chemical of potential ecological concern
ESV - Ecological screening value
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.
mg/kg - milligrams per kilogram
UCL - Upper confidence limit
VQ - Validation qualifier
GMA - Garage Maintenance Area.
RIR - Remedial investigation report.

[a] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas*** , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] ESVs and their sources are presented in the full SLERA (Appendix I)
[c] N = Chemical is not chosen as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
(d) = statistical test shows background and site data are not different with 95% confidence
(e) = infrequently detected (fewer than 5 percent of all samples)
[d] Y = Chemical is chosen as COPEC.
[e] 95% UCL determined using ProUCL Version 4.1 (EPA, 2011, *ProUCL Version 4.1.01* , Technical Support Center, Office of Science Policy, Atlanta, Georgia, July, http://www.epa.gov/osp/hstl/tsc/software.htm).
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] The EPC for the COPEC at the 0-1 foot soil depth range is used as the exposure concentration for some ecological receptors.

FIGURES

FIGURE 1-1
PBOW VICINITY MAP

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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NOTES:

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

LEGEND:

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

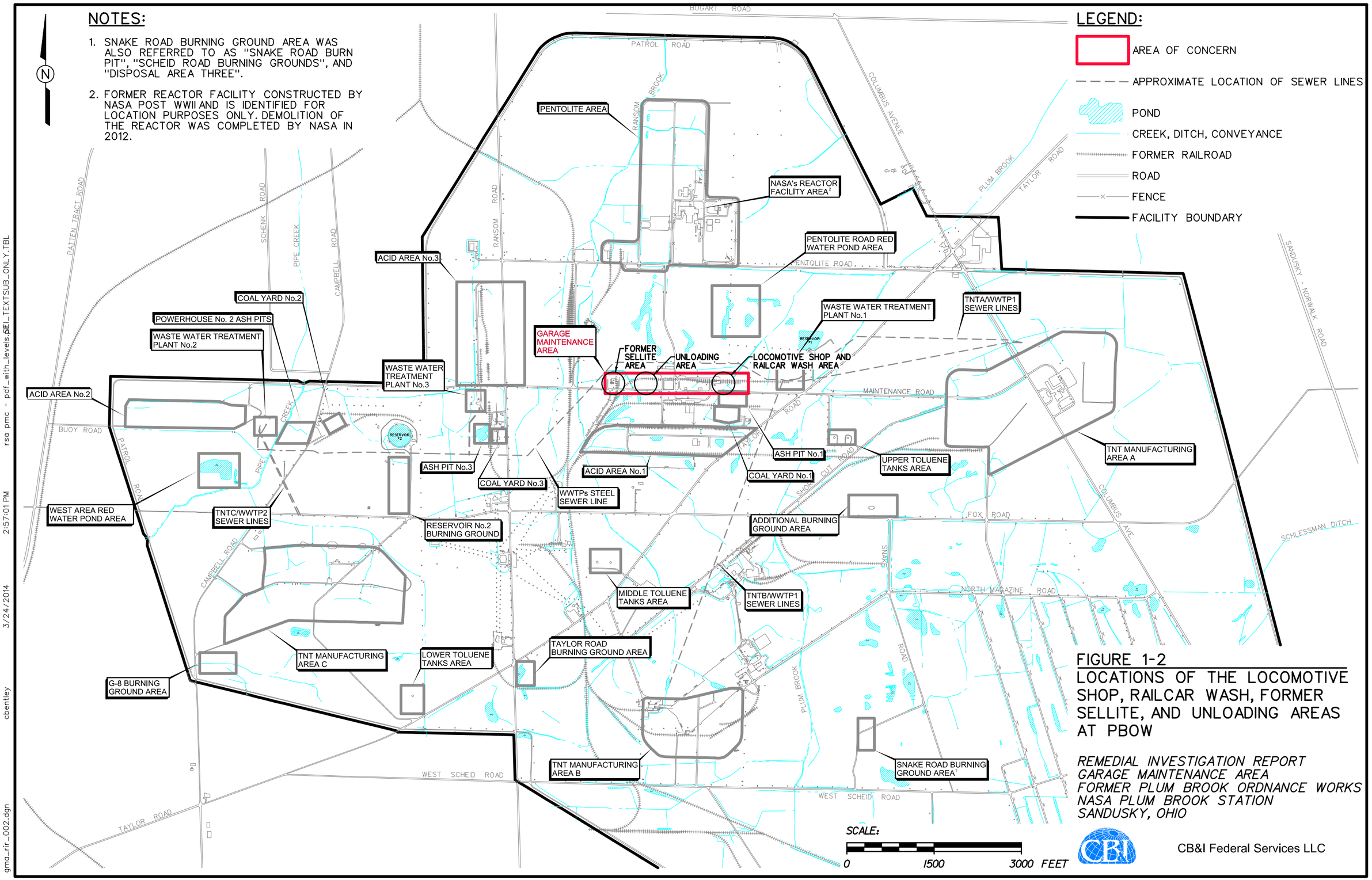

FIGURE 1-2
LOCATIONS OF THE LOCOMOTIVE SHOP, RAILCAR WASH, FORMER SELLITE, AND UNLOADING AREAS AT PBOW

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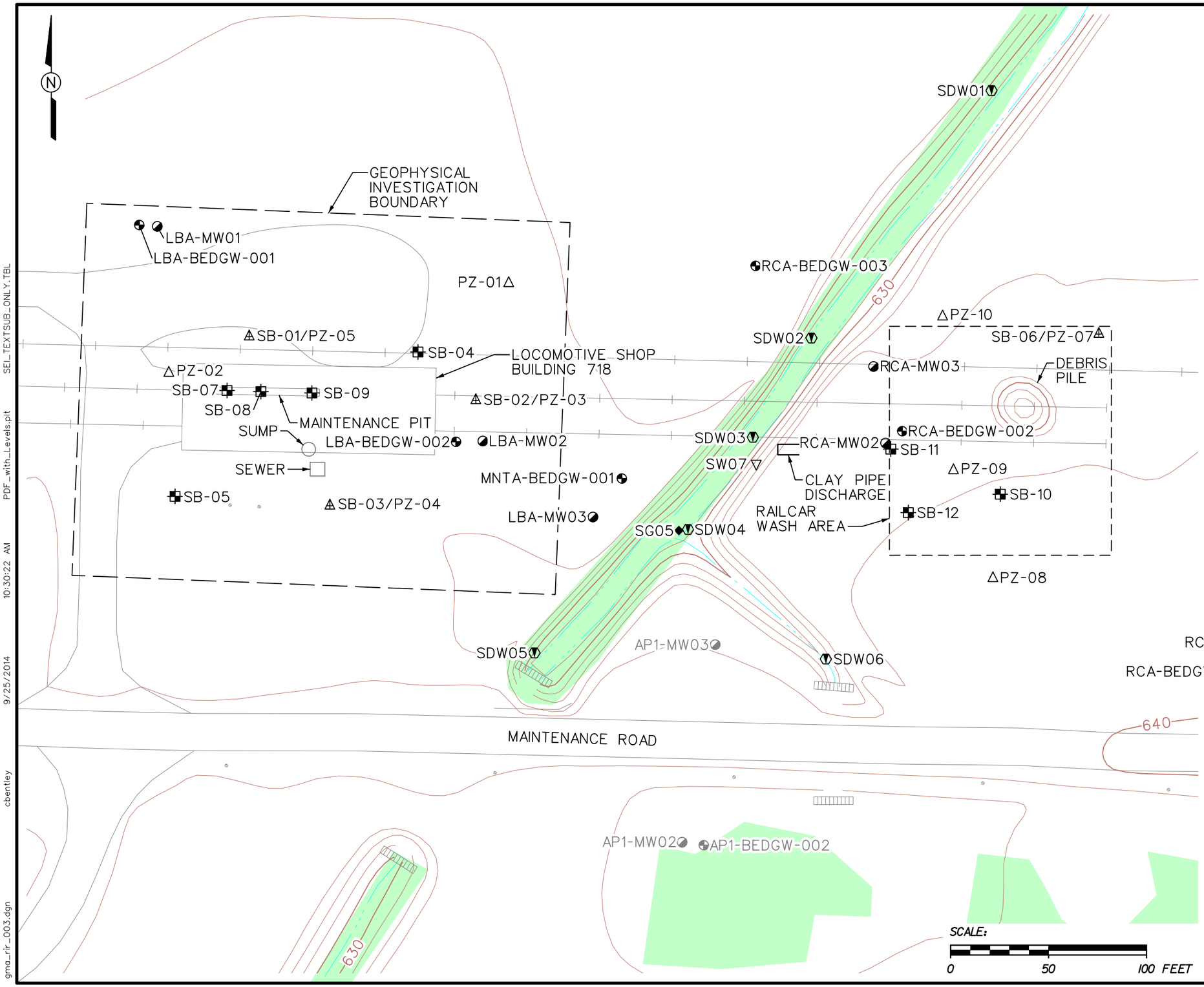

LEGEND:

- OVERBURDEN MONITORING WELL (SCREENED IN SHALE)
- BEDROCK MONITORING WELL (SCREENED IN LIMESTONE)
- SOIL BORING
- PIEZOMETER
- SOIL BORING/PIEZOMETER
- SURFACE WATER SAMPLE
- SURFACE WATER/SEDIMENT SAMPLE
- STAFF GAUGE
- TOPOGRAPHIC CONTOUR (2 FT. INTERVAL)
- CREEK, DITCH, CONVEYANCE
- WETLAND AREA (ENVIROSCIENCE, 2012) (NOTE 1)
- FORMER RAILROAD
- UTILITY POLE

NOTES:

1. WETLANDS AT PLUM BROOK HAVE BEEN FORMALLY DELINEATED BUT ARE CURRENTLY NOT JURISDICTIONAL. SEE TEXT FOR DETAILS.

FIGURE 3-1

GENERAL SITE FEATURES OF THE LOCOMOTIVE SHOP AND RAILCAR WASH AREAS WITH SITE TOPOGRAPHY AND SAMPLING LOCATIONS

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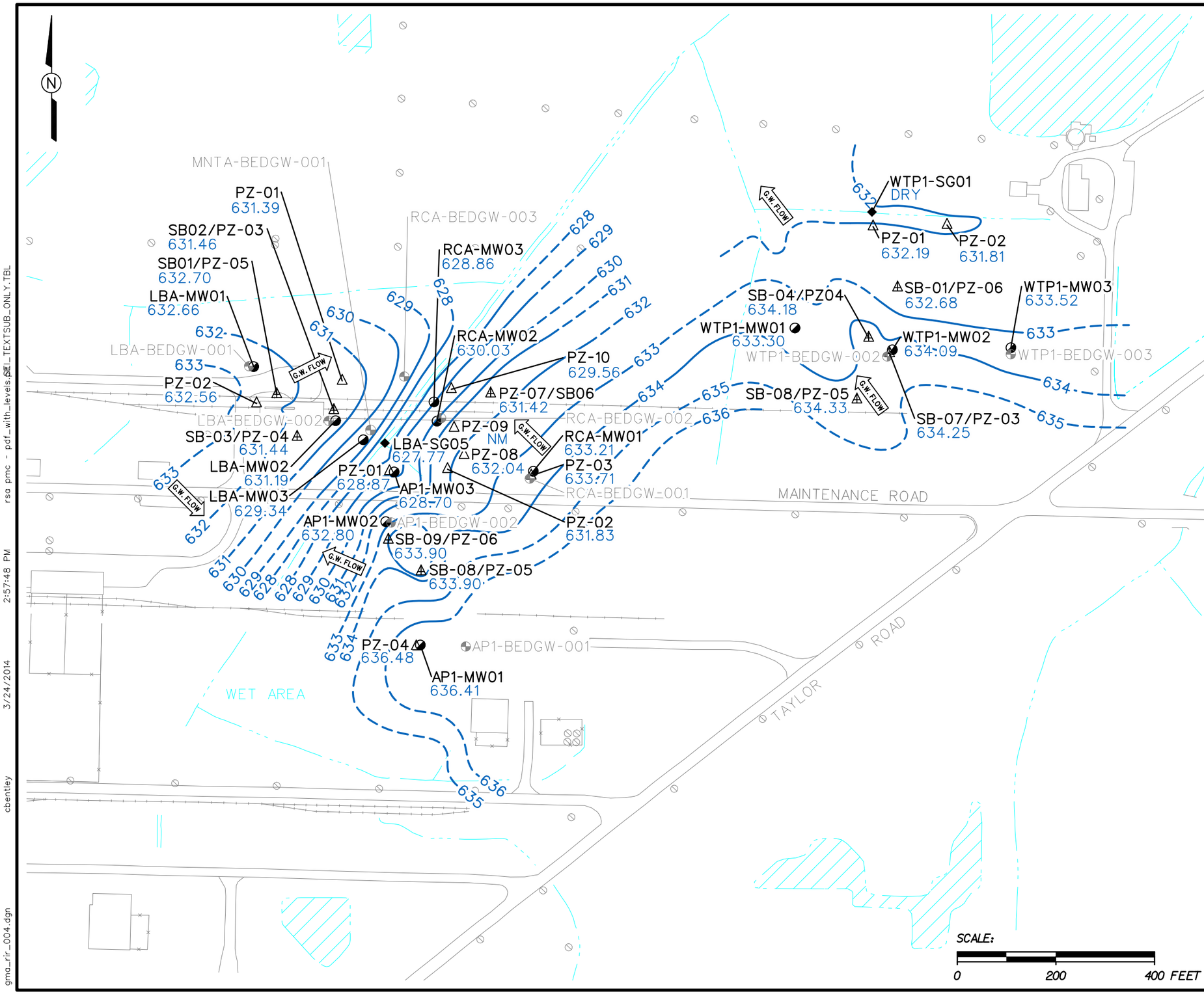

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- DELAWARE LIMESTONE MONITORING WELL
- PIEZOMETER
- SOIL BORING/PIEZOMETER
- STREAM STAFF GUAGE
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FENCE
- 628.85 GROUNDWATER ELEVATION (FT. MSL)
- —635— GROUNDWATER ELEVATION CONTOUR (FT. MSL) (DASHED WHERE INFERRED)
- G.W. FLOW GROUNDWATER FLOW DIRECTION
- NM NOT MEASURED

SCALE:

0 200 400 FEET

FIGURE 3-2
OVERBURDEN/SHALE
GROUNDWATER ELEVATION
CONTOUR MAP
(MAY 26, 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
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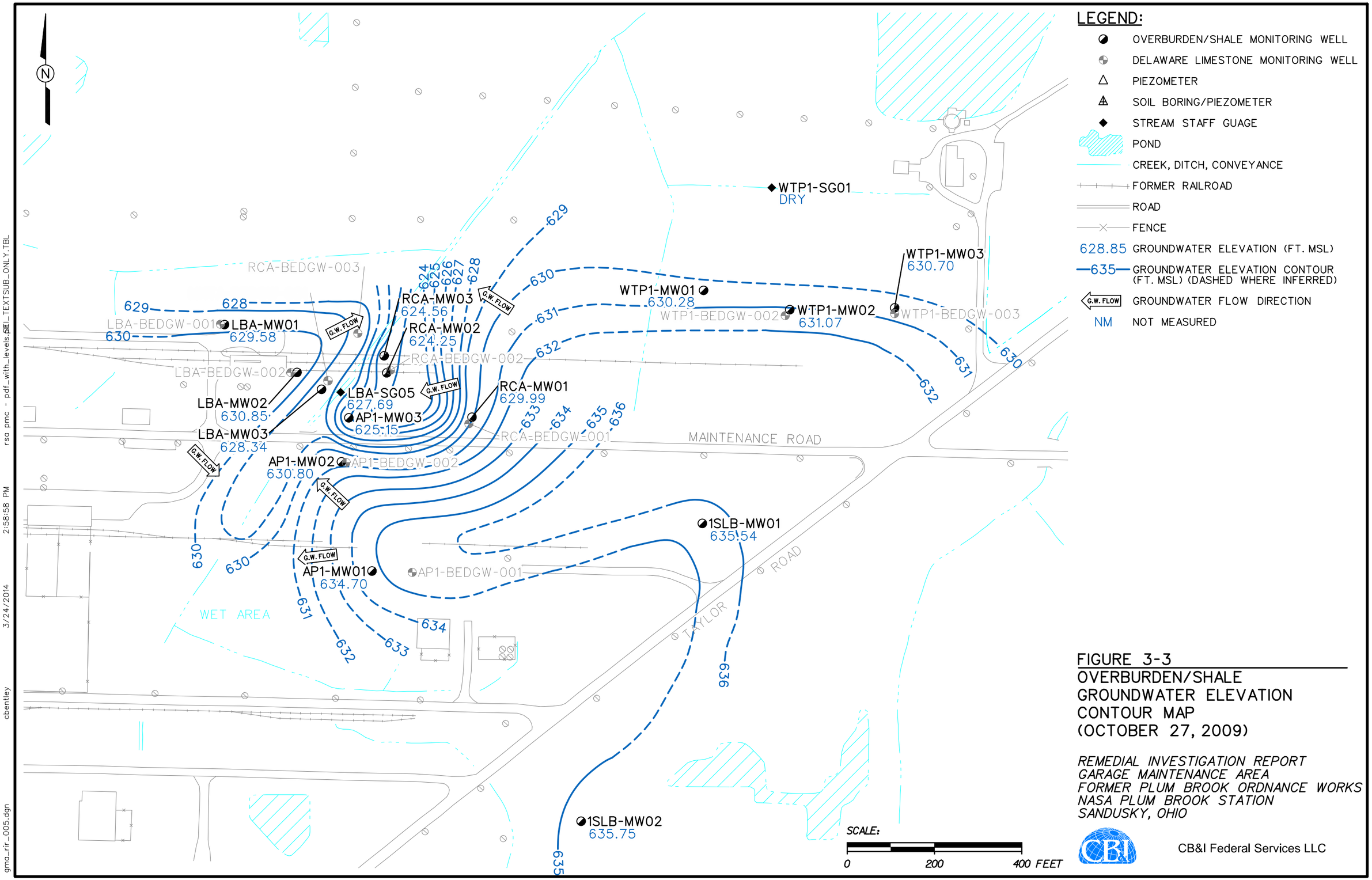

FIGURE 3-3
OVERBURDEN/SHALE
GROUNDWATER ELEVATION
CONTOUR MAP
(OCTOBER 27, 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
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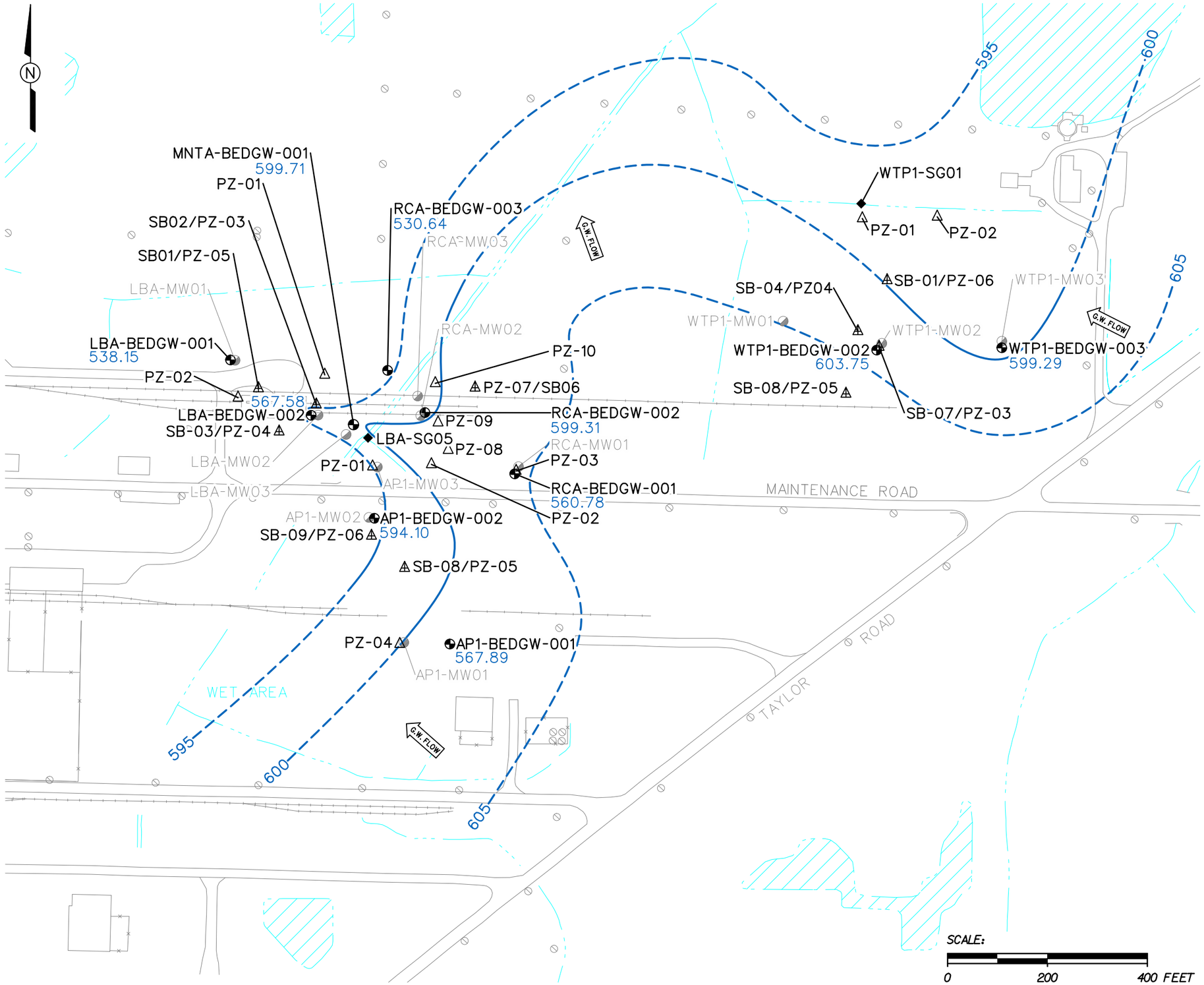

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- DELAWARE LIMESTONE MONITORING WELL
- PIEZOMETER
- SOIL BORING/PIEZOMETER
- STREAM STAFF GUAGE
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FENCE
- 603.75 GROUNDWATER ELEVATION (FT. MSL)
- 600 GROUNDWATER ELEVATION CONTOUR (FT. MSL) (DASHED WHERE INFERRED)
- G.W. FLOW GROUNDWATER FLOW DIRECTION

NOTES:

1. GROUNDWATER ELEVATIONS OF LBA-BEDGW-001, LBA-BEDGW-002, RCA-BEDGW-001, AP1-BEDGW-001, AND RCA-BEDGW-003 NOT USED DUE TO POSSIBLE LOW-PRODUCING BEDROCK FRACTURE CAUSING VARIABLE GROUNDWATER ELEVATIONS, SCREENED WITHIN A DIFFERENT FRACTURE NETWORK, OR NON-STATIC WATER LEVELS CAUSED BY RECENT NEARBY CORE DRILLING ACTIVITIES.

SCALE:
0 200 400 FEET

FIGURE 3-4
DELAWARE LIMESTONE GROUNDWATER ELEVATION CONTOUR MAP (MAY 26, 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
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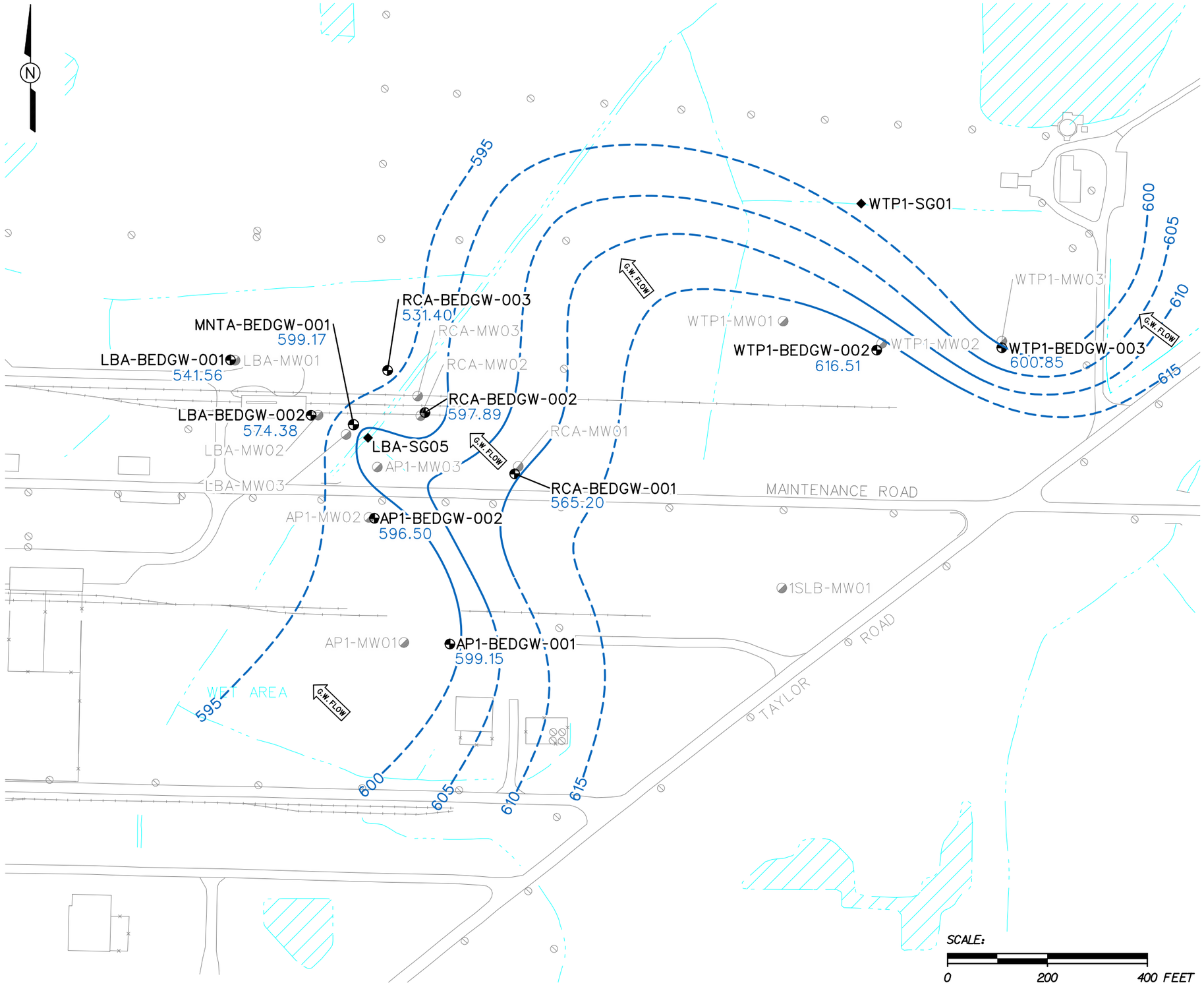

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- DELAWARE LIMESTONE MONITORING WELL
- PIEZOMETER
- SOIL BORING/PIEZOMETER
- STREAM STAFF GUAGE
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FENCE
- 600.85 GROUNDWATER ELEVATION (FT. MSL)
- 600 GROUNDWATER ELEVATION CONTOUR (FT. MSL) (DASHED WHERE INFERRED)
- G.W. FLOW GROUNDWATER FLOW DIRECTION

NOTES:

1. GROUNDWATER ELEVATIONS OF LBA-BEDGW-001, LBA-BEDGW-002, RCA-BEDGW-001, AND RCA-BEDGW-003 NOT USED DUE TO POSSIBLE LOW-PRODUCING BEDROCK FRACTURE CAUSING VARIABLE GROUNDWATER ELEVATIONS OR SCREENED WITHIN A DIFFERENT FRACTURE NETWORK.

SCALE:

0 200 400 FEET

FIGURE 3-5
DELAWARE LIMESTONE GROUNDWATER ELEVATION CONTOUR MAP (OCTOBER 27, 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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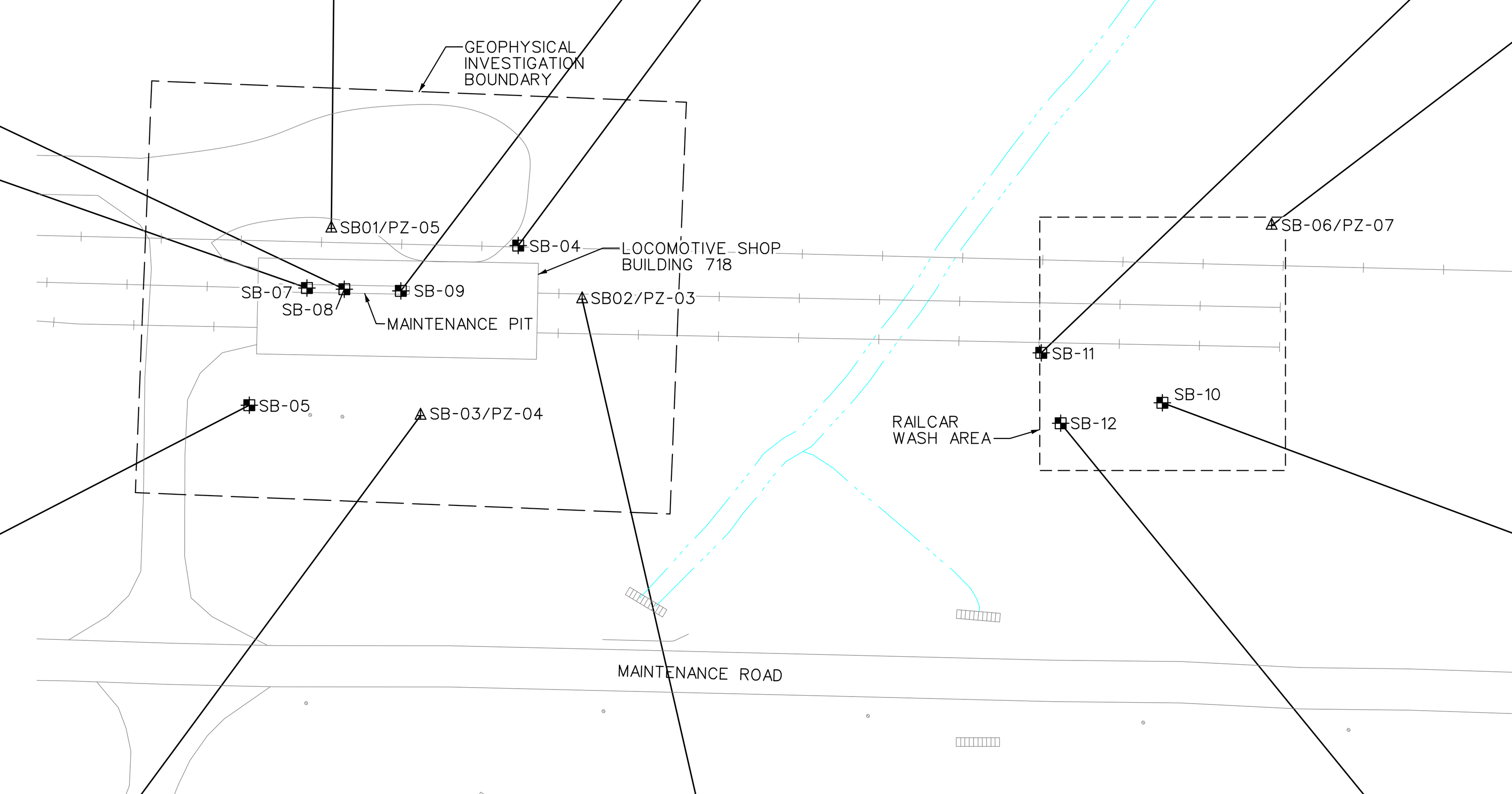


LOCATION CODE					LBA-SB01					
SAMPLE NO					LBA0001		LBA0002		LBA0003	
SAMPLE DATE					20-Jan-09		20-Jan-09		20-Jan-09	
DEPTH					0 - 1 Ft		3 - 5 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
VOLATILES										
Acetone	mg/kg	6,100	NE	0.339	0.0367	J	-	-	0.0305	J
Benzene	mg/kg	1.1	NE	0.0038	-	-	0.00217	J	0.00121	J
Butanone, 2-	mg/kg	2,800	NE	0.0147	-	-	-	-	0.00573	J
Carbon disulfide	mg/kg	82	NE	0.0074	-	-	-	-	0.000988	J
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	0.0254	J	-	-
Dichloroethene, 1,1-	mg/kg	24	NE	0.0056	-	-	0.00301	J	-	-
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.0099	-	-	0.0032	J	-	-
Naphthalene	mg/kg	3.6	NE	0.0035	-	-	0.00346	J	-	-
Toluene	mg/kg	500	NE	0.006	-	-	0.00312	J	0.00186	J
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	1.21	J	-	-
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	0.0624	J	-	-
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.0018	-	-	-	-	0.000988	J
SEMIVOLATILES										
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.0426	J	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	0.0395	J	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.26	0.0616	J	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	0.0627	J	-	-	-	-
METALS										
Aluminum	mg/kg	7,700	15,500	12000	4,400		7,580		9,330	
Antimony	mg/kg	3.1	9.3	1.46	0.386	J	0.722		0.375	J
Arsenic	mg/kg	0.39	36.5	15.3	4.5	J	10.1	J	4.78	J
Barium	mg/kg	1,500	826	218	16.3		33.6		61.3	
Beryllium	mg/kg	16	1	9.26	5.22	J	5.15	J	6.74	J
Cadmium	mg/kg	7	NE	0.819	-	-	0.513	J	0.263	J
Calcium	mg/kg	NE	52,300	288000	1,180		74,000		49,300	J
Chromium	mg/kg	0.29	29	19	10.4		11.1		13.6	
Cobalt	mg/kg	2.3	116	53.8	3.52		8.81		10.3	J
Copper	mg/kg	310	56.2	31.6	6.54		27		29.2	J
Iron	mg/kg	5,500	234,000	33900	15,000	J	16,600	J	21,500	
Lead	mg/kg	400	48.6	103	5.29		23		13	
Magnesium	mg/kg	NE	10,400	29600	796	J	16,800	J	18,600	J
Manganese	mg/kg	180	3,506	3000	198	J	384	J	548	J
Mercury	mg/kg	2.3	0.09	0.158	0.0198	J	0.0159	J	0.157	J
Nickel	mg/kg	150	55.1	43.5	9.01	J	22	J	27.1	J
Potassium	mg/kg	NE	3,390	1720	201		934		1,230	
Sodium	mg/kg	NE	NE	262	41.4		113		130	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.654		0.31	J
Vanadium	mg/kg	39	40.9	28.2	26.5		18.8		22.9	
Zinc	mg/kg	2,300	321.75	113	26		60		66.7	

LOCATION CODE					LBA-SB08	
SAMPLE NO					LBA0024	
SAMPLE DATE					20-Jan-09	
DEPTH					3 - 4.9 Ft	
SAMPLE PURPOSE					REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
SEMIVOLATILES						
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.18	J
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	0.74	J
Chrysene	mg/kg	15	NE	0.784	0.271	J
Fluoranthene	mg/kg	230	NE	1.26	0.23	J
Pyrene	mg/kg	170	NE	1.13	0.221	J
METALS						
Aluminum	mg/kg	7,700	15,500	12000	7,740	
Antimony	mg/kg	3.1	9.3	1.46	1.46	J
Arsenic	mg/kg	0.39	36.5	15.3	1.44	J
Barium	mg/kg	1,500	826	218	94.3	
Beryllium	mg/kg	16	1	9.26	1.15	J
Cadmium	mg/kg	7	NE	0.819	0.264	J
Calcium	mg/kg	NE	52,300	288000	288,000	J
Chromium	mg/kg	0.29	29	19	9.62	
Cobalt	mg/kg	2.3	116	53.8	1.65	J
Copper	mg/kg	310	56.2	31.6	10.4	J
Iron	mg/kg	5,500	234,000	33900	5,390	
Lead	mg/kg	400	48.6	103	10.8	
Magnesium	mg/kg	NE	10,400	29600	28,500	J
Manganese	mg/kg	180	3,506	3000	965	J
Mercury	mg/kg	2.3	0.09	0.158	0.00931	J
Nickel	mg/kg	150	55.1	43.5	5.58	J
Potassium	mg/kg	NE	3,390	1720	411	
Silver	mg/kg	39	11.1	2.25	1.01	
Sodium	mg/kg	NE	NE	262	223	
Vanadium	mg/kg	39	40.9	28.2	6.6	
Zinc	mg/kg	2,300	321.75	113	44.7	

LOCATION CODE					LBA-SB07	
SAMPLE NO					LBA0023	
SAMPLE DATE					20-Jan-09	
DEPTH					3 - 4.1 Ft	
SAMPLE PURPOSE					REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
SEMIVOLATILES						
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.163	J
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	0.327	J
Chrysene	mg/kg	15	NE	0.784	0.251	J
Fluoranthene	mg/kg	230	NE	1.26	0.171	J
Pyrene	mg/kg	170	NE	1.13	0.213	J
METALS						
Aluminum	mg/kg	7,700	15,500	12000	9,160	
Antimony	mg/kg	3.1	9.3	1.46	0.288	J
Arsenic	mg/kg	0.39	36.5	15.3	1.38	J
Barium	mg/kg	1,500	826	218	120	
Beryllium	mg/kg	16	1	9.26	1.2	J
Calcium	mg/kg	NE	52,300	288000	288,000	J
Chromium	mg/kg	0.29	29	19	6.31	
Cobalt	mg/kg	2.3	116	53.8	1.74	J
Copper	mg/kg	310	56.2	31.6	9.11	J
Iron	mg/kg	5,500	234,000	33900	4,920	
Lead	mg/kg	400	48.6	103	7.71	
Magnesium	mg/kg	NE	10,400	29600	23,500	J
Manganese	mg/kg	180	3,506	3000	1,050	J
Mercury	mg/kg	2.3	0.09	0.158	0.0159	J
Nickel	mg/kg	150	55.1	43.5	5.06	J
Potassium	mg/kg	NE	3,390	1720	462	
Silver	mg/kg	39	11.1	2.25	0.48	
Sodium	mg/kg	NE	NE	262	262	
Vanadium	mg/kg	39	40.9	28.2	6.31	
Zinc	mg/kg	2,300	321.75	113	33.9	

LOCATION CODE					LBA-SB05					
SAMPLE NO					LBA0015		LBA0016		LBA0017	
SAMPLE DATE					19-Jan-09		20-Jan-09		20-Jan-09	
DEPTH					0 - 1 Ft		3 - 5 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
VOLATILES										
Acetone	mg/kg	6,100	NE	0.339	0.112	J	-	-	0.021	J
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0113	J	-	-	-	-
Carbon disulfide	mg/kg	82	NE	0.0074	-	-	-	-	0.00307	J
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	0.00427	J	0.0345	J
Dichloroethene, 1,1-	mg/kg	24	NE	0.0056	-	-	-	-	0.00563	J
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	0.00538	J	0.0132		0.324	J
METALS										
Aluminum	mg/kg	7,700	15,500	12000	8,260		11,000		6,920	
Antimony	mg/kg	3.1	9.3	1.46	-	-	0.684		0.403	J
Arsenic	mg/kg	0.39	36.5	15.3	5.97	J	11.6	J	7.92	J
Barium	mg/kg	1,500	826	218	60.1		61.3		64.4	
Beryllium	mg/kg	16	1	9.26	5.36	J	8.55	J	5.69	J
Cadmium	mg/kg	7	NE	0.819	0.253	J	0.305	J	-	-
Calcium	mg/kg	NE	52,300	288000	5,520		3,050		51,200	J
Chromium	mg/kg	0.29	29	19	12.4		18.5		11	
Cobalt	mg/kg	2.3	116	53.8	4.21		10.1		8.37	J
Copper	mg/kg	310	56.2	31.6	18.7		30.1		26.8	J
Iron	mg/kg	5,500	234,000	33900	14,300	J	31,600	J	18,100	
Lead	mg/kg	400	48.6	103	12.2		15.9		12.4	
Magnesium	mg/kg	NE	10,400	29600	1,680	J	3,940	J	18,500	J
Manganese	mg/kg	180	3,506	3000	201	J	539	J	514	J
Mercury	mg/kg	2.3	0.09	0.158	0.0353		0.0238		-	-
Nickel	mg/kg	150	55.1	43.5	14.5	J	32.3	J	22.3	J
Potassium	mg/kg	NE	3,390	1720	481		1,020		823	
Sodium	mg/kg	NE	NE	262	41.7		55.4		100	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.402	J	0.269	J
Vanadium	mg/kg	39	40.9	28.2	21.6		27.6		19	
Zinc	mg/kg	2,300	321.75	113	48.1		81.4		57.2	

LOCATION CODE					LBA-SB09	
SAMPLE NO					LBA0025	
SAMPLE DATE					20-Jan-09	
DEPTH					3 - 4.2 Ft	
SAMPLE PURPOSE					REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
SEMIVOLATILES						
Acenaphthylene	mg/kg	NE	NE	0.224	0.195	J
Anthracene	mg/kg	1,700	NE	0.381	0.257	J
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.651	J
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	0.498	J
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	1.01	J
Bis(2-ethylhexyl)phthalate	mg/kg	35	NE	0.74	0.241	J
Chrysene	mg/kg	15	NE	0.784	0.719	J
Fluoranthene	mg/kg	230	NE	1.26	1.02	J
Phenanthrene	mg/kg	NE	NE	0.843	0.202	J
Pyrene	mg/kg	170	NE	1.13	0.91	J
METALS						
Aluminum	mg/kg	7,700	15,500	12000	2,200	
Antimony	mg/kg	3.1	9.3	1.46	1.24	J
Arsenic	mg/kg	0.39	36.5	15.3	3.41	J
Barium	mg/kg	1,500	826	218	26.7	
Beryllium	mg/kg	16	1	9.26	1.14	J
Cadmium	mg/kg	7	NE	0.819	0.221	J
Calcium	mg/kg	NE	52,300	288000	240,000	J
Chromium	mg/kg	0.29	29	19	4.63	
Cobalt	mg/kg	2.3	116	53.8	2.13	J
Copper	mg/kg	310	56.2	31.6	11.4	J
Iron	mg/kg	5,500	234,000	33900	6,980	
Lead	mg/kg	400	48.6	103	12.9	
Magnesium	mg/kg	NE	10,400	29600	29,600	J
Manganese	mg/kg	180	3,506	3000	369	J
Mercury	mg/kg	2.3	0.09	0.158	0.017	J
Nickel	mg/kg	150	55.1	43.5	7.33	J
Potassium	mg/kg	NE	3,390	1720	305	
Silver	mg/kg	39	11.1	2.25	2.25	
Sodium	mg/kg	NE	NE	262	142	
Vanadium	mg/kg	39	40.9	28.2	7.96	
Zinc	mg/kg	2,300	321.75	113	16.3	

LOCATION CODE					LBA-SB04					
SAMPLE NO					LBA0012		LBA0013		LBA0014	
SAMPLE DATE					19-Jan-09		19-Jan-09		16-Jan-09	
DEPTH					_9 - 1_9 Ft		3_9 - 5_9 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES										
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	-	-	0.163	J	-	-
VOLATILES										
Acetone	mg/kg	6,100	NE	0.339	0.0303	J	0.0219	J	-	-
Benzene	mg/kg	1.1	NE	0.0038	-	-	-	-	0.00225	J
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	-	-	0.00263	J
Dichloroethene, cis-1,2-	mg/kg	78	NE	0.0099	-	-	-	-	0.00986	J
Toluene	mg/kg	500	NE	0.006	-	-	-	-	0.00338	J
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	-	-	0.115	
Trichloroethene	mg/kg	2.8	NE	0.121	-	-	-	-	0.121	
METALS										
Aluminum	mg/kg	7,700	15,500	12000	5,800		5,390		7,750	
Antimony	mg/kg	3.1	9.3	1.46	-	-	-	-	0.381	J
Arsenic	mg/kg	0.39	36.5	15.3	5.2	J	4.58	J	9.37	J
Barium	mg/kg	1,500	826	218	22.1		20.7		41.8	
Beryllium	mg/kg	16	1	9.26	5.24	J	5.21	J	5.94	J
Cadmium	mg/kg	7	NE	0.819	-	-	-	-	0.291	J
Calcium	mg/kg	NE	52,300	288000	1,620		2,250		51,800	J
Chromium	mg/kg	0.29	29	19	11.8		12		11.9	
Cobalt	mg/kg	2.3	116	53.8	4.82		4.35		7.58	J
Copper	mg/kg	310	56.2	31.6	8.81		8.67		26.1	J
Iron	mg/kg	5,500	234,000	33900	14,800	J	14,200	J	18,700	
Lead	mg/kg	400	48.6	103	6.88		7.39		15.4	
Magnesium	mg/kg	NE	10,400	29600	913	J	1,050	J	18,900	J
Manganese	mg/kg	180	3,506	3000	324	J	253	J	367	J
Mercury	mg/kg	2.3	0.09	0.158	0.0188	J	0.0118	J	0.0144	J
Nickel	mg/kg	150	55.1	43.5	11.8	J	11.1	J	21.6	J
Potassium	mg/kg	NE	3,390	1720	188		205		983	
Sodium	mg/kg	NE	NE	262	37.8		40		105	
Thallium	mg/kg	NE	1.3	0.678	-	-	-	-	0.34	J
Vanadium	mg/kg	39	40.9	28.2	27.5		25.5		19.2	
Zinc	mg/kg	2,300	321.75	113	30		30		55.8	

LOCATION CODE					LBA-SB11					
SAMPLE NO					LBA0031		LBA0032		LBA0033	
SAMPLE DATE					19-Jan-09		19-Jan-09		19-Jan-09	
DEPTH					0 - 1 Ft		3_9 - 5_9 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES										
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	0.527		-	-	-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	1.13		0.947		5.68	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	4.12	
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	22.7	
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	1.52	
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	11.8	
VOLATILES										
Acetone	mg/kg	6,100	NE	0.339	0.265	J	0.0388	J	0.0301	J
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0136	J	-	-	-	-
Toluene	mg/kg	500	NE	0.006	-	-	-	-	0.00324	J
SEMIVOLATILES										
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	1.29		0.866		5.82	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	0.204	J	0.129	J	2.49	
PCBs										
Aroclor 1260	mg/kg	0.22	NE	0.24	0.0629	J	0.061	J		
METALS										
Aluminum	mg/kg	7,700	15,500	12000	6,690		8,940		10,400	
Antimony	mg/kg	3.1	9.3	1.46	-	-	0.27	J	0.505	
Arsenic	mg/kg	0.39	36.5	15.3	8.54	J	11	J	5.19	J
Barium	mg/kg	1,500	826	218	55.2	J	154	J	62.4	J
Beryllium	mg/kg	16	1	9.26	6.88	J	8.88	J	6.78	J
Cadmium	mg/kg	7	NE	0.819	-	-	-	-	0.313	J
Calcium	mg/kg	NE	52,300	288000	1,970	J	1,460	J	37,600	J
Chromium	mg/kg	0.29	29	19	14.7	J	16.4	J	15.3	J
Cobalt	mg/kg	2.3	116	53.8	4.68	J	53.8	J	12.7	J
Copper	mg/kg	310	56.2	31.6	14.2		15.3		31.6	
Iron	mg/kg	5,500	234,000	33900	21,600		33,900		22,000	
Lead	mg/kg	400	48.6	103	10	J	12.9	J	15.4	J
Magnesium	mg/kg	NE	10,400	29600	1,070	J	1,530	J	15,600	J
Manganese	mg/kg	180	3,506	3000	115		3,000		796	
Mercury	mg/kg	2.3	0.09	0.158	0.026		0.0299		-	-
Nickel	mg/kg	150	55.1	43.5	14.3	J	38.2	J	33.2	J
Potassium	mg/kg	NE	3,390	1720	242		363		1,210	
Selenium	mg/kg	39	2	0.85	-	-	0.516	J	-	-
Sodium	mg/kg	NE	NE	262	18.8		29.2		87.7	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.294	J	0.336	J
Vanadium	mg/kg	39	40.9	28.2	25.7		28.2		23.7	
Zinc	mg/kg	2,300	321.75	113	69.9	J	113	J	74	

LOCATION CODE					LBA-SB06									
SAMPLE NO					LBA0018		LBA0019		LBA0020		LBA0021		LBA0022	
SAMPLE DATE					20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09	
DEPTH					0 - 1 Ft		3 - 5 Ft		8 - 10 Ft		8 - 10 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG		FD		FS	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES														
Acetone	mg/kg	6,100	NE	0.339	0.104	J	-	-	0.0151	J	0.0352	J	-	-
Benzene	mg/kg	1.1	NE	0.0038	-	-	0.00303	J	0.00254	J	-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.00827	J	-	-	-	-	0.00555	J	-	-
Toluene	mg/kg	500	NE	0.006	-	-	0.00576	J	0.0032	J	0.00123	J	-	-
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.0018	-	-	0.00178	J	-	-	-	-		
SEMIVOLATILES														
Acenaphthylene	mg/kg	NE	NE	0.224	0.224	J	-	-	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.381	0.381	J	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.652	J	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	0.395	J	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	0.878	J	-	-	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	0.784	J	-	-	-	-	-	-	-	-
Dibenzofuran	mg/kg	7.8	NE	0.461	0.461	J	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.26	1.26	J	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	1.66	1.66	J	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	3.6	NE	1.02	1.02	J	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	0.843	J	-	-	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	1.13	J	-	-	-	-	-	-	-	-
METALS														
Aluminum	mg/kg	7,700	15,500	12000	7,020		7,410		7,850		7,930		7,660	
Antimony	mg/kg	3.1	9.3	1.46	0.377	J	0.341	J	0.445	J	0.519	J	-	-
Arsenic	mg/kg	0.39	36.5	15.3	11.3	J	7.5	J	5.55	J	7.58	J	5	
Barium	mg/kg	1,500	826	218	68		46.1		42	J	107	J	54.5	
Beryllium	mg/kg	16	1	9.26	9.26	J	6.59	J	5.84	J	7.29	J	-	-
Cadmium	mg/kg	7	NE	0.819	0.338	J	0.254	J	0.32	J	0.408	J	-	-
Calcium	mg/kg	NE	52,300	288000	5,080		47,700	J	47,100	J	43,900	J	50,100	
Chromium	mg/kg	0.29	29	19	11.5		11.6		12.4		12.3		13.5	
Cobalt	mg/kg	2.3	116	53.8	9.09		9.71	J	7.78	J	14.5	J	8	
Copper	mg/kg	310	56.2	31.6	16.8		26.7	J	27	J	28.1	J	21.5	
Iron	mg/kg	5,500	234,000	33900	31,400	J	21,500		18,400		23,500		18,200	
Lead	mg/kg	400	48.6	103	18.3		11.4		13.6		14.5		8.4	
Magnesium	mg/kg	NE	10,400	29600	1,800	J	16,500	J	20,500	J	17,600	J	14,600	
Manganese	mg/kg	180	3,506	3000	519	J	417	J	315	J	798	J	351	J
Mercury	mg/kg	2.3	0.09	0.158	0.0456		0.014	J	0.0122	J	0.0148	J	-	-
Nickel	mg/kg	150	55.1	43.5	21.7	J	22.9	J	23	J	28.2	J	21.4	
Potassium	mg/kg	NE	3,390	1720	591		822		1,010		983		1,720	
Sodium	mg/kg	NE	NE	262	50.4		93.3		106		95.4		-	-
Thallium	mg/kg	NE	1.3	0.678	0.294	J	0.302	J	0.307	J	0.385	J	-	-
Vanadium	mg/kg	39	40.9	28.2	24.4		20.3		21.2		22.7		17.8	
Zinc	mg/kg	2,300	321.75	113	58.4		59		56.1		63.8		48.2	

LOCATION CODE					LBA-SB10									
SAMPLE NO					LBA0026		LBA0027		LBA0028		LBA0029		LBA0030	
SAMPLE DATE					19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09		19-Jan-09	
DEPTH					0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		3 - 4_4 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES														
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	-	-	-	-	-	-	-	-	0.378	
VOLATILES														
Acetone	mg/kg	6,100	NE	0.339	0.339	J	0.087	J	0.072		0.0524	J	0.0247	J
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0147	J	0.0078	J	-	-	-	-	-	-
Vinyl acetate	mg/kg	97	NE	0.002	-	-	0.00197	UJ			-	-	-	-
SEMIVOLATILES														
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	-	-	-	-	-	-	-	-	0.352	J
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	-	-	-	-	-	-	-	-	0.0771	J
Fluoranthene	mg/kg	230	NE	1.26	-	-	0.0401	J	-	-	-	-	-	-
METALS														
Aluminum	mg/kg	7,700	15,500	12000	7,210		5,830		7,240		7,180		12,000	
Antimony	mg/kg	3.1	9.3	1.46	0.573	J	0.247	J	-	-	0.317	J	0.814	
Arsenic	mg/kg	0.39	36.5	15.3	9.26	J	6.74	J	5.9		12.2	J	15.3	J
Barium	mg/kg	1,500	826	218	50.5	J	39.6	J	37.9		76.6	J	63.1	J
Beryllium	mg/kg	16	1	9.26	6.41	J	5.17	J	-	-	7.47	J	9.03	J
Cadmium	mg/kg	7	NE	0.819	0.492	J	0.261	J	-	-	0.486		0.671	
Calcium	mg/kg	NE	52,300	288000	4,380	J	3,220	J	3,000		3,980	J	7,120	J
Chromium	mg/kg	0.29	29	19	13.2	J	10.8	J	13.9		12.9	J	19	J
Cobalt	mg/kg	2.3	116	53.8	7.31	J	4.75	J	-	-	14.5	J	24.4	J
Copper	mg/kg	310	56.2	31.6	13.6		10.4		10.2		13.5		31.5	
Iron	mg/kg	5,500	234,000	33900	18,300		14,600		17,800		23,700		28,800	
Lead	mg/kg	400	48.6	103	16	J	11.9	J	9		10.9	J	21.7	J
Magnesium	mg/kg	NE	10,400	29600	1,650	J	1,220	J	1,410		1,530	J	5,500	J
Manganese	mg/kg	180	3,506	3000	281		187		160	J	726		1,140	
Mercury	mg/kg	2.3	0.09	0.158	0.0318		0.0266		-	-	0.0272		0.0167	J
Nickel	mg/kg	150	55.1	43.5	20.1	J	15.3	J	15.3		33.1	J	43.5	J
Potassium	mg/kg	NE	3,390	1720	374		293		-	-	320		1,030	
Selenium	mg/kg	39	2	0.85	-	-	-	-	0.61		-	-	-	-
Sodium	mg/kg	NE	NE	262	30.8		23.5		-	-	26.7		53.4	
Thallium	mg/kg	NE	1.3	0.678	0.558		-	-	-	-	-	-	0.678	
Vanadium	mg/kg	39	40.9	28.2	25.4		20.6		26.2		27.7		27.9	
Zinc	mg/kg	2,300	321.75	113	60.1	J	47.5	J	45.5		102	J	96.9	J

LOCATION CODE					LBA-SB03									
SAMPLE NO					LBA0007		LBA0008		LBA0009		LBA0010		LBA0011	
SAMPLE DATE					20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09		20-Jan-09	
DEPTH					0 - 1 Ft		0 - 1 Ft		0 - 1 Ft		2_5 - 3_2 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		FD		FS		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
VOLATILES														
Acetone	mg/kg	6,100	NE	0.339	0.133	J	0.08	J	0.1		-	-	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0129	J	0.0092	J	-	-	-	-	-	-
Carbon disulfide	mg/kg	82	NE	0.0074	0.00254	J	0.00735	J	-	-	-	-	-	-
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	-	-	-	-	-	-	0.0158	J
Toluene	mg/kg	500	NE	0.006	-	-	0.00104	J	-	-	-	-	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	-	-	0.00139	J	-	-	-	-	0.0928	
SEMIVOLATILES														
Acenaphthylene	mg/kg	NE	NE	0.224	-	-	0.0706	J	-	-	-	-	-	-
Anthracene	mg/kg	1,700	NE	0.381	-	-	0.0811	J	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.15	NE	0.652	0.0645	J	0.236	J	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.015	NE	0.498	0.054	J	0.187	J	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.15	NE	1.01	0.0996	J	0.284	J	-	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	NE	NE	0.106	-	-	0.106	J	-	-	-	-	-	-
Chrysene	mg/kg	15	NE	0.784	0.0808	J	0.232	J	-	-	-	-	-	-
Di-n-butyl phthalate	mg/kg	610	NE	0.059	0.059	J	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	1.26	0.141	J	0.455	J	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.13	-	-	0.13	J	-	-	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.843	0.072	J	0.161	J	-	-	-	-	-	-
Pyrene	mg/kg	170	NE	1.13	0.111	J	0.337	J	-	-	-	-	-	-
PCBs														
Aroclor 1260	mg/kg	0.22	NE	0.24	0.0798		0.104		0.24		-	-		
METALS														
Aluminum	mg/kg	7,700	15,500	12000	6,790		6,330		7,680		8,700		7,110	
Antimony	mg/kg	3.1	9.3	1.46	0.954		0.759		-	-	0.348	J	0.407	J
Arsenic	mg/kg	0.39	36.5	15.3	8.05	J	11.5	J	10.3		4.42	J	6.28	J
Barium	mg/kg	1,500	826	218	51.9	J	152	J	106		61.2		58.2	
Beryllium	mg/kg	16	1	9.26	5.73	J	8.07	J	-	-	6.18	J	5.32	J
Cadmium	mg/kg	7	NE	0.819	0.525		0.819		0.81		-	-	0.315	J
Calcium	mg/kg	NE	52,300	288000	4,600		4,500		4,840		2,970		53,500	J
Chromium	mg/kg	0.29	29	19	10.7		10.1		10.8		13.8		11.1	
Cobalt	mg/kg	2.3	116	53.8	6.14	J	33.2	J	16.9		6.63		8.91	J
Copper	mg/kg	310	56.2	31.6	14.2		13.8		17		11.8		27.5	J
Iron	mg/kg	5,500	234,000	33900	16,300	J	29,100	J	25,100		17,300	J	16,900	
Lead	mg/kg	400	48.6	103	103	J	39.9	J	28.6		9.31		14	
Magnesium	mg/kg	NE	10,400	29600	2,010	J	2,160	J	2,450		2,200	J	19,400	J
Manganese	mg/kg	180	3,506	3000	287	J	1,680	J	1,240	J	228	J	475	J
Mercury	mg/kg	2.3	0.09	0.158	0.042		0.0441		-	-	0.055		0.158	J
Nickel	mg/kg	150	55.1	43.5	14	J	25.1	J	29.8		20.3	J	23.5	J
Potassium	mg/kg	NE	3,390	1720	628		624		949		342		866	
Selenium	mg/kg	39	2	0.85	-	-	-	-	0.85		-	-	-	-
Sodium	mg/kg	NE	NE	262	34.6		45.8		-	-	52.9		110	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.308	J	-	-	-	-	0.327	J
Vanadium	mg/kg	39	40.9	28.2	20.1		22		17.1		20.9		18.3	
Zinc	mg/kg	2,300	321.75	113	67.6		71.8		58		60.5		56.4	

LOCATION CODE					LBA-SB02					
SAMPLE NO					LBA0004		LBA0005		LBA0006	
SAMPLE DATE					19-Jan-09		19-Jan-09		19-Jan-09	
DEPTH					0 - 1 Ft		3 - 5 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES										
Amino-2,6-dinitrotoluene, 4-	mg/kg	15	NE	0.53	0.324		0.53		-	-
Amino-4,6-dinitrotoluene, 2-	mg/kg	15	NE	0.438	0.294		0.438		-	-
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	0.153	J	0.321		1.37	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	4.12	-	-	-	-	0.842	J
Nitrotoluene, 2-	mg/kg	2.9	NE	22.7	-	-	-	-	2.34	
Nitrotoluene, 3-	mg/kg	0.61	NE	1.52	-	-	-	-	0.308	
Nitrotoluene, 4-	mg/kg	24	NE	11.8	-	-	-	-	0.707	
VOLATILES										
Acetone	mg/kg	6,100	NE	0.339	0.124	J	0.0297	J	0.0282	J
Benzene	mg/kg	1.1	NE	0.0038	-	-	0.00381	J	-	-
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.0103	J	-	-	-	-
Dichloroethane, 1,1-	mg/kg	3.3	NE	0.0345	-	-	0.00323	J	-	-
Dichloroethene, 1,1-	mg/kg	24	NE	0.0056	-	-	0.00254	J	-	-
Naphthalene	mg/kg	3.6	NE	0.0035	-	-	0.00151	J	-	-
Toluene	mg/kg	500	NE	0.006	-	-	0.00599	J	-	-
Trichloroethane, 1,1,1-	mg/kg	870	NE	1.21	0.0156	J	1.19		0.0309	
Trichloroethene	mg/kg	2.8	NE	0.121	0.00263	J	0.0487	J	0.0122	
Trimethylbenzene, 1,2,4-	mg/kg	6.2	NE	0.0018	-	-	0.00171	J	-	-
SEMIVOLATILES										
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	0.268	J	1.03		9.88	
Dinitrotoluene, 2,6-	mg/kg	0.71	NE	3.82	-	-	0.389	J	3.82	
METALS										
Aluminum	mg/kg	7,700	15,500	12000	7,710		9,960		8,330	
Antimony	mg/kg	3.1	9.3	1.46	0.303	J	0.581		0.488	J
Arsenic	mg/kg	0.39	36.5	15.3	7.11	J	8.1	J	5.84	J
Barium	mg/kg	1,500	826	218	218		67.7		44.3	
Beryllium	mg/kg	16	1	9.26	6.24	J	7.39	J	5.35	J
Cadmium	mg/kg	7	NE	0.819	0.699		0.36	J	0.338	J
Calcium	mg/kg	NE	52,300	288000	8,530	J	3,360		43,000	J
Chromium	mg/kg	0.29	29	19	10.9		17		13.1	
Cobalt	mg/kg	2.3	116	53.8	16.5	J	8.62		8.88	J
Copper	mg/kg	310	56.2	31.6	17.5	J	23.9		27.4	J
Iron	mg/kg	5,500	234,000	33900	17,500		22,700	J	16,300	
Lead	mg/kg	400	48.6	103	14.7		15		15.1	
Magnesium	mg/kg	NE	10,400	29600	2,100	J	3,510	J	18,300	J
Manganese	mg/kg	180	3,506	3000	1,560	J	706	J	240	J
Mercury	mg/kg	2.3	0.09	0.158	0.0317		0.0198	J	-	-
Nickel	mg/kg	150	55.1	43.5	21.9	J	31.4	J	24.9	J
Potassium	mg/kg	NE	3,390	1720	285		748		1,020	
Sodium	mg/kg	NE	NE	262	24		45.7		96.4	
Thallium	mg/kg	NE	1.3	0.678	-	-	0.357	J	0.416	J
Vanadium	mg/kg	39	40.9	28.2	23.7		24.7		21.7	
Zinc	mg/kg	2,300	321.75	113	44.9		70.2		60.4	
GENERAL CHEMISTRY										
Total organic carbon	mg/kg	NE	NE	3040	3,040					

LOCATION CODE					LBA-SB12					
SAMPLE NO					LBA0034		LBA0035		LBA0036	
SAMPLE DATE					19-Jan-09		19-Jan-09		19-Jan-09	
DEPTH					0 - 1 Ft		3 - 3_9 Ft		8 - 10 Ft	
SAMPLE PURPOSE					REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES										
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	5.68	-	-	0.393		-	-
VOLATILES										
Acetone	mg/kg	6,100	NE	0.339	0.152	J	0.0464	J	0.0525	J
Butanone, 2-	mg/kg	2,800	NE	0.0147	0.00999	J	-	-	0.00791	J
SEMIVOLATILES										
Dinitrotoluene, 2,4-	mg/kg	0.71	NE	9.88	-	-	0.23	J	-	-
Fluoranthene	mg/kg	230	NE	1.26	0.0499	J	-	-	-	-
PCBs										
Aroclor 1221	mg/kg	0.14	NE	0.19	0.19		-	-		
METALS										
Aluminum	mg/kg	7,700	15,500	12000	5,950		7,140		11,800	
Antimony	mg/kg	3.1	9.3	1.46	0.25	J	-	-	0.306	J
Arsenic	mg/kg	0.39	36.5	15.3	8.68	J	6.83	J	6.6	J
Barium	mg/kg	1,500	826	218	93.8	J	74.4	J	58.6	J
Beryllium	mg/kg	16	1	9.26	6.74	J	7.02	J	7.35	J
Cadmium	mg/kg	7	NE	0.819	0.503		-	-	-	-
Calcium	mg/kg	NE	52,300	288000	3,650	J	1,320	J	32,200	J
Chromium	mg/kg	0.29	29	19	11.7	J	14.7	J	17.6	J
Cobalt	mg/kg	2.3	116	53.8	21.3	J	17.2	J	8.82	J
Copper	mg/kg	310	56.2	31.6	12		12.8		28.4	
Iron	mg/kg	5,500	234,000	33900	19,800		21,800		23,800	
Lead	mg/kg	400	48.6	103	12.9	J	9.64	J	12.3	J
Magnesium	mg/kg	NE	10,400	29600	1,360	J	1,240	J	10,900	J
Manganese	mg/kg	180	3,506	3000	1,160		493		556	
Mercury	mg/kg	2.3	0.09	0.158	0.0309		0.0287		0.0135	J
Nickel	mg/kg	150	55.1	43.5	22.6	J	23.6	J	29.1	J
Potassium	mg/kg	NE	3,390	1720	433		264		1,320	
Sodium	mg/kg	NE	NE	262	26.9		27.8		91.4	
Thallium	mg/kg	NE	1.3	0.678	-	-	-	-	0.39	J
Vanadium	mg/kg	39	40.9	28.2	23.5		22.5		24.3	
Zinc	mg/kg	2,300	321.75	113	64.5	J	80.1	J	72.4	J

LEGEND:

- SOIL BORING
- SOIL BORING/PIEZOMETER
- mg/kg MILLIGRAM PER KILOGRAM
- NE NOT ESTABLISHED (RBSCs), NOT EVALUATED (BSCs)
- \- NOT DETECTED

NOTES:

1. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
2. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
3. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT RESULTS IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
4. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
5. VALIDATION QUALIFIERS (VQ):
   J - THE COMPOUND/ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS AN ESTIMATED CONCENTRATION.

FIGURE 3-6
DETECTED CONSTITUENTS AT THE LOCOMOTIVE SHOP AND RAILCAR WASH AREAS IN SURFACE AND SUBSURFACE SOIL SAMPLES ABOVE RBSCs AND/OR BSCs (JANUARY AND FEBRUARY 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

SCALE: 0 50 100 FEET

CB&I Federal Services LLC

LEGEND:

- ▽ SURFACE WATER SAMPLE
- SURFACE WATER/SEDIMENT SAMPLE
- mg/kg MILLIGRAM PER KILOGRAM
- NE NOT ESTABLISHED (RBSCs)
- \- NOT DETECTED

NOTES:

1. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
2. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT RESULTS IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
3. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
4. VALIDATION QUALIFIERS (VQ):
   - J- THE COMPOUND/ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS AN ESTIMATED CONCENTRATION.
   - B- THE ANALYTE WAS NOT DETECTED SIGNIFICANTLY ABOVE THE LEVELS FOUND IN THE ASSOCIATED METHOD BLANK OR FIELD BLANKS.

			LOCATION CODE	LBA-SW03					
			SAMPLE NO	LBA2002		LBA2003		LBA2004	
			SAMPLE DATE	21-May-09		21-May-09		21-May-09	
			DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
			SAMPLE PURPOSE	REG		FD		FS	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ
VOLATILES									
Dichloroethane, 1,1-	ug/L	24	0.45	0.26	J	0.45	J	-	-
Dichloroethene, cis-1	ug/L	370	0.24	0.22	J	0.24	J	-	-
Trichloroethane, 1,1,	ug/L	9,100	0.59	0.59	J	0.53	J	-	-
METALS									
Aluminum	ug/L	37,000	23,800	1,990		1,540		1,720	
Barium	ug/L	7,300	155	64.5	J	58.2	J	-	-
Chromium	ug/L	0.43	39.8	3.2	J	2.9	J	-	-
Cobalt	ug/L	11	16.3	2.4	J	2.3	J	-	-
Iron	ug/L	26,000	43,900	4,650		3,570		2,850	
Lead	ug/L	15	18	5	J	3.9	J	-	-
Manganese	ug/L	880	2,220	1,870		1,560		1,170	
Nickel	ug/L	730	71.6	7.9	J	6.4	J	-	-
Selenium	ug/L	180	4.4	3.4	J	3.8	J	-	-
Vanadium	ug/L	180	46.1	5	J	4.3	J	-	-
Zinc	ug/L	11,000	177	35		30.2		21.2	

			LOCATION CODE	LBA-SD03	
			SAMPLE NO	LBA1002	
			SAMPLE DATE	21-May-09	
			DEPTH	0 - _5 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Aluminum	mg/kg	77,000	10900	7,780	J
Arsenic	mg/kg	3.9	17.8	8.3	J
Barium	mg/kg	15,000	156	58.8	J
Beryllium	mg/kg	160	0.96	0.67	J
Cadmium	mg/kg	70	1.9	0.46	J
Chromium	mg/kg	2.9	18.8	13.5	J
Cobalt	mg/kg	23	26	11.8	J
Copper	mg/kg	3,100	26.2	13.3	J
Iron	mg/kg	55,000	32200	18,700	J
Lead	mg/kg	400	17.9	9.5	J
Manganese	mg/kg	1,800	5360	828	J
Nickel	mg/kg	1,500	63.2	26.1	J
Selenium	mg/kg	390	3	1.7	J
Vanadium	mg/kg	390	27.7	21.9	J
Zinc	mg/kg	23,000	80.3	54.1	J

			LOCATION CODE	LBA-SW01	
			SAMPLE NO	LBA2000	
			SAMPLE DATE	20-May-09	
			DEPTH	0 - 0 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
VOLATILES					
Dichloroethane, 1,1-	ug/L	24	0.45	0.25	J
METALS					
Aluminum	ug/L	37,000	23,800	1,790	
Barium	ug/L	7,300	155	49.8	J
Chromium	ug/L	0.43	39.8	2.6	J
Iron	ug/L	26,000	43,900	2,570	
Lead	ug/L	15	18	2.6	J
Manganese	ug/L	880	2,220	554	
Nickel	ug/L	730	71.6	4.8	J
Vanadium	ug/L	180	46.1	5	J
Zinc	ug/L	11,000	177	19.7	J
GENERAL CHEMISTRY					
HARDNESS (as CaC	ug/L	NE	464,000	464,000	

			LOCATION CODE	LBA-SD01	
			SAMPLE NO	LBA1000	
			SAMPLE DATE	20-May-09	
			DEPTH	0 - _5 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
VOLATILES					
Methylene chloride	mg/kg	110	0.0582	0.0582	
METALS					
Aluminum	mg/kg	77,000	10900	6,300	
Arsenic	mg/kg	3.9	17.8	16	
Barium	mg/kg	15,000	156	75.7	
Beryllium	mg/kg	160	0.96	0.75	
Cadmium	mg/kg	70	1.9	1.9	
Chromium	mg/kg	2.9	18.8	10.4	
Cobalt	mg/kg	23	26	24.9	
Copper	mg/kg	3,100	26.2	13.5	
Iron	mg/kg	55,000	32200	21,000	
Lead	mg/kg	400	17.9	10.8	
Manganese	mg/kg	1,800	5360	5,360	
Mercury	mg/kg	23	0.031	0.025	J
Nickel	mg/kg	1,500	63.2	52.2	
Selenium	mg/kg	390	3	3	J
Thallium	mg/kg	NE	3.1	1.9	
Vanadium	mg/kg	390	27.7	22.2	
Zinc	mg/kg	23,000	80.3	80.3	

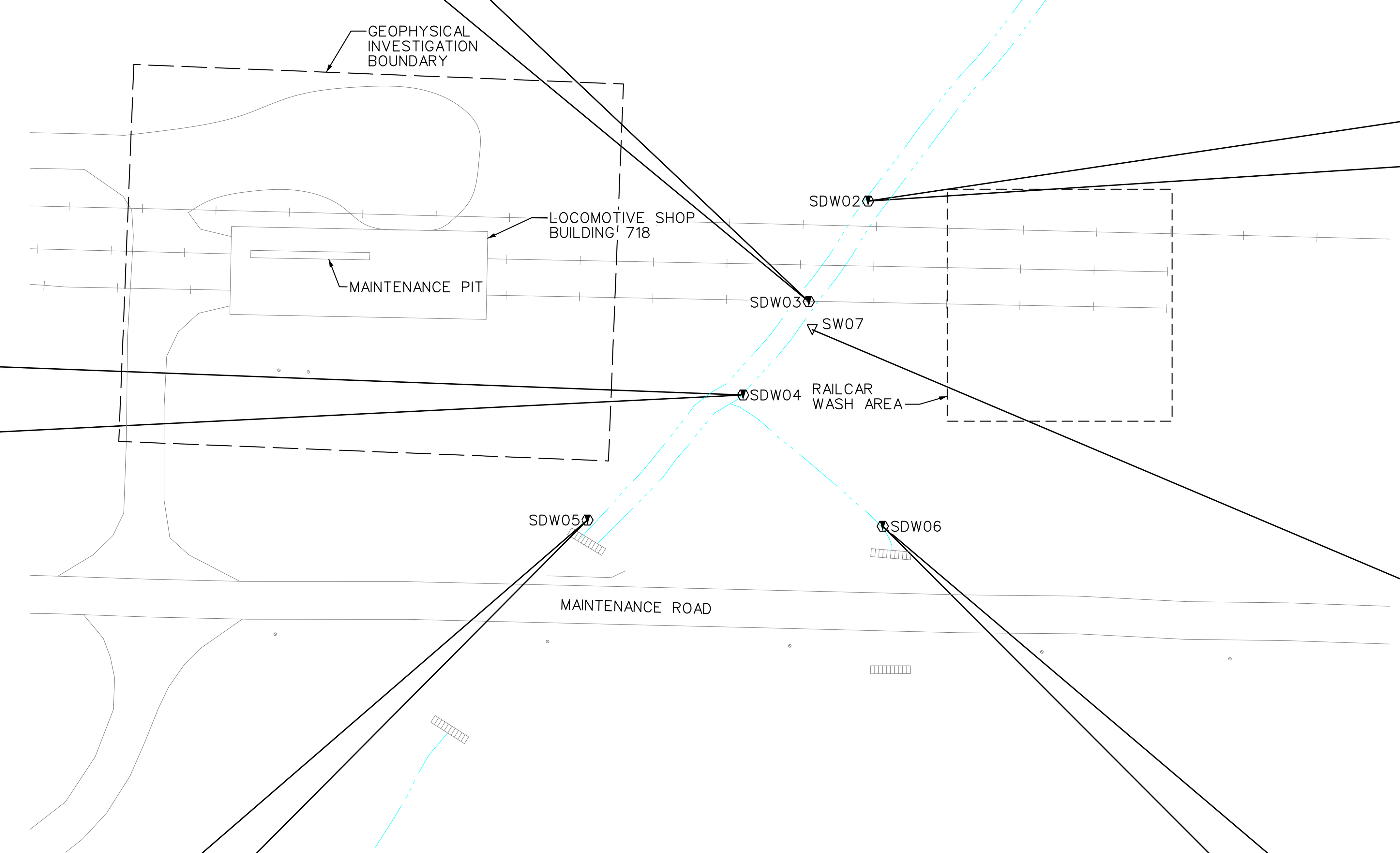
			LOCATION CODE	LBA-SW04	
			SAMPLE NO	LBA2005	
			SAMPLE DATE	21-May-09	
			DEPTH	0 - 0 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Aluminum	ug/L	37,000	23,800	2,460	
Barium	ug/L	7,300	155	62.6	J
Chromium	ug/L	0.43	39.8	4.1	J
Cobalt	ug/L	11	16.3	2.5	J
Iron	ug/L	26,000	43,900	4,920	
Lead	ug/L	15	18	4.3	J
Manganese	ug/L	880	2,220	1,050	
Nickel	ug/L	730	71.6	8.6	J
Vanadium	ug/L	180	46.1	5.7	J
Zinc	ug/L	11,000	177	31.1	

			LOCATION CODE	LBA-SW02	
			SAMPLE NO	LBA2001	
			SAMPLE DATE	21-May-09	
			DEPTH	0 - 0 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
VOLATILES					
Dichloroethane, 1,1-	ug/L	24	0.45	0.39	J
Trichloroethane, 1,1,	ug/L	9,100	0.59	0.47	J
METALS					
Aluminum	ug/L	37,000	23,800	1,660	
Barium	ug/L	7,300	155	101	J
Chromium	ug/L	0.43	39.8	2.8	J
Cobalt	ug/L	11	16.3	4.2	J
Iron	ug/L	26,000	43,900	4,020	
Lead	ug/L	15	18	3.2	J
Manganese	ug/L	880	2,220	1,760	
Nickel	ug/L	730	71.6	8.9	J
Vanadium	ug/L	180	46.1	4.5	J
Zinc	ug/L	11,000	177	32	

			LOCATION CODE	LBA-SD02	
			SAMPLE NO	LBA1001	
			SAMPLE DATE	21-May-09	
			DEPTH	0 - _5 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
VOLATILES					
Acetone	mg/kg	61,000	0.0921	0.0921	J
Methylene chloride	mg/kg	110	0.0582	0.0195	B
METALS					
Aluminum	mg/kg	77,000	10900	5,710	J
Arsenic	mg/kg	3.9	17.8	9.4	J
Barium	mg/kg	15,000	156	90.3	J
Beryllium	mg/kg	160	0.96	0.61	
Cadmium	mg/kg	70	1.9	0.46	
Chromium	mg/kg	2.9	18.8	10.7	J
Cobalt	mg/kg	23	26	17.5	J
Copper	mg/kg	3,100	26.2	10.5	J
Iron	mg/kg	55,000	32200	20,500	J
Lead	mg/kg	400	17.9	9	J
Manganese	mg/kg	1,800	5360	1,510	
Mercury	mg/kg	23	0.031	0.023	J
Nickel	mg/kg	1,500	63.2	26.6	J
Selenium	mg/kg	390	3	2.1	J
Thallium	mg/kg	NE	3.1	0.26	J
Vanadium	mg/kg	390	27.7	19.4	J
Zinc	mg/kg	23,000	80.3	52.4	J

			LOCATION CODE	LBA-SD04	
			SAMPLE NO	LBA1003	
			SAMPLE DATE	21-May-09	
			DEPTH	0 - _5 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Aluminum	mg/kg	77,000	10900	7,760	J
Arsenic	mg/kg	3.9	17.8	17.8	J
Barium	mg/kg	15,000	156	92.1	J
Beryllium	mg/kg	160	0.96	0.96	
Cadmium	mg/kg	70	1.9	0.97	
Chromium	mg/kg	2.9	18.8	13.4	J
Cobalt	mg/kg	23	26	26	J
Copper	mg/kg	3,100	26.2	22.2	J
Iron	mg/kg	55,000	32200	30,200	J
Lead	mg/kg	400	17.9	17.9	J
Manganese	mg/kg	1,800	5360	1,610	
Mercury	mg/kg	23	0.031	0.031	J
Nickel	mg/kg	1,500	63.2	39.8	J
Selenium	mg/kg	390	3	2.2	J
Vanadium	mg/kg	390	27.7	26.5	J
Zinc	mg/kg	23,000	80.3	73.9	J

			LOCATION CODE	LBA-SW07	
			SAMPLE NO	LBA2008	
			SAMPLE DATE	22-May-09	
			DEPTH	0 - 0 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Aluminum	ug/L	37,000	23,800	11.3	B
Barium	ug/L	7,300	155	41.6	J
Iron	ug/L	26,000	43,900	1,090	
Manganese	ug/L	880	2,220	381	



			LOCATION CODE	LBA-SW05	
			SAMPLE NO	LBA2006	
			SAMPLE DATE	22-May-09	
			DEPTH	0 - 0 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
VOLATILES					
Dichloroethane, 1,1-	ug/L	24	0.45	0.39	J
METALS					
Aluminum	ug/L	37,000	23,800	2,520	
Barium	ug/L	7,300	155	62.2	J
Chromium	ug/L	0.43	39.8	4.6	J
Cobalt	ug/L	11	16.3	3	J
Iron	ug/L	26,000	43,900	5,890	
Lead	ug/L	15	18	5.5	J
Manganese	ug/L	880	2,220	2,220	
Nickel	ug/L	730	71.6	8.7	J
Selenium	ug/L	180	4.4	3.5	J
Vanadium	ug/L	180	46.1	6.9	J
Zinc	ug/L	11,000	177	33.4	

			LOCATION CODE	LBA-SD05	
			SAMPLE NO	LBA1004	
			SAMPLE DATE	22-May-09	
			DEPTH	0 - _5 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Aluminum	mg/kg	77,000	10900	8,850	
Arsenic	mg/kg	3.9	17.8	9.5	
Barium	mg/kg	15,000	156	63.8	
Beryllium	mg/kg	160	0.96	0.68	
Cadmium	mg/kg	70	1.9	0.64	
Chromium	mg/kg	2.9	18.8	15.9	
Cobalt	mg/kg	23	26	10.8	
Copper	mg/kg	3,100	26.2	22.7	
Iron	mg/kg	55,000	32200	22,100	
Lead	mg/kg	400	17.9	11.5	
Manganese	mg/kg	1,800	5360	737	
Mercury	mg/kg	23	0.031	0.022	J
Nickel	mg/kg	1,500	63.2	26.6	
Selenium	mg/kg	390	3	1.7	J
Vanadium	mg/kg	390	27.7	24.5	
Zinc	mg/kg	23,000	80.3	55	

			LOCATION CODE	LBA-SD06					
			SAMPLE NO	LBA1005		LBA1006		LBA1007	
			SAMPLE DATE	22-May-09		22-May-09		22-May-09	
			DEPTH	0 - _5 Ft		0 - _5 Ft		0 - _5 Ft	
			SAMPLE PURPOSE	REG		FD		FS	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ
VOLATILES									
Carbon disulfide	mg/kg	820	0.0019	0.0019	J	-	-	-	-
SEMIVOLATILES									
Benzo(b)fluoranthene	mg/kg	1.5	0.0481	0.0481	J	0.0458	J	-	-
Fluoranthene	mg/kg	2,300	0.0934	0.0738	J	0.0934	J	-	-
Phenanthrene	mg/kg	NE	0.0546	-	-	0.0546	J	-	-
Pyrene	mg/kg	1,700	0.0694	0.0562	J	0.0694	J	-	-
METALS									
Aluminum	mg/kg	77,000	10900	10,700		9,900		10,900	
Arsenic	mg/kg	3.9	17.8	11.7		10.4		16.5	
Barium	mg/kg	15,000	156	70.7		81.6		156	
Beryllium	mg/kg	160	0.96	0.84		0.77		0.72	
Cadmium	mg/kg	70	1.9	0.56		0.56		-	-
Chromium	mg/kg	2.9	18.8	18.8		17.6		18.3	
Cobalt	mg/kg	23	26	11.3		11.7		24.6	
Copper	mg/kg	3,100	26.2	24.5		21		26.2	
Iron	mg/kg	55,000	32200	25,500		23,300		32,200	
Lead	mg/kg	400	17.9	10.4		10.5		17	
Manganese	mg/kg	1,800	5360	779		1,170		2,280	
Mercury	mg/kg	23	0.031	0.022	J	0.023	J	-	-
Nickel	mg/kg	1,500	63.2	33.8		34.2		63.2	
Selenium	mg/kg	390	3	1.9	J	1.8	J	-	-
Thallium	mg/kg	NE	3.1	-	-	-	-	3.1	
Vanadium	mg/kg	390	27.7	27		25.8		27.7	
Zinc	mg/kg	23,000	80.3	63		59.1		78.3	

			LOCATION CODE	LBA-SW06	
			SAMPLE NO	LBA2007	
			SAMPLE DATE	22-May-09	
			DEPTH	0 - 0 Ft	
			SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Aluminum	ug/L	37,000	23,800	23,800	
Arsenic	ug/L	0.45	8.8	8.8	J
Barium	ug/L	7,300	155	155	J
Beryllium	ug/L	73	1.1	1.1	J
Chromium	ug/L	0.43	39.8	39.8	
Cobalt	ug/L	11	16.3	16.3	J
Copper	ug/L	1,500	38.5	38.5	
Iron	ug/L	26,000	43,900	43,900	
Lead	ug/L	15	18	18	
Manganese	ug/L	880	2,220	662	
Nickel	ug/L	730	71.6	71.6	
Selenium	ug/L	180	4.4	4.4	J
Vanadium	ug/L	180	46.1	46.1	J
Zinc	ug/L	11,000	177	177	

SCALE: 0 50 100 FEET

FIGURE 3-7
DETECTED CONSTITUENTS AT THE LOCOMOTIVE SHOP AND RAILCAR WASH AREAS IN SURFACE WATER AND SEDIMENT SAMPLES ABOVE RBSCs (MAY 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

CB&I Federal Services LLC

LEGEND:

- OVERBURDEN MONITORING WELL (SCREENED IN SHALE)
- BEDROCK MONITORING WELL (SCREENED IN LIMESTONE)
- PIEZOMETER
- SOIL BORING/PIEZOMETER
- ug/L MICROGRAM PER LITER
- NE NOT ESTABLISHED (RBSCs), NOT EVALUATED (BSCs)
- \- NOT DETECTED

NOTES:

1. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
2. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
3. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT RESULTS IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
4. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
5. VALIDATION QUALIFIERS (VQ):
   J - THE COMPOUND/ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS AN ESTIMATED CONCENTRATION.
   B- THE ANALYTE WAS NOT DETECTED SIGNIFICANTLY ABOVE THE LEVELS FOUND IN THE ASSOCIATED METHOD BLANK OR FIELD BLANKS.

				LOCATION CODE	LBA-PZ05					
				SAMPLE NO	LBA3006		LBA3001		LBA3002	
				SAMPLE DATE	28-Jan-09		28-Jan-09		28-Jan-09	
				DEPTH	10.07 - 10.1 Ft		10.07 - 10.1 Ft		10.07 - 10.1 Ft	
				SAMPLE PURPOSE	REG		FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
VOLATILES										
Dichloroethane, 1,1-	ug/L	2.4	NE	10	0.81	J	0.79	J	-	-
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	1.06	J	0.96	J	2.2	
METALS-UNFILTERED										
Aluminum	ug/L	3,700	309	27500	**4,710**		**3,860**		**27,500**	
Arsenic	ug/L	0.045	7.4	42.7	**14.4**		**11.9**		**22.4**	
Barium	ug/L	730	11,800	323	114		107		255	
Beryllium	ug/L	7.3	NE	13.7	4.05	J	3.2	J	-	-
Cadmium	ug/L	1.8	NE	4.63	2.23	J	2.7	J	-	-
Chromium	ug/L	0.043	NE	39.1	6.35	J	-	-	39.1	
Cobalt	ug/L	1.1	12.1	18.6	6.12	J	5.01	J	-	-
Copper	ug/L	150	19.8	66	17.2		17.4		**54.3**	
Iron	ug/L	2,600	1,550	48900	**12,600**		**10,200**		**48,900**	
Lead	ug/L	15	NE	48.6	8.41		6.91		31.2	
Manganese	ug/L	88	636	1450	366		286		**1,240**	
Nickel	ug/L	73	8.6	58.2	7.86		4.98	J	**58.2**	
Vanadium	ug/L	18	NE	65.9	11.6		9.17		65.9	
Zinc	ug/L	1,100	507	141	38	J	31.9	J	141	
METALS-FILTERED										
Aluminum	ug/L	3,700	309	159	159		128		-	-
Arsenic	ug/L	0.045	7.4	28	1.99	J	**9.75**	J	-	-
Barium	ug/L	730	11,800	190	90.5		93.6		-	-
Iron	ug/L	2,600	1,550	446	446		382		132	
Manganese	ug/L	88	636	457	110		108		104	
WATER QUALITY PARAMETERS										
Alkalinity	ug/L	NE	NE	333000	172,000		119,000		230,000	
Chloride	ug/L	NE	NE	195000	6,980	J	6,550	J	6,300	J
Hardness	ug/L	NE	NE	1120000	359,000		317,000		680,000	
Nitrate-Nitrite	ug/L	NE	NE	900	26	J	-	-		
Sulfate	ug/L	NE	NE	282000	53,300	J	52,800	J	56,200	
Total dissolved solids	ug/L	NE	NE	951000	331,000	J	700,000	J	310,000	
Total suspended solids	ug/L	NE	NE	3860000	641,000		676,000		1,200,000	
Turbidity	NTU	NE	NE	866	403	J	375	J	64	

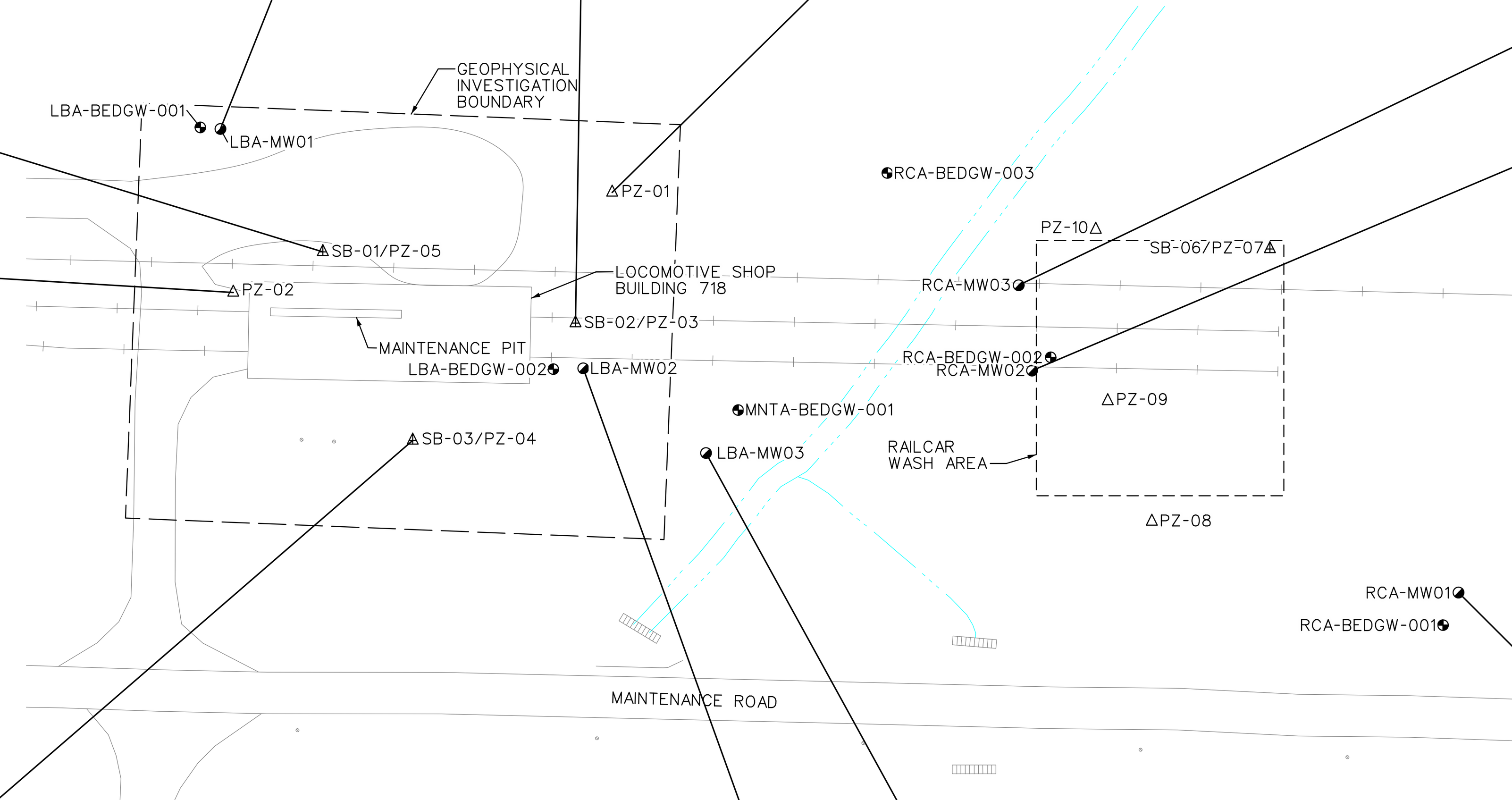
				LOCATION CODE	LBA-MW01			
				SAMPLE NO	LB3067		LB3075	
				SAMPLE DATE	12-May-09		4-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG	
				LOW-FLOW SAMPLED	No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
VOLATILES								
Dichloroethane, 1,1-	ug/L	2.4	NE	10	2.2		2	
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	1.3		-	-
METALS-UNFILTERED								
Aluminum	ug/L	3,700	309	27500	58.9	B	176	J
Barium	ug/L	730	11,800	323	73.5	J	61.7	J
Iron	ug/L	2,600	1,550	48900	242	J	684	
Manganese	ug/L	88	636	1450	436		458	
Nickel	ug/L	73	8.6	58.2	4.3	J	2.4	J
Selenium	ug/L	18	NE	6.3	6.3	J	4.9	J
METALS-FILTERED								
Barium	ug/L	730	11,800	190	66.9	J	56	J
Manganese	ug/L	88	636	457	457		135	
Nickel	ug/L	73	8.6	21.1	5	J	2.7	J
Selenium	ug/L	18	NE	5.9	5.9	J	-	-
Zinc	ug/L	1,100	507	15.5	-	-	14.5	J
WATER QUALITY PARAMETERS								
Alkalinity	ug/L	NE	NE	333000	299,000		285,000	
Chloride	ug/L	NE	NE	195000	105,000		171,000	
Cyanide, total	ug/L	73	NE	16	8.5	J	-	-
HARDNESS (as CaCO3)	ug/L	NE	NE	657000	657,000		600,000	
Nitrate-Nitrite	ug/L	NE	NE	900	-	-	110	
Sulfate	ug/L	NE	NE	282000	190,000		139,000	
Total dissolved solids	ug/L	NE	NE	951000	876,000		790,000	
Total suspended solids	ug/L	NE	NE	3860000	14,000		20,000	
Turbidity	NTU	NE	NE	866	8.6		12.7	

				LOCATION CODE	LBA-PZ03	
				SAMPLE NO	LBA3004	
				SAMPLE DATE	29-Jan-09	
				DEPTH	8.42 - 8.46 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
EXPLOSIVES						
Amino-2,6-dinitrotoluene, 4-	ug/L	7.3	NE	1.71	1.71	
Amino-4,6-dinitrotoluene, 2-	ug/L	7.3	NE	1.6	1.6	
Dinitrotoluene, 2,4-	ug/L	0.099	NE	17.8	17.2	
Dinitrotoluene, 2,6-	ug/L	0.099	NE	15.1	15.1	
Nitrotoluene, 2-	ug/L	0.31	NE	74.7	6.89	
Nitrotoluene, 3-	ug/L	0.37	NE	9.1	3.91	
Nitrotoluene, 4-	ug/L	4.2	NE	8.6	1.8	
VOLATILES						
Dichloroethane, 1,1-	ug/L	2.4	NE	10	0.77	J
Dichloroethene, cis-1,2-	ug/L	37	NE	0.87	0.34	J
Naphthalene	ug/L	0.14	NE	4.33	4.33	
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	38.5	
Trichloroethene	ug/L	2	NE	7.03	7.03	
Trimethylbenzene, 1,2,4-	ug/L	1.5	NE	0.4	0.4	J
SEMIVOLATILES						
Dinitrotoluene, 2,4-	ug/L	0.099	NE	13.3	13.3	
Dinitrotoluene, 2,6-	ug/L	0.099	NE	8.4	7.11	J
METALS-UNFILTERED						
Aluminum	ug/L	3,700	309	27500	261	
Barium	ug/L	730	11,800	323	16	
Cadmium	ug/L	1.8	NE	4.63	2.97	J
Iron	ug/L	2,600	1,550	48900	681	
Manganese	ug/L	88	636	1450	35.1	
METALS-FILTERED						
Barium	ug/L	730	11,800	190	15.1	
Manganese	ug/L	88	636	457	29.5	
WATER QUALITY PARAMETERS						
Alkalinity	ug/L	NE	NE	333000	103,000	
Chloride	ug/L	NE	NE	195000	3,610	
Hardness	ug/L	NE	NE	1120000	255,000	
Nitrate-Nitrite	ug/L	NE	NE	900	581	
Sulfate	ug/L	NE	NE	282000	30,500	
Total dissolved solids	ug/L	NE	NE	951000	239,000	
Total suspended solids	ug/L	NE	NE	3860000	21,000	
Turbidity	NTU	NE	NE	866	19.7	J

				LOCATION CODE	LBA-PZ01	
				SAMPLE NO	LBA3000	
				SAMPLE DATE	31-Jan-09	
				DEPTH	7.17 - 7.28 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
VOLATILES						
Dichloroethane, 1,1-	ug/L	2.4	NE	10	6.66	
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	58.4	
Trichloroethene	ug/L	2	NE	7.03	0.81	J
METALS-UNFILTERED						
Aluminum	ug/L	3,700	309	27500	162	
Barium	ug/L	730	11,800	323	31.7	
Cadmium	ug/L	1.8	NE	4.63	4.63	
Copper	ug/L	150	19.8	66	5.98	J
Iron	ug/L	2,600	1,550	48900	469	
Manganese	ug/L	88	636	1450	25.3	
METALS-FILTERED						
Barium	ug/L	730	11,800	190	30.9	
Cadmium	ug/L	1.8	NE	4.46	4.46	
Iron	ug/L	2,600	1,550	446	90.9	
Manganese	ug/L	88	636	457	21.4	
WATER QUALITY PARAMETERS						
Alkalinity	ug/L	NE	NE	333000	240,000	
Chloride	ug/L	NE	NE	195000	6,140	J
Hardness	ug/L	NE	NE	1120000	517,000	
Nitrate-Nitrite	ug/L	NE	NE	900	297	J
Sulfate	ug/L	NE	NE	282000	193,000	
Total dissolved solids	ug/L	NE	NE	951000	584,000	
Turbidity	NTU	NE	NE	866	10.9	J

				LOCATION CODE	RCA-MW03			
				SAMPLE NO	RC3076		RC3082	
				SAMPLE DATE	11-May-09		4-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG	
				LOW-FLOW SAMPLED	No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
VOLATILES								
Acetone	ug/L	2,200	NE	10	10	J	-	-
Bromoform	ug/L	8.5	NE	0.36	0.36	J	-	-
Dibromochloromethane	ug/L	0.15	NE	0.2	0.2	J	-	-
METALS-UNFILTERED								
Aluminum	ug/L	3,700	309	27500	52.2	J	**1,340**	
Barium	ug/L	730	11,800	323	114	J	102	J
Chromium	ug/L	0.043	NE	39.1	-	-	3.3	J
Cobalt	ug/L	1.1	12.1	18.6	-	-	2.3	J
Iron	ug/L	2,600	1,550	48900	-	-	**2,510**	
Lead	ug/L	15	NE	48.6	2.1	J	3.7	B
Manganese	ug/L	88	636	1450	53		102	
Nickel	ug/L	73	8.6	58.2	-	-	**9.1**	J
Vanadium	ug/L	18	NE	65.9	-	-	3	J
Zinc	ug/L	1,100	507	141	13.4	B	18.3	J
METALS-FILTERED								
Barium	ug/L	730	11,800	190	111	J	98.1	J
Lead	ug/L	15	NE	2.7	-	-	2.4	J
Manganese	ug/L	88	636	457	84.7		25.6	
Nickel	ug/L	73	8.6	21.1	3.1	J	3.4	J
Selenium	ug/L	18	NE	5.9	4	J	-	-
Zinc	ug/L	1,100	507	15.5	-	-	7.6	J
WATER QUALITY PARAMETERS								
Alkalinity	ug/L	NE	NE	333000	307,000		295,000	
Chloride	ug/L	NE	NE	195000	12,200		12,100	
Hardness	ug/L	NE	NE	1120000				
HARDNESS (as CaCO3)	ug/L	NE	NE	657000	126,000		148,000	
Sulfate	ug/L	NE	NE	282000	4,300		4,400	
Total dissolved solids	ug/L	NE	NE	951000	230,000		348,000	
Total suspended solids	ug/L	NE	NE	3860000	-	-	52,000	
Turbidity	NTU	NE	NE	866	2.1		25	

				LOCATION CODE	RCA-MW02			
				SAMPLE NO	RC3075		RC3081	
				SAMPLE DATE	11-May-09		3-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG	
				LOW-FLOW SAMPLED	No		No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
EXPLOSIVES								
Dinitrotoluene, 2,4-	ug/L	0.099	NE	17.8	0.23		-	-
Dinitrotoluene, 2,6-	ug/L	0.099	NE	15.1	0.29		-	-
Nitrotoluene, 2-	ug/L	0.31	NE	74.7	2.1		1.8	
Nitrotoluene, 4-	ug/L	4.2	NE	8.6	1.2		0.61	
METALS-UNFILTERED								
Aluminum	ug/L	3,700	309	27500	77.1	J	**1,290**	
Barium	ug/L	730	11,800	323	77.2	J	55.8	J
Chromium	ug/L	0.043	NE	39.1	-	-	2.8	J
Cobalt	ug/L	1.1	12.1	18.6	6.1	J	3.7	J
Iron	ug/L	2,600	1,550	48900	-	-	**2,830**	
Lead	ug/L	15	NE	48.6	-	-	4.5	B
Manganese	ug/L	88	636	1450	422		272	
Nickel	ug/L	73	8.6	58.2	**21**	J	**11.4**	J
Vanadium	ug/L	18	NE	65.9	-	-	3.4	J
Zinc	ug/L	1,100	507	141	13.1	B	17.3	J
METALS-FILTERED								
Aluminum	ug/L	3,700	309	159	13.7	J	-	-
Barium	ug/L	730	11,800	190	82.7	J	46.6	J
Cobalt	ug/L	1.1	12.1	6.1	6.1	J	1.4	J
Lead	ug/L	15	NE	2.7	2	J	-	-
Manganese	ug/L	88	636	457	389		157	
Nickel	ug/L	73	8.6	21.1	**21.1**	J	6.3	J
Selenium	ug/L	18	NE	5.9	3.8	J	-	-
Vanadium	ug/L	18	NE	0.92	0.92	J	-	-
Zinc	ug/L	1,100	507	15.5	9.2	J	7.4	J
WATER QUALITY PARAMETERS								
Alkalinity	ug/L	NE	NE	333000	322,000		320,000	
Chloride	ug/L	NE	NE	195000	11,600		11,400	
Cyanide, total	ug/L	73	NE	16	13		-	-
HARDNESS (as CaCO3)	ug/L	NE	NE	657000	512,000		387,000	
Nitrate-Nitrite	ug/L	NE	NE	900	-	-	32	J
Sulfate	ug/L	NE	NE	282000	282,000		210,000	
Total dissolved solids	ug/L	NE	NE	951000	951,000		694,000	
Total suspended solids	ug/L	NE	NE	3860000	27,000		206,000	
Turbidity	NTU	NE	NE	866	3		30.9	



				LOCATION CODE	LBA-PZ02	
				SAMPLE NO	LBA3003	
				SAMPLE DATE	29-Jan-09	
				DEPTH	14.14-14.14 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
VOLATILES						
Acetone	ug/L	2,200	NE	10	3.46	J
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	0.72	J
METALS-UNFILTERED						
Aluminum	ug/L	3,700	309	27500	**12,800**	
Arsenic	ug/L	0.045	7.4	42.7	**42.7**	
Barium	ug/L	730	11,800	323	323	
Beryllium	ug/L	7.3	NE	13.7	13.7	
Cadmium	ug/L	1.8	NE	4.63	2.43	J
Chromium	ug/L	0.043	NE	39.1	20.4	
Cobalt	ug/L	1.1	12.1	18.6	**18.6**	
Copper	ug/L	150	19.8	66	**66**	
Iron	ug/L	2,600	1,550	48900	**40,700**	
Lead	ug/L	15	NE	48.6	48.6	
Manganese	ug/L	88	636	1450	**1,450**	
Nickel	ug/L	73	8.6	58.2	**20.5**	
Vanadium	ug/L	18	NE	65.9	35.9	
Zinc	ug/L	1,100	507	141	136	
METALS-FILTERED						
Arsenic	ug/L	0.045	7.4	28	**28**	
Barium	ug/L	730	11,800	190	87.7	
Manganese	ug/L	88	636	457	273	
WATER QUALITY PARAMETERS						
Alkalinity	ug/L	NE	NE	333000	177,000	
Chloride	ug/L	NE	NE	195000	7,960	J
Hardness	ug/L	NE	NE	1120000	1,120,000	
Sulfate	ug/L	NE	NE	282000	43,800	J
Total dissolved solids	ug/L	NE	NE	951000	172,000	
Total suspended solids	ug/L	NE	NE	3860000	3,860,000	
Turbidity	NTU	NE	NE	866	866	J

				LOCATION CODE	LBA-PZ04	
				SAMPLE NO	LBA3005	
				SAMPLE DATE	30-Jan-09	
				DEPTH	6.70 - 6.71 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
VOLATILES						
Dichloroethane, 1,1-	ug/L	2.4	NE	10	10	
Dichloroethene, 1,1-	ug/L	34	NE	1.9	0.66	J
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	18.1	
METALS-UNFILTERED						
Aluminum	ug/L	3,700	309	27500	**12,600**	
Arsenic	ug/L	0.045	7.4	42.7	**13.5**	
Barium	ug/L	730	11,800	323	110	
Beryllium	ug/L	7.3	NE	13.7	12.3	
Chromium	ug/L	0.043	NE	39.1	20.3	
Cobalt	ug/L	1.1	12.1	18.6	**12.4**	
Copper	ug/L	150	19.8	66	**53.7**	
Iron	ug/L	2,600	1,550	48900	**36,000**	
Lead	ug/L	15	NE	48.6	26.6	
Manganese	ug/L	88	636	1450	**698**	
Nickel	ug/L	73	8.6	58.2	**17.6**	
Vanadium	ug/L	18	NE	65.9	37.1	
Zinc	ug/L	1,100	507	141	111	
METALS-FILTERED						
Barium	ug/L	730	11,800	190	27.4	
Cadmium	ug/L	1.8	NE	4.46	3.29	J
Manganese	ug/L	88	636	457	24.6	
WATER QUALITY PARAMETERS						
Alkalinity	ug/L	NE	NE	333000	238,000	
Chloride	ug/L	NE	NE	195000	3,240	J
Hardness	ug/L	NE	NE	1120000	921,000	
Nitrate-Nitrite	ug/L	NE	NE	900	61	J
Sulfate	ug/L	NE	NE	282000	28,200	
Total dissolved solids	ug/L	NE	NE	951000	295,000	
Total suspended solids	ug/L	NE	NE	3860000	1,770,000	
Turbidity	NTU	NE	NE	866	165	J

				LOCATION CODE	LBA-MW02											
				SAMPLE NO	LB3068		LB3069		LB3070		LB3076		LB3077		LB3079	
				SAMPLE DATE	19-May-09		19-May-09		19-May-09		5-Nov-09		5-Nov-09		5-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		FD		FS		REG		FD		FS	
				LOW-FLOW SAMPLED	Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	ug/L	7.3	NE	1.71	0.28		-	-	0.26		0.48	J	-	-		
Amino-4,6-dinitrotoluene, 2-	ug/L	7.3	NE	1.6	0.2		0.2		-	-	0.54	J	0.29	J		
Dinitrotoluene, 2,4-	ug/L	0.099	NE	17.8	5.4	J	10.8	J	9.9		3.4	J	17.8	J		
Dinitrotoluene, 2,6-	ug/L	0.099	NE	15.1	5.3	J	7.8	J	6.9		5.9	J	12.4	J		
HMX	ug/L	180	NE	0.32	-	-	-	-	-	-	-	-	-	-		
Nitrobenzene	ug/L	0.12	NE	1.2	-		-		-		-		-		1.2	
Nitrotoluene, 2-	ug/L	0.31	NE	74.7	25.1	J	48.5	J	39		8.1	J	74.7	J		
Nitrotoluene, 3-	ug/L	0.37	NE	9.1	2.9	J	5.7	J	4.5		1.2	J	9.1	J		
Nitrotoluene, 4-	ug/L	4.2	NE	8.6	2.9	J	5.8	J	4.5		0.56	J	8.6	J		
VOLATILES																
Dichloroethane, 1,1-	ug/L	2.4	NE	10	1.6		1.5		1.4		3		3.7		3.6	
Dichloroethene, 1,1-	ug/L	34	NE	1.9	1.1	J	-	-	1.9		1.2		-	-	-	-
Dichloroethene, cis-1,2-	ug/L	37	NE	0.87	0.81	J	0.87	J	-	-	0.78	J	0.83	J	-	-
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	36.8		40		40		29.5		32.7		33	
Trichloroethene	ug/L	2	NE	7.03	5.6		5.2		4.8		4.3		4.8		5.1	
SEMIVOLATILES																
Di-n-butyl phthalate	ug/L	370	NE	1.3	1.3	B	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene, 2,4-	ug/L	0.099	NE	13.3	2.1	J	6.4	J	-	-	6.1	J	12.9	J	-	-
Dinitrotoluene, 2,6-	ug/L	0.099	NE	8.4	2.4	J	4.3	J	-	-	6	J	8.4	J	-	-
METALS-UNFILTERED																
Aluminum	ug/L	3,700	309	27500	39.5	B	35.2	B	-	-	**361**		**313**		**1,190**	
Barium	ug/L	730	11,800	323	59.7	J	60.7	J	-	-	76.6	J	82.1	J	-	-
Iron	ug/L	2,600	1,550	48900	-	-	-	-	-	-	200	J	207	J	1,430	
Lead	ug/L	15	NE	48.6	-	-	2.3	J	-	-	2.5	B	3.4	B	-	-
Manganese	ug/L	88	636	1450	57.3		59.7		55.4		184		159		160	
Selenium	ug/L	18	NE	6.3	-	-	-	-	-	-	4.5	J	-	-	-	-
Zinc	ug/L	1,100	507	141	-	-	9.2	J	-	-	-	-	-	-	-	-
METALS-FILTERED																
Aluminum	ug/L	3,700	309	159	37.6	J	28.3	J	-	-	-	-	-	-	-	-
Barium	ug/L	730	11,800	190	51.3	J	49.2	J	-	-	28	J	33.8	J	-	-
Lead	ug/L	15	NE	2.7	-	-	-	-	-	-	2.1	J	2.4	J	-	-
Manganese	ug/L	88	636	457	47.2		46.1		57.3		30.1	J	46.3	J	47.4	
Mercury	ug/L	1.1	NE	0.16	-	-	-	-	-	-	-	-	0.16	J	-	-
Selenium	ug/L	18	NE	5.9	3.6	J	-	-	-	-	-	-	-	-	-	-
Zinc	ug/L	1,100	507	15.5	-	-	9.5	J	-	-	-	-	-	-	-	-
WATER QUALITY PARAMETERS																
Alkalinity	ug/L	NE	NE	333000	234,000		237,000		230,000		250,000		277,000		280,000	
Chloride	ug/L	NE	NE	195000	7,300		7,300		5,700		7,000		7,200		5,800	
Cyanide, total	ug/L	73	NE	16	7.5	J	-	-	-	-	-	-	-	-	-	-
Hardness	ug/L	NE	NE	1120000					300,000						320,000	
HARDNESS (as CaCO3)	ug/L	NE	NE	657000	273,000		281,000				303,000		315,000			
Nitrate	ug/L	5,800	NE	300											300	
Nitrate-Nitrite	ug/L	NE	NE	900	710	J	750	J	900		440	J	450	J		
Sulfate	ug/L	NE	NE	282000	38,000		38,100		49,500		37,300	J	39,600	J	51,300	
Total dissolved solids	ug/L	NE	NE	951000	396,000	J	316,000		350,000		339,000		365,000		370,000	
Total suspended solids	ug/L	NE	NE	3860000	-	-	6,000	J	-	-	-	-	7,000	J	38,000	
Turbidity	NTU	NE	NE	866	2.1	J	2.9	J	0.6		2	J	9.7	J	16	

				LOCATION CODE	LBA-MW03			
				SAMPLE NO	LB3071		LB3080	
				SAMPLE DATE	10-May-09		3-Nov-09	
				DEPTH	0 - 0 Ft		0 - 0 Ft	
				SAMPLE PURPOSE	REG		REG	
				LOW-FLOW SAMPLED	Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
EXPLOSIVES								
HMX	ug/L	180	NE	0.32	-	-	0.32	
VOLATILES								
Carbon disulfide	ug/L	100	NE	0.54	-	-	0.54	J
Carbon tetrachloride	ug/L	0.2	NE	4	-	-	4	
Dichloroethane, 1,1-	ug/L	2.4	NE	10	6.3		8.3	
Dichloroethene, 1,1-	ug/L	34	NE	1.9	1.4		0.68	J
Trichloroethane, 1,1,1-	ug/L	910	NE	58.4	35.3		22.1	
METALS-UNFILTERED								
Aluminum	ug/L	3,700	309	27500	-	-	20.4	J
Barium	ug/L	730	11,800	323	125	J	260	
Manganese	ug/L	88	636	1450	68.2		292	
Nickel	ug/L	73	8.6	58.2	3.2	J	3	J
Zinc	ug/L	1,100	507	141	11.3	J	-	-
METALS-FILTERED								
Barium	ug/L	730	11,800	190	131	J	190	J
Lead	ug/L	15	NE	2.7	2.7	J	-	-
Manganese	ug/L	88	636	457	71.7		181	
Nickel	ug/L	73	8.6	21.1	3.5	J	-	-
Selenium	ug/L	18	NE	5.9	4.8	J	-	-
Zinc	ug/L	1,100	507	15.5	11.3	J	-	-
WATER QUALITY PARAMETERS								
Alkalinity	ug/L	NE	NE	333000	246,000		333,000	
Chloride	ug/L	NE	NE	195000	6,800		195,000	J
Cyanide, total	ug/L	73	NE	16	13	J	-	-
HARDNESS (as CaCO3)	ug/L	NE	NE	657000	333,000		311,000	
Nitrate-Nitrite	ug/L	NE	NE	900	-	-	110	
Sulfate	ug/L	NE	NE	282000	69,800		45,400	
Total dissolved solids	ug/L	NE	NE	951000	580,000		394,000	
Total suspended solids	ug/L	NE	NE	3860000	5,000	J	4,000	
Turbidity	NTU	NE	NE	866	-	-	1	J

				LOCATION CODE	RCA-MW01	
				SAMPLE NO	RC3074	
				SAMPLE DATE	12-May-09	
				DEPTH	0 - 0 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
METALS-UNFILTERED						
Aluminum	ug/L	3,700	309	27500	**386**	J
Barium	ug/L	730	11,800	323	188	J
Iron	ug/L	2,600	1,550	48900	348	
Manganese	ug/L	88	636	1450	77.8	
Nickel	ug/L	73	8.6	58.2	3.6	J
Selenium	ug/L	18	NE	6.3	6.7	B
Vanadium	ug/L	18	NE	65.9	1.1	J
METALS-FILTERED						
Barium	ug/L	730	11,800	190	182	J
Manganese	ug/L	88	636	457	68.2	
Nickel	ug/L	73	8.6	21.1	3.1	J
Selenium	ug/L	18	NE	5.9	3.8	J
Zinc	ug/L	1,100	507	15.5	15.5	J
WATER QUALITY PARAMETERS						
Alkalinity	ug/L	NE	NE	333000	267,000	
Chloride	ug/L	NE	NE	195000	21,700	
Cyanide, total	ug/L	73	NE	16	16	
HARDNESS (as CaCO3)	ug/L	NE	NE	657000	331,000	
Sulfate	ug/L	NE	NE	282000	67,100	
Total dissolved solids	ug/L	NE	NE	951000	509,000	
Total suspended solids	ug/L	NE	NE	3860000	70,000	
Turbidity	NTU	NE	NE	866	21.3	

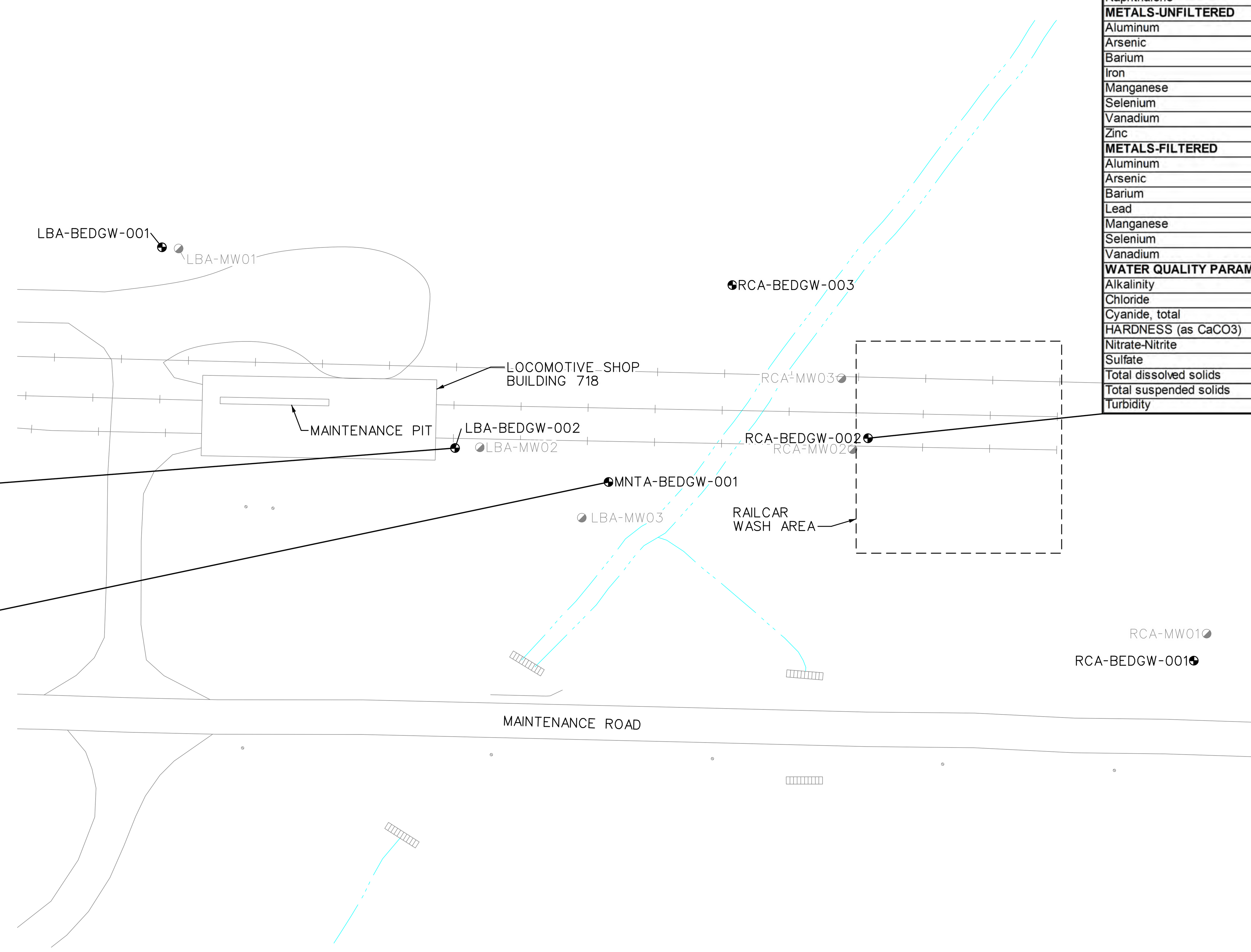
FIGURE 3-8
DETECTED CONSTITUENTS AT THE LOCOMOTIVE SHOP AND RAILCAR WASH AREAS IN OVERBURDEN/SHALE GROUNDWATER SAMPLES ABOVE RBSCs AND/OR BSCs (JANUARY, MAY, AND NOVEMBER 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

SCALE: 0 50 100 FEET

CB&I Federal Services LLC

					LOCATION CODE	LBA-BEDGW-002	
					SAMPLE NO	LB3073	
					SAMPLE DATE	12-May-09	
					DEPTH	0 - 0 Ft	
					SAMPLE PURPOSE	REG	
					LOW-FLOW SAMPLED	No	
Parameter	Units	RBSC	BSC	MDC		Result	VQ
VOLATILES							
Benzene	ug/L	0.41	2.4	1,680		**1,680**	J
Butanone, 2-	ug/L	710	NE	56.3		56.3	J
Chloroform	ug/L	0.19	NE	26.8		26.8	
Chloromethane	ug/L	19	NE	35.6		35.6	J
Ethylbenzene	ug/L	1.5	0.87	169		**169**	
Toluene	ug/L	230	1.7	692		**692**	
Xylenes, total	ug/L	20	5.5	1,130		**1,130**	
SEMIVOLATILES							
3-Methylphenol and 4-Methylphenol	ug/L	NE	NE	5.2		5.2	
Dimethylphenol, 2,4-	ug/L	73	NE	12.3		12.3	
Methylnaphthalene, 2-	ug/L	15	NE	256		20.9	
Methylphenol, 2-	ug/L	180	NE	5.6		5.6	
Naphthalene	ug/L	0.14	NE	64.9		25.6	
Phenol	ug/L	1,100	NE	8		8	
METALS-UNFILTERED							
Aluminum	ug/L	3,700	309	155		73.8	B
Arsenic	ug/L	0.045	7.4	131		**131**	
Barium	ug/L	730	11,800	762		762	
Cadmium	ug/L	1.8	NE	0			
Iron	ug/L	2,600	1,550	2,940		**2,940**	
Manganese	ug/L	88	636	1,070		**1,070**	
Nickel	ug/L	73	8.6	7.2		7.2	J
Selenium	ug/L	18	NE	11.7		11.7	J
Thallium	ug/L	NE	NE	6.4		6.4	J
Vanadium	ug/L	18	NE	1.6		1.4	J
METALS-FILTERED							
Arsenic	ug/L	0.045	7.4	125		**125**	
Barium	ug/L	730	11,800	764		764	
Manganese	ug/L	88	636	1,000		**1,000**	
Nickel	ug/L	73	8.6	5.7		5.7	J
Selenium	ug/L	18	NE	9.3		9.3	J
Vanadium	ug/L	18	NE	1.9		1.1	J
WATER QUALITY PARAMETERS							
Alkalinity	ug/L	NE	NE	770,000		369,000	
Chloride	ug/L	NE	NE	3,260,000		3,260,000	
Cyanide, total	ug/L	73	NE	110		14	J
HARDNESS (as CaCO3)	ug/L	NE	NE	2,600,000		2,600,000	
Sulfate	ug/L	NE	NE	218,000		14,800	
Total dissolved solids	ug/L	NE	NE	7,970,000		7,970,000	
Total suspended solids	ug/L	NE	NE	193,000		60,000	
Turbidity	NTU	NE	NE	168		168	



					LOCATION CODE	RCA-BEDGW-002			
					SAMPLE NO	RC3078		RC3084	
					SAMPLE DATE	11-May-09		5-Nov-09	
					DEPTH	0 - 0 Ft		0 - 0 Ft	
					SAMPLE PURPOSE	REG		REG	
					LOW-FLOW SAMPLED	No		No	
Parameter	Units	RBSC	BSC	MDC		Result	VQ	Result	VQ
VOLATILES									
Acetone	ug/L	2,200	NE	50.7		50.7	J	-	-
Benzene	ug/L	0.41	2.4	1,680		**31.9**		**114**	
Butanone, 2-	ug/L	710	NE	56.3		-	-	13.2	
Chloromethane	ug/L	19	NE	35.6		12.8		-	-
Ethylbenzene	ug/L	1.5	0.87	169		**17**		**43.4**	
Tetrachloroethane, 1,1,2,2-	ug/L	0.067	NE	3.7		3.7		-	-
Toluene	ug/L	230	1.7	692		**28.9**		**93.6**	
Xylenes, total	ug/L	20	5.5	1,130		**97.2**		**234**	
SEMIVOLATILES									
Dimethylphenol, 2,4-	ug/L	73	NE	12.3		1.5	J	1.6	J
Methylnaphthalene, 2-	ug/L	15	NE	256		6.3		8.1	
Naphthalene	ug/L	0.14	NE	64.9		4.5	J	7.2	
METALS-UNFILTERED									
Aluminum	ug/L	3,700	309	155		155	J	138	J
Arsenic	ug/L	0.045	7.4	131		**19.9**		**28**	
Barium	ug/L	730	11,800	762		485		562	
Iron	ug/L	2,600	1,550	2,940		-	-	385	
Manganese	ug/L	88	636	1,070		227		158	
Selenium	ug/L	18	NE	11.7		6.8	B	8.5	J
Vanadium	ug/L	18	NE	1.6		1.6	J	-	-
Zinc	ug/L	1,100	507	11.6		14.8	B	9.2	B
METALS-FILTERED									
Aluminum	ug/L	3,700	309	71.7		35.6	J	71.7	J
Arsenic	ug/L	0.045	7.4	125		**13.1**		**42.7**	
Barium	ug/L	730	11,800	764		494		576	
Lead	ug/L	15	NE	3.3		3.3	J	-	-
Manganese	ug/L	88	636	1,000		186		177	
Selenium	ug/L	18	NE	9.3		7	J	7.2	J
Vanadium	ug/L	18	NE	1.9		1.9	J	1.3	J
WATER QUALITY PARAMETERS									
Alkalinity	ug/L	NE	NE	770,000		753,000		770,000	
Chloride	ug/L	NE	NE	3,260,000		1,480,000		2,520,000	
Cyanide, total	ug/L	73	NE	110		110	J	-	-
HARDNESS (as CaCO3)	ug/L	NE	NE	2,600,000		1,850,000		2,030,000	
Nitrate-Nitrite	ug/L	NE	NE	200		-	-	200	J
Sulfate	ug/L	NE	NE	218,000		218,000		39,400	J
Total dissolved solids	ug/L	NE	NE	7,970,000		3,320,000		3,910,000	
Total suspended solids	ug/L	NE	NE	193,000		-	-	17,000	
Turbidity	NTU	NE	NE	168		47.4		76.4	

					LOCATION CODE	IT-MNTA-BEDGW-001			
					SAMPLE NO	LB3074		BEDGW-001-1109	
					SAMPLE DATE	19-May-09		6-Nov-09	
					DEPTH	0 - 0 Ft		0 - 0 Ft	
					SAMPLE PURPOSE	REG		REG	
					LOW-FLOW SAMPLED	No		No	
Parameter	Units	RBSC	BSC	MDC		Result	VQ	Result	VQ
VOLATILES									
Acetone	ug/L	2,200	NE	50.7		345	J	-	-
Benzene	ug/L	0.41	2.4	1,680		-	-	**3.7**	
Butanone, 2-	ug/L	710	NE	56.3		81.3	J	-	-
Carbon disulfide	ug/L	100	NE	3.8		11.6	J	3.8	
Chloroform	ug/L	0.19	NE	26.8		66.7		-	-
Ethylbenzene	ug/L	1.5	0.87	169		**16.7**	J	**9.9**	
Methyl-2-pentanone, 4-	ug/L	200	NE	3.3		-	-	3.3	J
Methylene chloride	ug/L	4.8	NE	77.6		77.6	J		
Tetrachloroethane, 1,1,2,2-	ug/L	0.067	NE	3.7		-	-	1.2	
Toluene	ug/L	230	1.7	692		**14.2**	J	**10**	
Xylenes, total	ug/L	20	5.5	1,130		**235**		**136**	
SEMIVOLATILES									
Fluorene	ug/L	150	NE	5.4		5.4	J		
Methylnaphthalene, 2-	ug/L	15	NE	256		71		256	J
Naphthalene	ug/L	0.14	NE	64.9		17.7	J	64.9	J
Phenanthrene	ug/L	NE	NE	37.3		12.7	J	37.3	J
METALS-UNFILTERED									
Aluminum	ug/L	3,700	309	155		90.4	B	79.6	J
Barium	ug/L	730	11,800	762		343		305	
Cadmium	ug/L	1.8	NE	1.4		1.4	J		
Iron	ug/L	2,600	1,550	2,940		591		180	J
Lead	ug/L	15	NE	0		2.6	J	-	-
Manganese	ug/L	88	636	1,070		95.5		85.8	
Thallium	ug/L	NE	NE	6.4		3.8	J	-	-
Vanadium	ug/L	18	NE	1.6		2.8	J	1.6	J
Zinc	ug/L	1,100	507	11.6		11.6	J	11.5	B
METALS-FILTERED									
Aluminum	ug/L	3,700	309	71.7		43.3	J	52.6	J
Barium	ug/L	730	11,800	764		329		304	
Lead	ug/L	15	NE	3.3		2	J	2.3	J
Manganese	ug/L	88	636	1,000		47		70.2	
Selenium	ug/L	18	NE	9.3		-	-	4.2	J
Vanadium	ug/L	18	NE	1.9		2.7	J	0.93	J
Zinc	ug/L	1,100	507	0		11.2	J	-	-
WATER QUALITY PARAMETERS									
Alkalinity	ug/L	NE	NE	770,000		773,000		718,000	
Chloride	ug/L	NE	NE	3,260,000		132,000		2,550,000	
Cyanide, total	ug/L	73	NE	110		71		-	-
HARDNESS (as CaCO3)	ug/L	NE	NE	2,600,000		1,740,000		1,570,000	
Nitrate-Nitrite	ug/L	NE	NE	200		-	-	90	J
Sulfate	ug/L	NE	NE	218,000		9,600		-	-
Total dissolved solids	ug/L	NE	NE	7,970,000		5,780,000		4,680,000	
Total suspended solids	ug/L	NE	NE	193,000		53,000		193,000	
Turbidity	NTU	NE	NE	168		66	J	71.5	

LEGEND:

- OVERBURDEN MONITORING WELL (SCREENED IN SHALE)
- BEDROCK MONITORING WELL (SCREENED IN LIMESTONE)
- ug/L MICROGRAM PER LITER
- NE NOT ESTABLISHED (RBSCs), NOT EVALUATED (BSCs)
- \- NOT DETECTED

NOTES:

1. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
2. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
3. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT RESULTS IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
4. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
5. LBA-BEDGW-001, RCA-BEDGW-001, AND RCA-BEDGW-003 WERE NOT SAMPLED DUE TO INSUFFICIENT RECHARGE.
6. VALIDATION QUALIFIERS (VQ):
   J - THE COMPOUND/ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS AN ESTIMATED CONCENTRATION.
   B- THE ANALYTE WAS NOT DETECTED SIGNIFICANTLY ABOVE THE LEVELS FOUND IN THE ASSOCIATED METHOD BLANK OR FIELD BLANKS.

SCALE: 0 50 100 FEET

FIGURE 3-9

DETECTED CONSTITUENTS AT THE LOCOMOTIVE SHOP AND RAILCAR WASH AREAS IN BEDROCK GROUNDWATER SAMPLES ABOVE RBSCs AND/OR BSCs (MAY AND NOVEMBER 2009)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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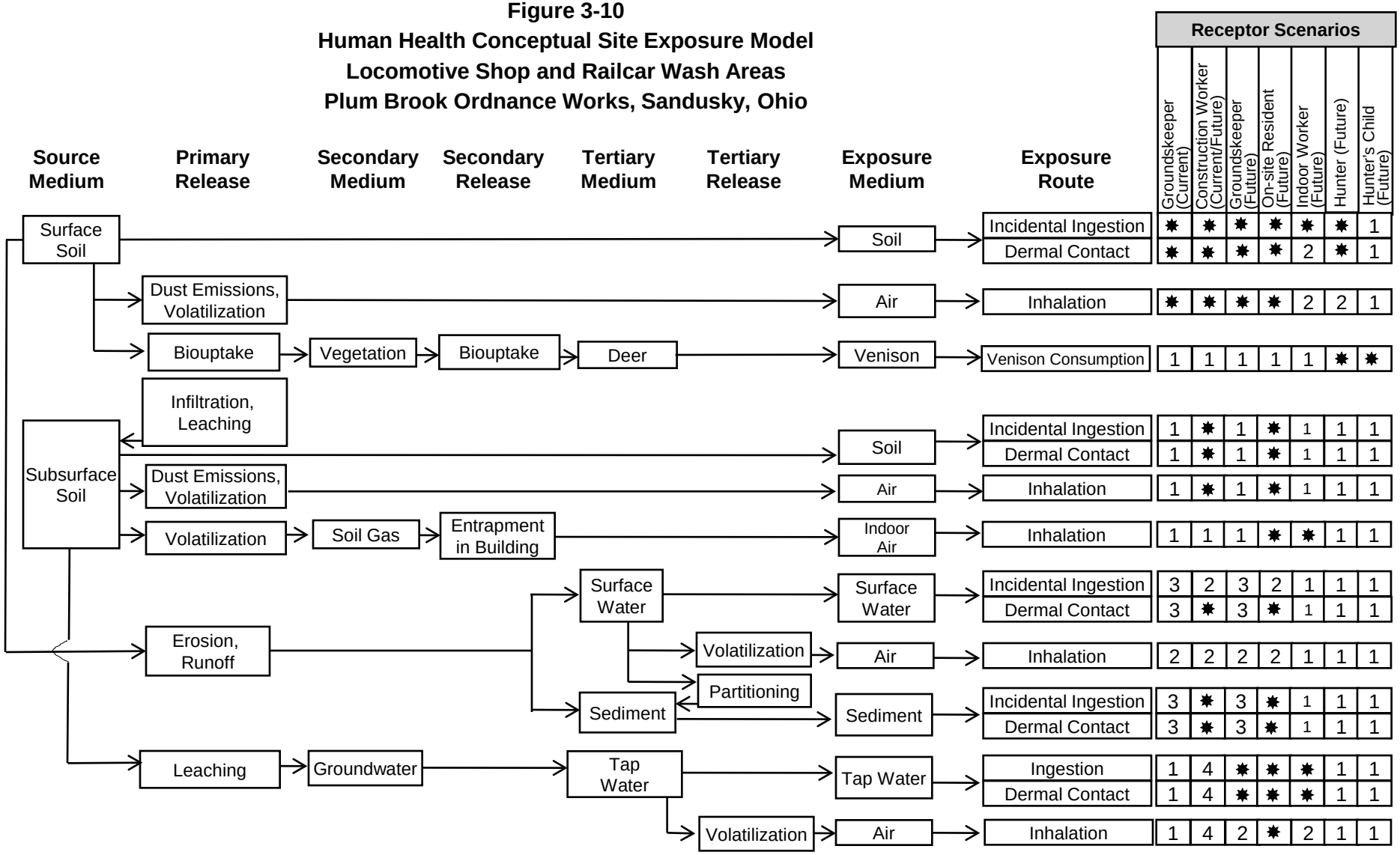
Figure 3-10
Human Health Conceptual Site Exposure Model
Locomotive Shop and Railcar Wash Areas
Plum Brook Ordnance Works, Sandusky, Ohio



✸ = Complete exposure route quantified in the risk assessment.
1 = There is no plausible pathway for exposure to this medium.
2 = Although theoretically complete, this pathway is not quantified as explained in text.
3 = Contact with this medium, although plausible, is not part of this receptor's normal or expected activities; therefore contact would be sporadic and is not quantified.
4 = For current use there is no plausible exposure pathway. For future use, the pathway is potentially complete, but is not quantified as explained in the text.

Figure 3-11

Simplified Terrestrial Food Web Conceptual Site Model
Locomotive Shop and Railcar Wash Areas
Plum Brook Ordnance Works, Sandusky, Ohio

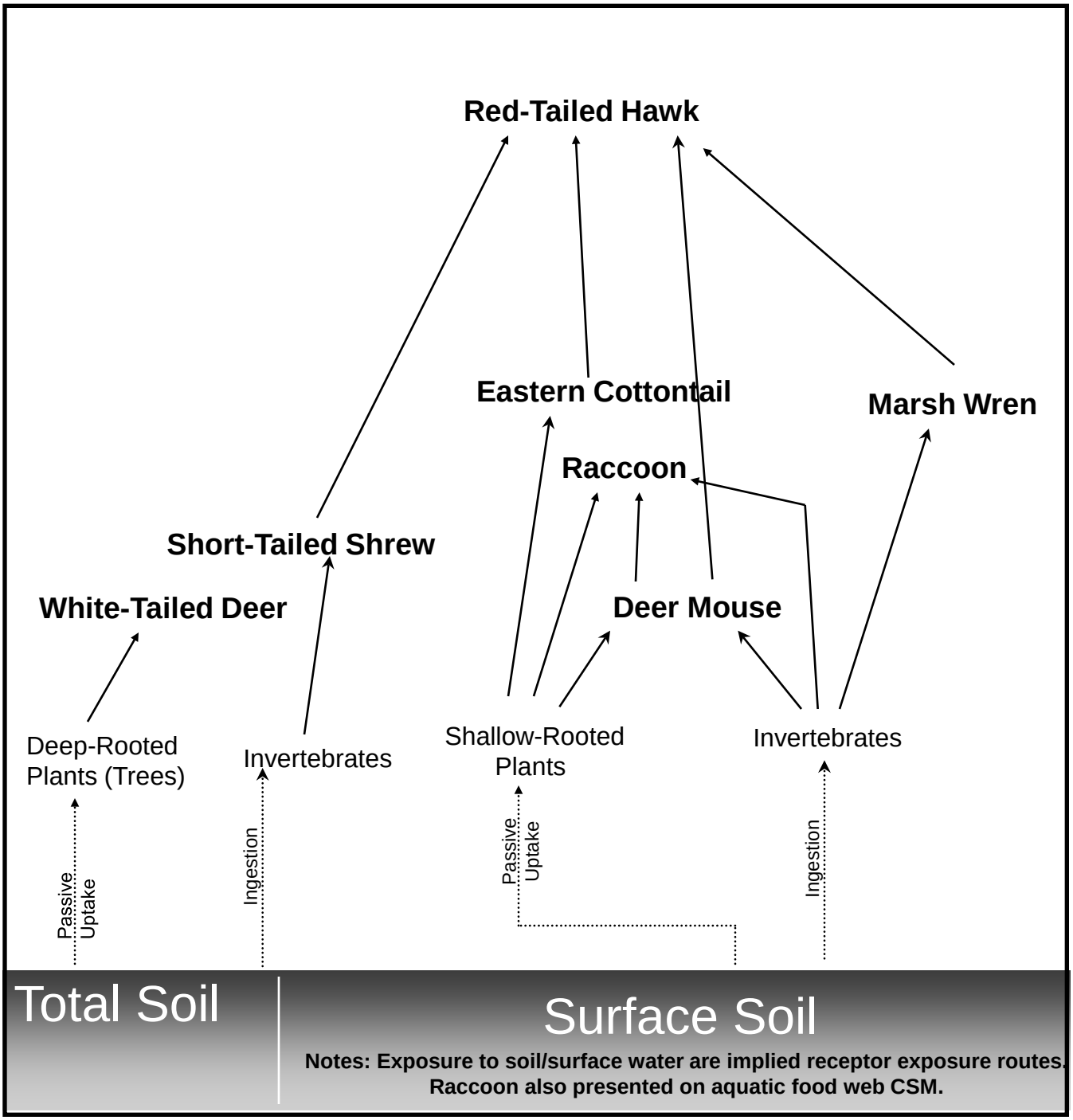
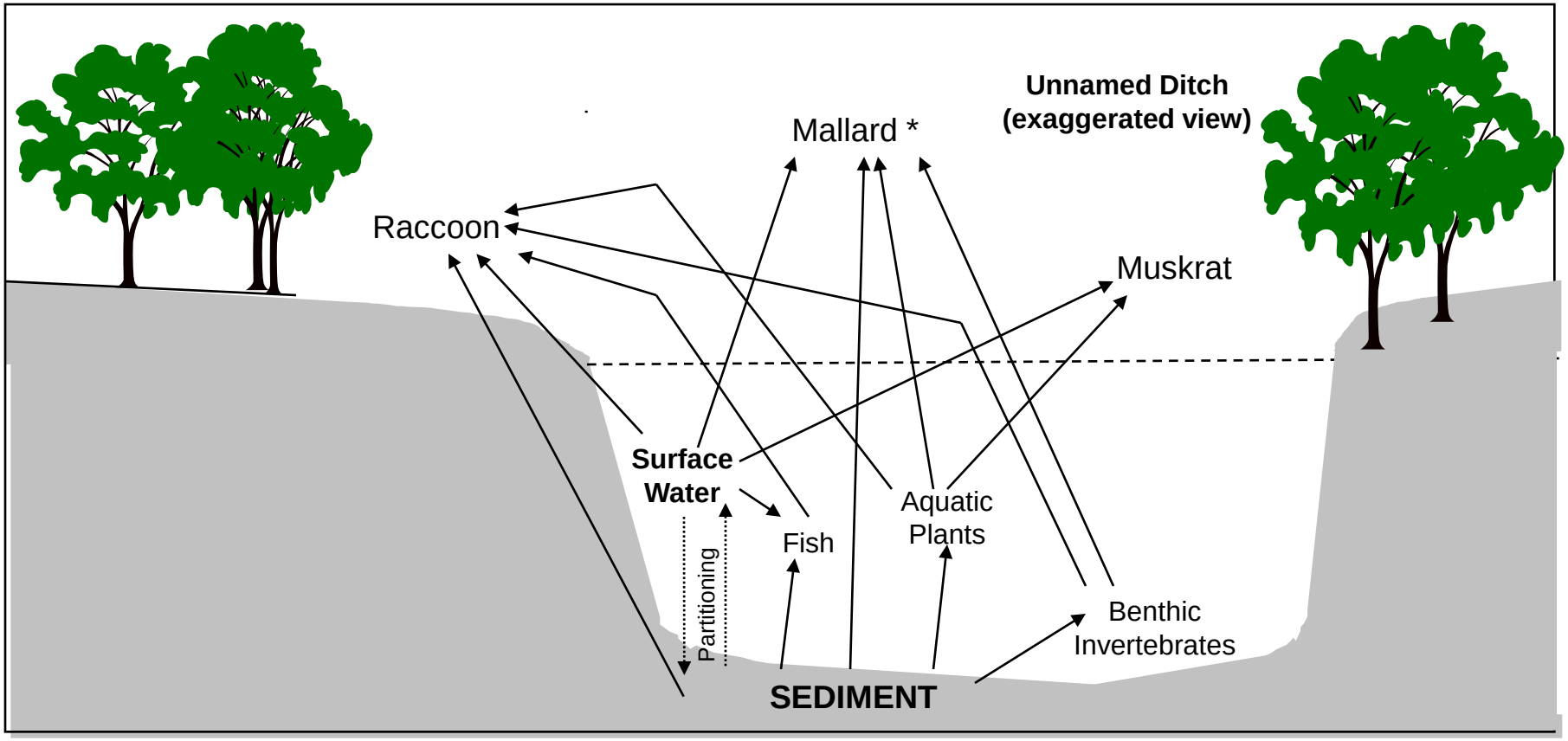


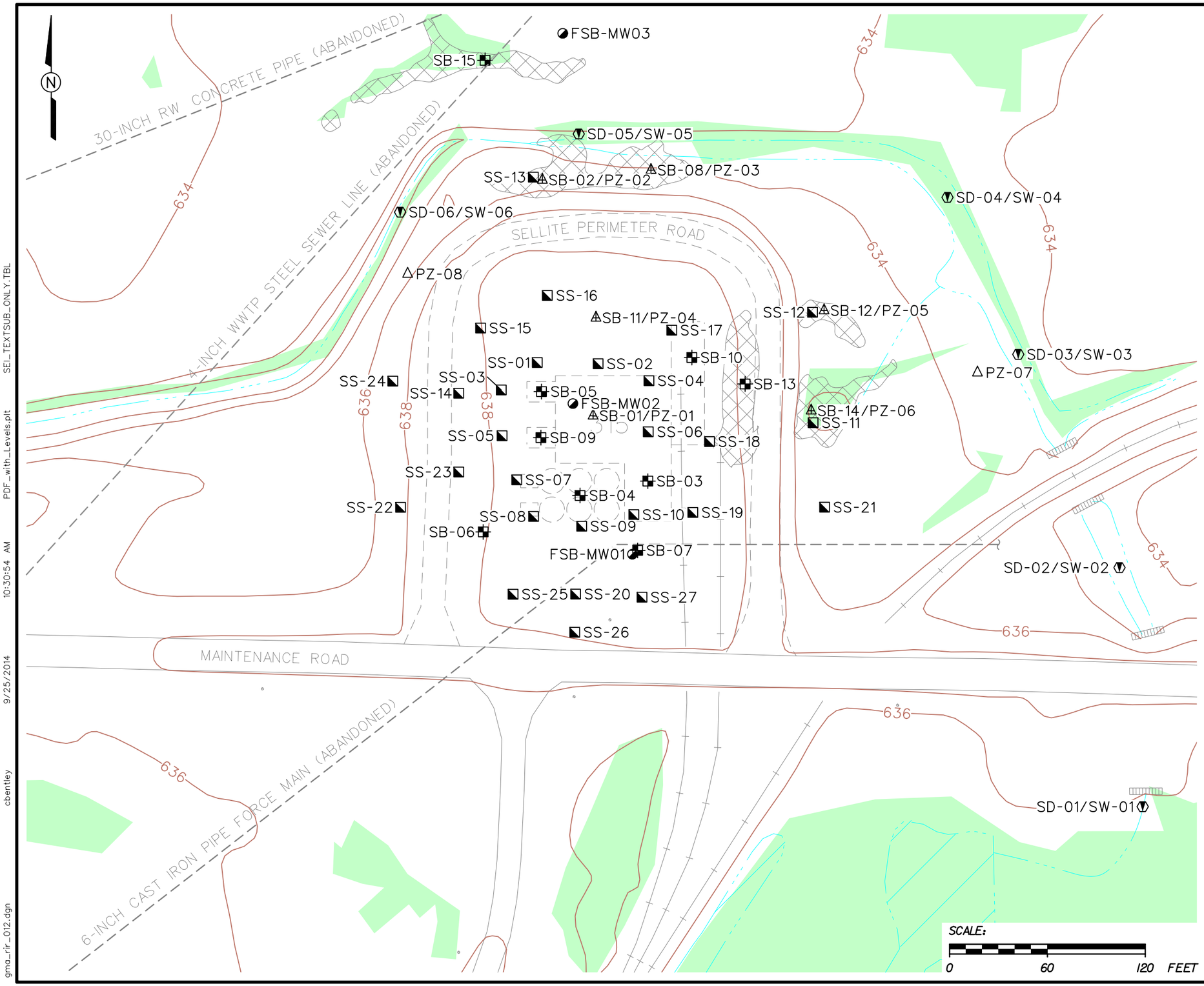
Figure 3-12

Simplified Aquatic Food Web Conceptual Site Model
Locomotive Shop and Railcar Wash Areas
Plum Brook Ordnance Works, Sandusky, Ohio



Note: The raccoon is also presented on terrestrial food web CSM.

*** = The mallard is not evaluated in the risk assessment.**



LEGEND:

- OVERBURDEN MONITORING WELL
- SURFACE SOIL SAMPLE
- SOIL BORING
- SOIL BORING / PIEZOMETER
- PIEZOMETER
- SURFACE WATER / SEDIMENT SAMPLE
- POND
- CREEK, DITCH, CONVEYANCE
- WETLAND AREA (ENVIROSCIENCE, 2012) (NOTE 1)
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- 634 TOPOGRAPHIC CONTOUR (2 FT. INTERVAL)

NOTES:

1. WETLANDS AT PLUM BROOK HAVE BEEN FORMALLY DELINEATED BUT ARE CURRENTLY NOT JURISDICTIONAL. SEE TEXT FOR DETAILS.

FIGURE 4-1

GENERAL SITE FEATURES OF THE FORMER SELLITE AREA WITH SITE TOPOGRAPHY AND SAMPLING LOCATIONS

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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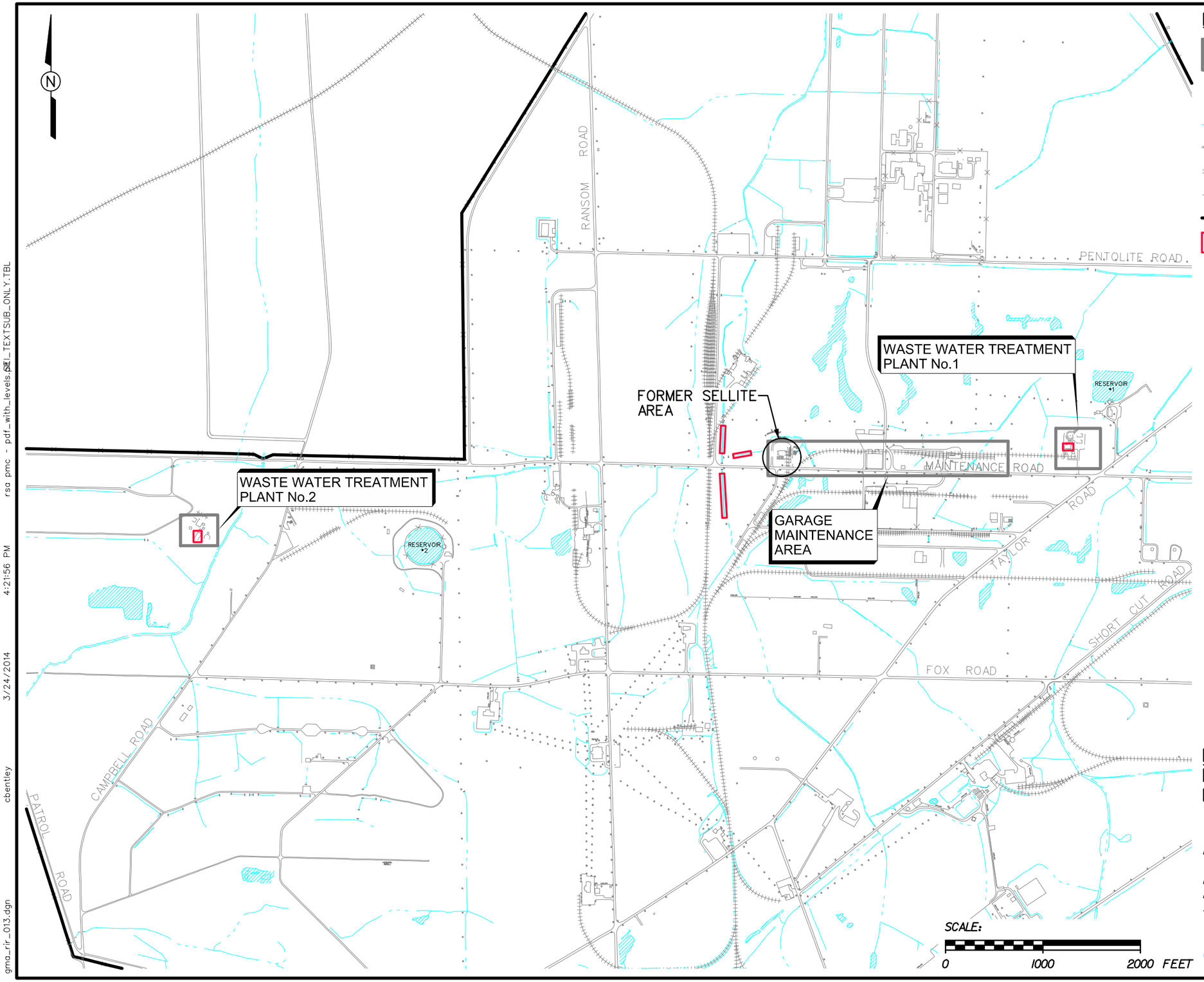

LEGEND:

- AREA OF CONCERN
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FENCE
- FACILITY BOUNDARY
- BACKGROUND pH SAMPLING LOCATION

FIGURE 4-2
BACKGROUND pH SAMPLING LOCATIONS

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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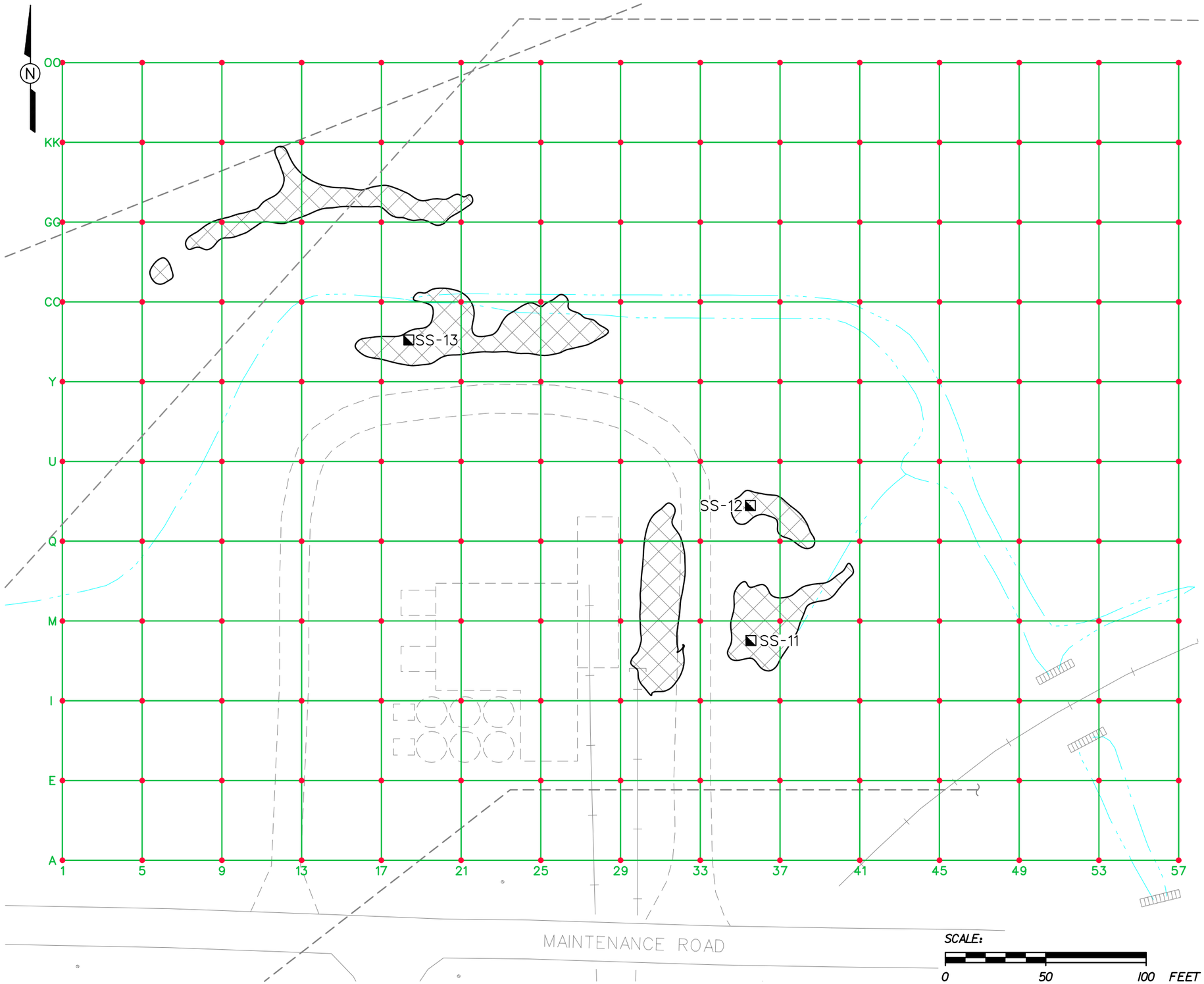

LEGEND:

- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF UNDERGROUND UTILITIES
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- SURFACE SOIL SAMPLE
- PHASE I SAMPLING GRID (40 FT. x 40 FT.)
- POTENTIAL PHASE I SAMPLING LOCATION

NOTES:

1. SAMPLING WAS PERFORMED AT GRID NODES.
2. NOT ALL NODES WERE SAMPLED DUE TO SITE CONDITIONS (LIMITED ACCESS, BRUSH, SURFACE DEBRIS, ETC.).

SCALE: 0 50 100 FEET

FIGURE 4-3
PHASE I SURFACE SOIL pH SAMPLING GRID

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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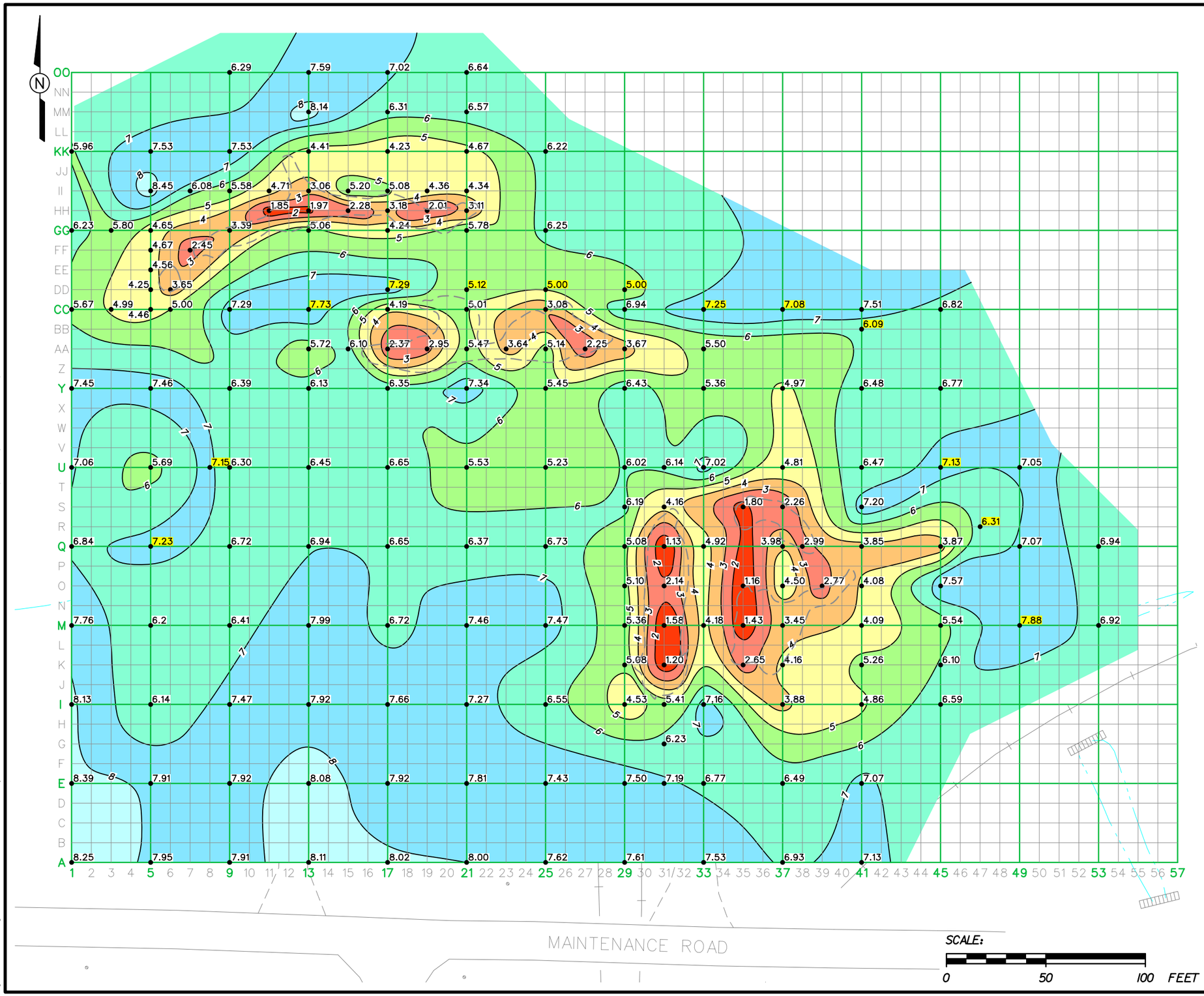

LEGEND:

- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- PHASE I SAMPLING GRID (40 FT. x 40 FT.)
- PHASE II SAMPLING GRID (10 FT. x 10 FT.)
- PHASE I / PHASE II pH SAMPLING LOCATION
- 6.94 pH RESULT (FIELD SCREENING)
- 7.88 pH RESULT IN DITCH (FIELD SCREENING)

pH ISOCONTOUR KEY (S.U.):

- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9

FIGURE 4-4
SURFACE SOIL pH SAMPLING RESULTS

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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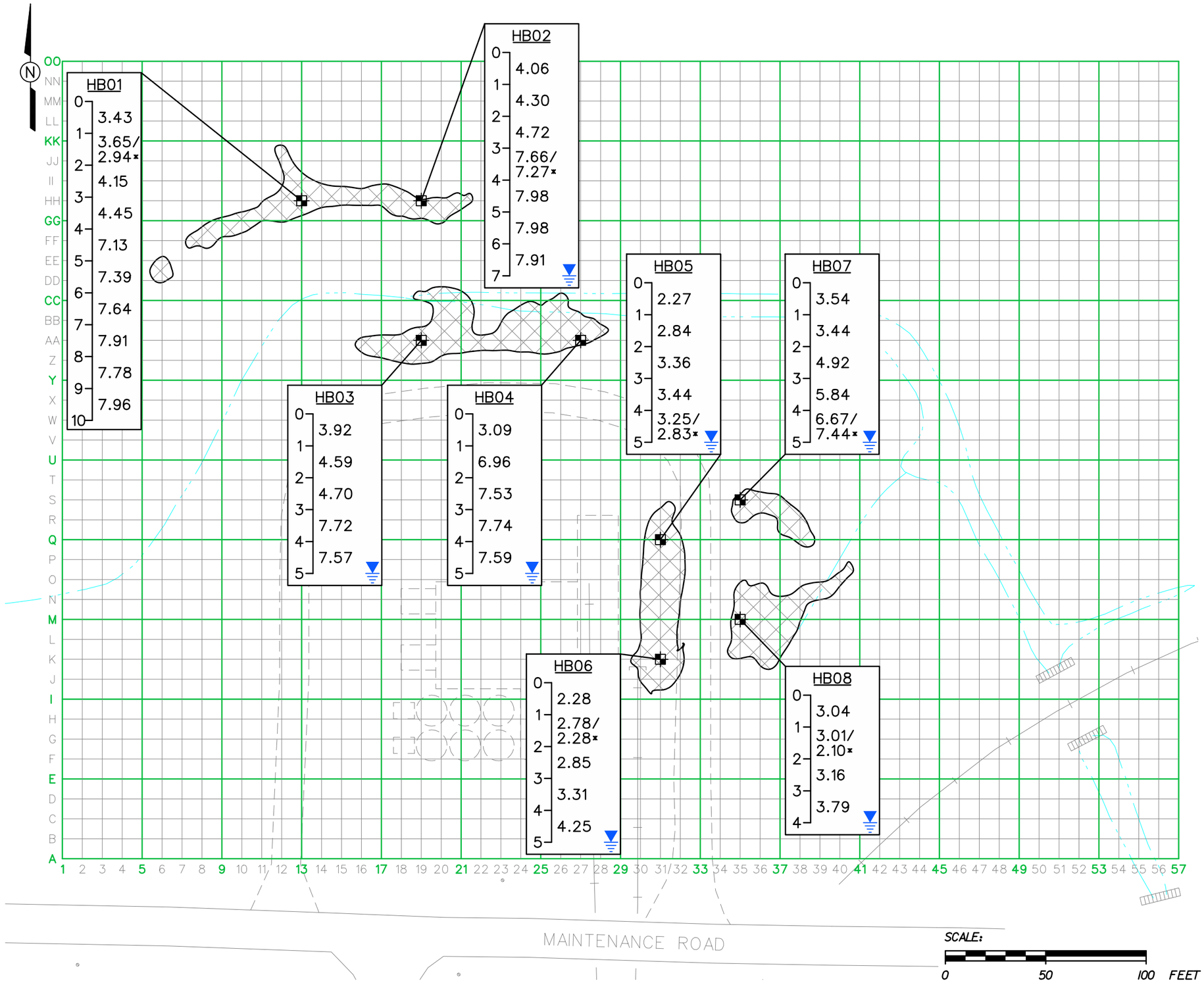

LEGEND:

- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- PHASE I SAMPLING GRID (40 FT. x 40 FT.)
- PHASE II SAMPLING GRID (10 FT. x 10 FT.)
- HAND AUGER SAMPLING LOCATION
- STATIC WATER LEVEL

BORING ID

FEET BELOW GROUND SURFACE

0 3.04
1 3.01/2.10*
2 3.16
3 3.79
4

pH RESULT (FIELD/LAB*)

FIGURE 4-5
SUBSURFACE SOIL pH SAMPLING RESULTS

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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NOTES:

1. FSB - FORMER SELLITE BUILDING.
2. ULA - UNLOADING AREA.
3. ULA WELL AND PIEZOMETER DATA INCLUDED FOR INFORMATIONAL PURPOSES ONLY.

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- PIEZOMETER
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- 629.22 GROUNDWATER ELEVATION (FT. MSL)
- —632— GROUNDWATER ELEVATION CONTOUR (FT. MSL) (DASHED WHERE INFERRED)
- G.W. FLOW GROUNDWATER FLOW DIRECTION

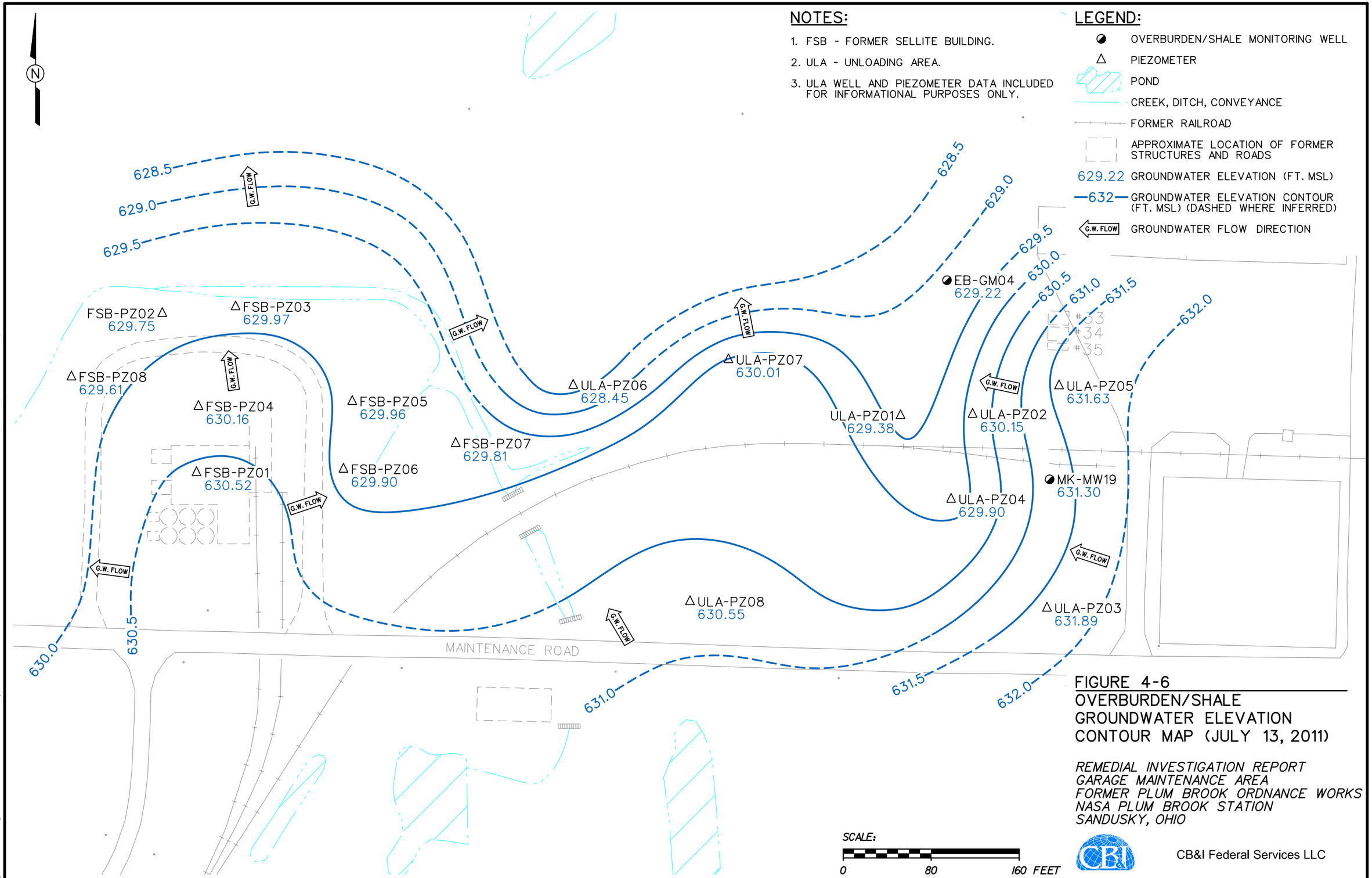

FIGURE 4-6
OVERBURDEN/SHALE GROUNDWATER ELEVATION CONTOUR MAP (JULY 13, 2011)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

SCALE:
0 80 160 FEET

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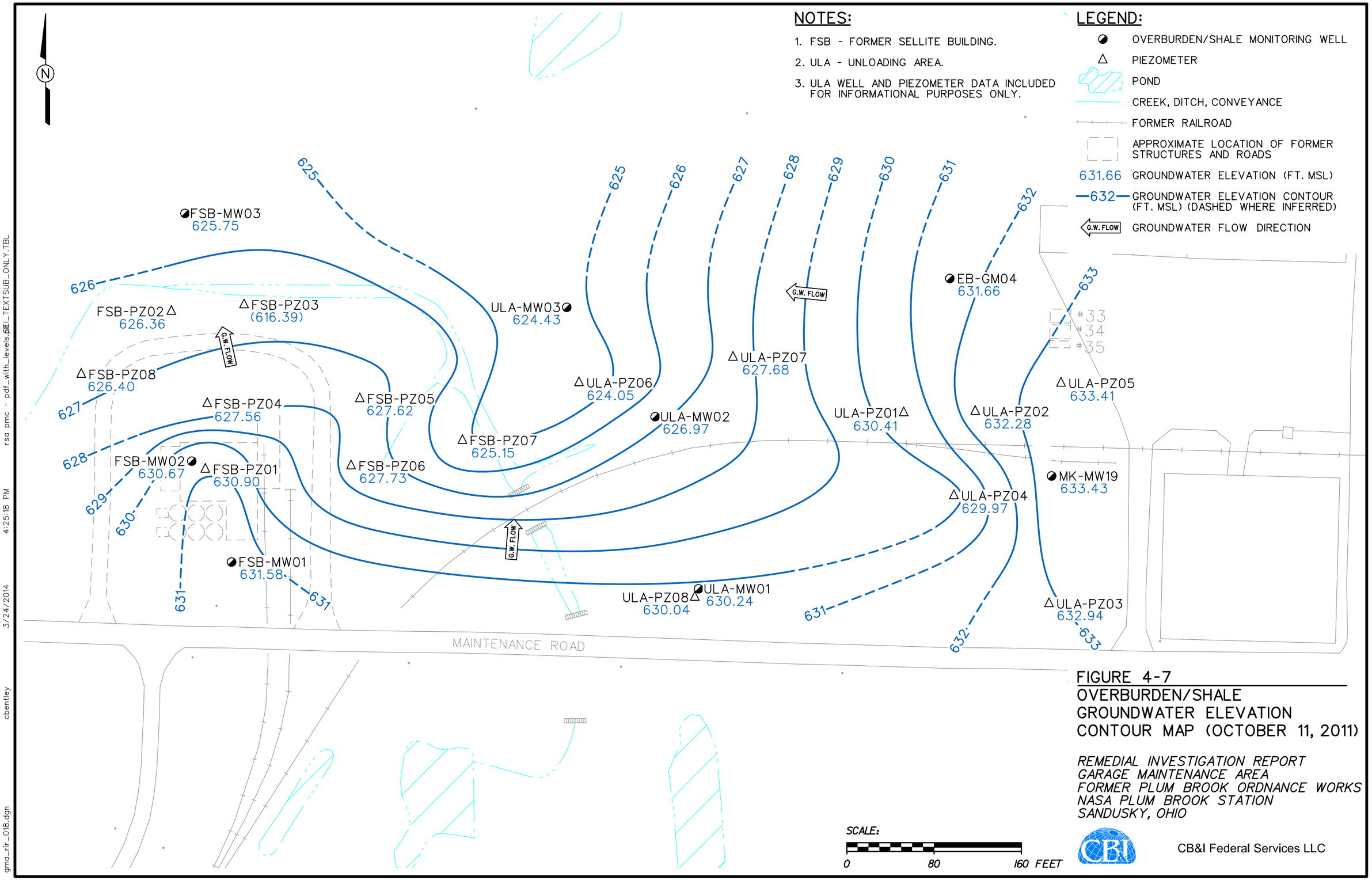

FIGURE 4-7
OVERBURDEN/SHALE GROUNDWATER ELEVATION CONTOUR MAP (OCTOBER 11, 2011)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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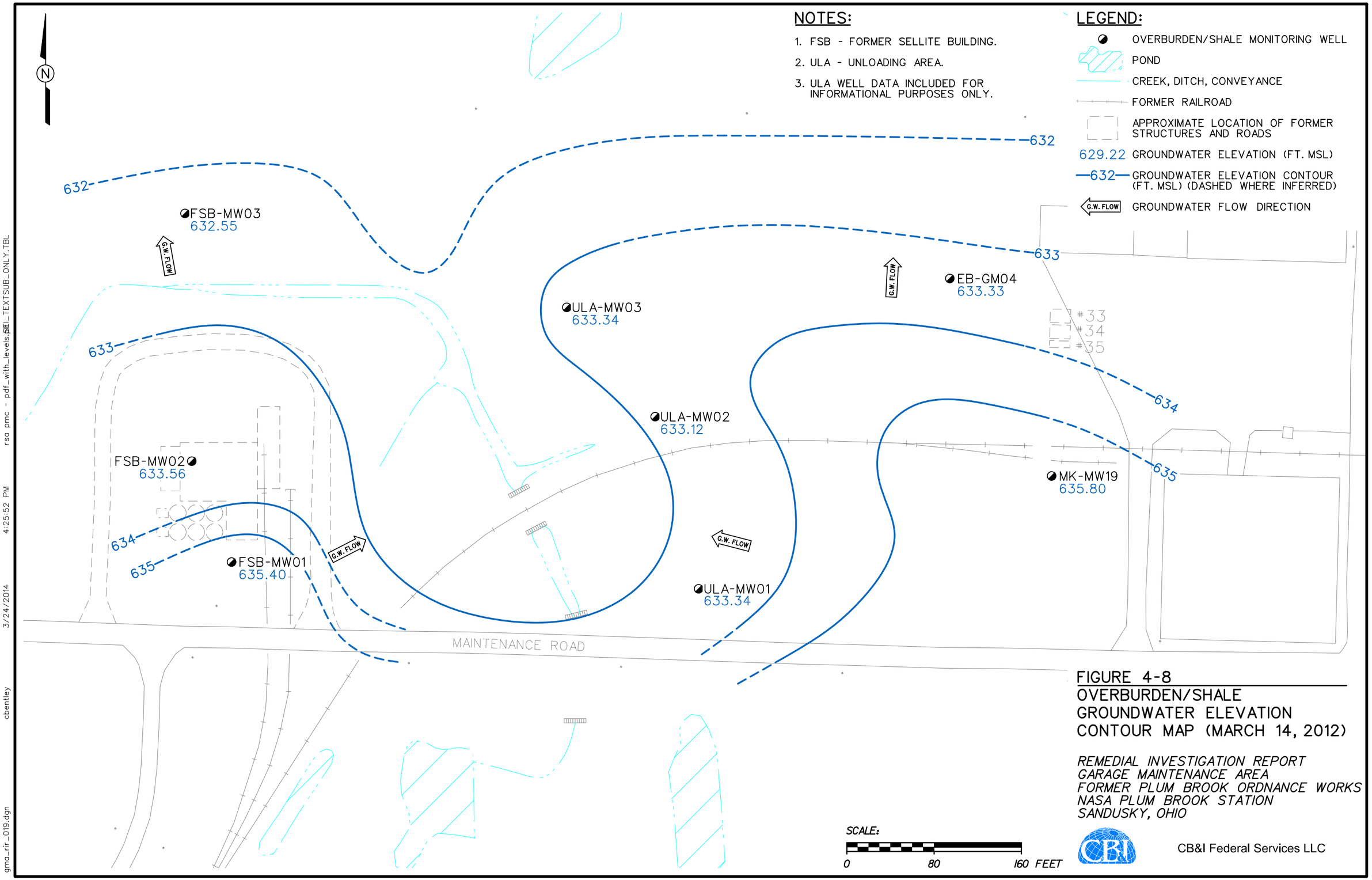

FIGURE 4-8
OVERBURDEN/SHALE GROUNDWATER ELEVATION CONTOUR MAP (MARCH 14, 2012)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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				LOCATION CODE	FSB-SS16	
				SAMPLE NUMBER	FSB0072	
				SAMPLE DATE	8-Nov-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1268	mg/kg	0.22	NE	1,500	5.67	

				LOCATION CODE	FSB-SS01	
				SAMPLE NUMBER	FSB0055	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1260	mg/kg	0.22	NE	41.1	4.46	J
Aroclor 1268	mg/kg	0.22	NE	1,500	11.8	J

				LOCATION CODE	FSB-SS15	
				SAMPLE NUMBER	FSB0071	
				SAMPLE DATE	8-Nov-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1260	mg/kg	0.22	NE	41.1	3.04	J
Aroclor 1268	mg/kg	0.22	NE	1,500	22.6	J

				LOCATION CODE	FSB-SB05	
				SAMPLE NUMBER	FSB0007	
				SAMPLE DATE	20-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	6.84	J
Aroclor 1260	mg/kg	0.22	NE	41.1	5.44	J
Aroclor 1268	mg/kg	0.22	NE	1,500	1.55	J

				LOCATION CODE	FSB-SS03	
				SAMPLE NUMBER	FSB0057	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1260	mg/kg	0.22	NE	41.1	2.64	J
Aroclor 1268	mg/kg	0.22	NE	1,500	8.76	J

				LOCATION CODE	FSB-SS24	
				SAMPLE NUMBER	FSB0082	
				SAMPLE DATE	8-Nov-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.664	J
Aroclor 1260	mg/kg	0.22	NE	41.1	0.986	J
Aroclor 1268	mg/kg	0.22	NE	1,500	1.07	J

				LOCATION CODE	FSB-SS14	
				SAMPLE NUMBER	FSB0070	
				SAMPLE DATE	8-Nov-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	1.62	J
Aroclor 1260	mg/kg	0.22	NE	41.1	5.34	J
Aroclor 1268	mg/kg	0.22	NE	1,500	7.25	J

				LOCATION CODE	FSB-SS05					
				SAMPLE NUMBER	FSB0059		FSB0060		FSB0069	
				SAMPLE DATE	25-Aug-11		25-Aug-11		25-Aug-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		FD		FS	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
PCBs										
Aroclor 1254	mg/kg	0.11	NE	12.1	4.96	J	4.4	J	8.4	
Aroclor 1260	mg/kg	0.22	NE	41.1	10.2	J	18.8	J	-	-
Aroclor 1268	mg/kg	0.22	NE	1,500	10	J	9.51	J		

				LOCATION CODE	FSB-SS23					
				SAMPLE NUMBER	FSB0079		FSB0080		FSB0081	
				SAMPLE DATE	8-Nov-11		8-Nov-11		8-Nov-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		FD		FS	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
PCBs										
Aroclor 1260	mg/kg	0.22	NE	41.1	19	J	-	-	-	-
Aroclor 1268	mg/kg	0.22	NE	1,500	120	J	71.7	J	1,500	

				LOCATION CODE	FSB-SB09	
				SAMPLE NUMBER	FSB0011	
				SAMPLE DATE	20-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
SEMIVOLATILES						
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	0.0446	J
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	6.37	J
Aroclor 1260	mg/kg	0.22	NE	41.1	18.2	J
Aroclor 1268	mg/kg	0.22	NE	1,500	33.6	J
METALS						
Antimony	mg/kg	3.1	9.3	11.7	**11.7**	
Chromium	mg/kg	0.29	29	39.9	**39.9**	
Lead	mg/kg	400	48.6	4,060	**4,060**	
Mercury	mg/kg	1	0.09	2.1	**2.1**	

				LOCATION CODE	FSB-SS07	
				SAMPLE NUMBER	FSB0062	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	12.1	J
Aroclor 1260	mg/kg	0.22	NE	41.1	41.1	J
Aroclor 1268	mg/kg	0.22	NE	1,500	35.5	J

				LOCATION CODE	FSB-SB15	
				SAMPLE NUMBER	FSB0051	
				SAMPLE DATE	30-Jun-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
SEMIVOLATILES						
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	0.0273	J
PCBs						
Aroclor 1268	mg/kg	0.22	NE	1,500	0.678	

				LOCATION CODE	FSB-SS02	
				SAMPLE NUMBER	FSB0056	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	2.53	J
Aroclor 1260	mg/kg	0.22	NE	41.1	5.68	J
Aroclor 1268	mg/kg	0.22	NE	1,500	4.97	J

				LOCATION CODE	FSB-SB08	
				SAMPLE NUMBER	FSB0010	
				SAMPLE DATE	17-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
METALS						
Vanadium	mg/kg	39	40.9	67.1	**67.1**	

				LOCATION CODE	FSB-SB01	
				SAMPLE NUMBER	FSB0001	
				SAMPLE DATE	19-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	4.82	J
Aroclor 1260	mg/kg	0.22	NE	41.1	6.68	J
Aroclor 1268	mg/kg	0.22	NE	1,500	2.3	J

				LOCATION CODE	FSB-SS04	
				SAMPLE NUMBER	FSB0058	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.7	J
Aroclor 1260	mg/kg	0.22	NE	41.1	2.51	J
Aroclor 1268	mg/kg	0.22	NE	1,500	0.824	J

				LOCATION CODE	FSB-SS06	
				SAMPLE NUMBER	FSB0061	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.868	J
Aroclor 1260	mg/kg	0.22	NE	41.1	1.41	J
Aroclor 1268	mg/kg	0.22	NE	1,500	0.371	J

				LOCATION CODE	FSB-SB12	
				SAMPLE NUMBER	FSB0014	
				SAMPLE DATE	17-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.138	

				LOCATION CODE	FSB-SB13			
				SAMPLE NUMBER	FSB0015		FSB0049	
				SAMPLE DATE	17-May-11		17-May-11	
				DEPTH	0 - 1 Ft		8 - 10 Ft	
				SAMPLE PURPOSE	REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
PCBs								
Aroclor 1254	mg/kg	0.11	NE	12.1	0.138			
METALS								
Aluminum	mg/kg	7,700	15,500	19,700	424		**19,700**	

				LOCATION CODE	FSB-SS18	
				SAMPLE NUMBER	FSB0074	
				SAMPLE DATE	8-Nov-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	1.89	J
Aroclor 1260	mg/kg	0.22	NE	41.1	3.71	J
Aroclor 1268	mg/kg	0.22	NE	1,500	16.5	J

				LOCATION CODE	FSB-SB03			
				SAMPLE NUMBER	FSB0003		FSB0005	
				SAMPLE DATE	20-May-11		20-May-11	
				DEPTH	0 - 1 Ft		0 - 1 Ft	
				SAMPLE PURPOSE	REG		FS	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
SEMIVOLATILES								
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	-	-	0.024	
PCBs								
Aroclor 1260	mg/kg	0.22	NE	41.1	0.12	J	2.9	J

				LOCATION CODE	FSB-SB04	
				SAMPLE NUMBER	FSB0006	
				SAMPLE DATE	16-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	4.58	J
Aroclor 1260	mg/kg	0.22	NE	41.1	3.53	J

				LOCATION CODE	FSB-SS10	
				SAMPLE NUMBER	FSB0065	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	7.63	J
Aroclor 1260	mg/kg	0.22	NE	41.1	12.3	J
Aroclor 1268	mg/kg	0.22	NE	1,500	4.71	J

				LOCATION CODE	FSB-SS09	
				SAMPLE NUMBER	FSB0064	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	1.72	J
Aroclor 1260	mg/kg	0.22	NE	41.1	1.37	J

				LOCATION CODE	FSB-SB07	
				SAMPLE NUMBER	FSB0009	
				SAMPLE DATE	16-May-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
SEMIVOLATILES						
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	0.0318	J
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.113	J

				LOCATION CODE	FSB-SS27	
				SAMPLE NUMBER	FSB0085	
				SAMPLE DATE	20-Dec-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.379	J
Aroclor 1260	mg/kg	0.22	NE	41.1	0.772	J

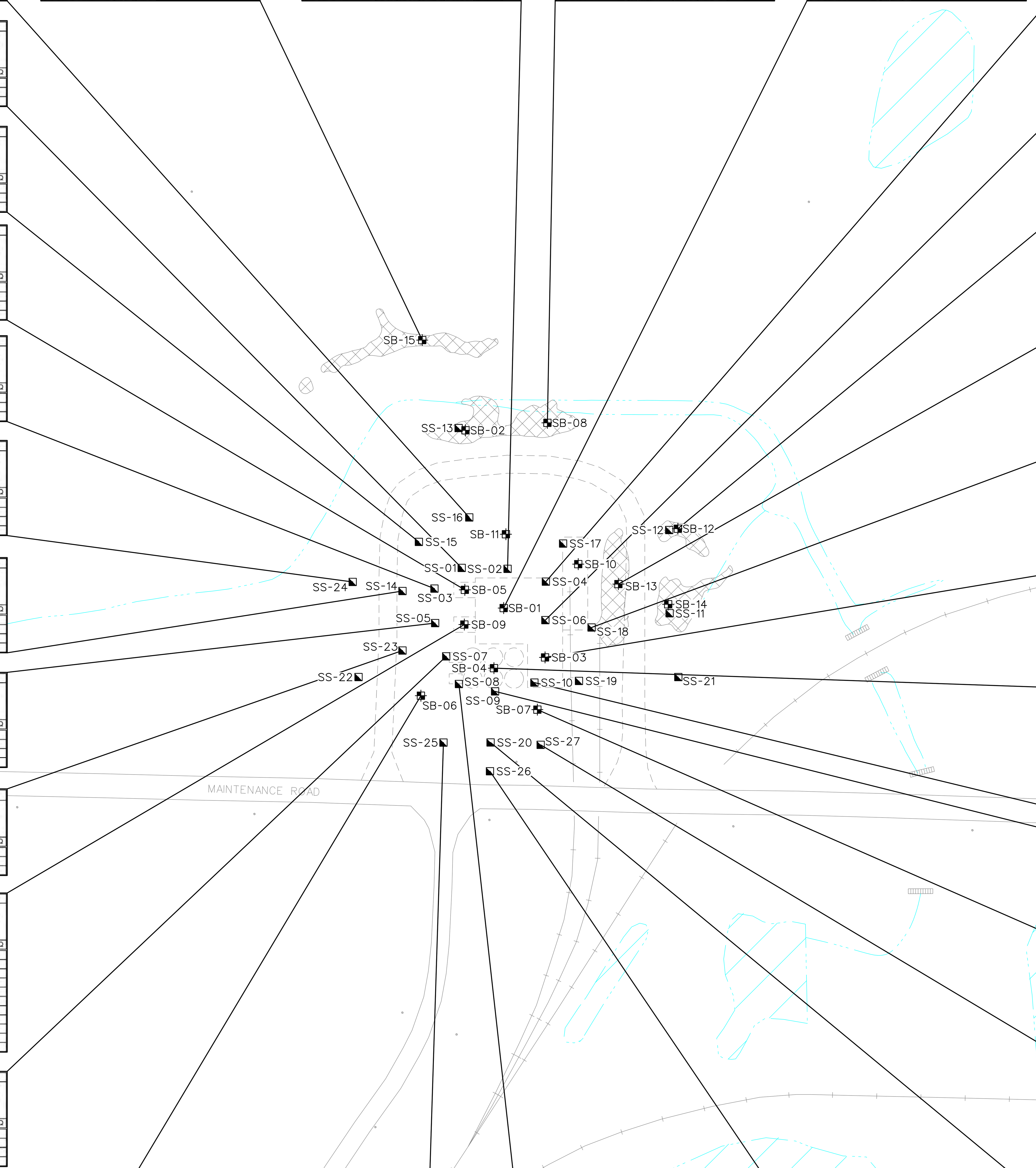
				LOCATION CODE	FSB-SB06			
				SAMPLE NUMBER	FSB0008		FSB0024	
				SAMPLE DATE	16-May-11		16-May-11	
				DEPTH	0 - 1 Ft		3 - 5 Ft	
				SAMPLE PURPOSE	REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
SEMIVOLATILES								
Benzo(a)anthracene	mg/kg	0.15	NE	0.0892	0.0892	J	1.06	
Benzo(a)pyrene	mg/kg	0.015	NE	0.0944	0.0944	J	0.885	
Benzo(b)fluoranthene	mg/kg	0.15	NE	0.132	0.132	J	1.15	
Dibenz(a,h)anthracene	mg/kg	0.015	NE	0.116	-	-	0.116	J
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	NE	0.0637	0.0637	J	0.513	
PCBs								
Aroclor 1254	mg/kg	0.11	NE	12.1	0.133	J	0.462	

				LOCATION CODE	FSB-SS25	
				SAMPLE NUMBER	FSB0083	
				SAMPLE DATE	20-Dec-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	1.33	J
Aroclor 1260	mg/kg	0.22	NE	41.1	2.2	J

				LOCATION CODE	FSB-SS08	
				SAMPLE NUMBER	FSB0063	
				SAMPLE DATE	25-Aug-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.65	J
Aroclor 1260	mg/kg	0.22	NE	41.1	0.757	J

				LOCATION CODE	FSB-SS26	
				SAMPLE NUMBER	FSB0084	
				SAMPLE DATE	20-Dec-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	0.222	J
Aroclor 1260	mg/kg	0.22	NE	41.1	0.291	J

				LOCATION CODE	FSB-SS20	
				SAMPLE NUMBER	FSB0076	
				SAMPLE DATE	8-Nov-11	
				DEPTH	0 - 1 Ft	
				SAMPLE PURPOSE	REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
PCBs						
Aroclor 1254	mg/kg	0.11	NE	12.1	3.94	J
Aroclor 1260	mg/kg	0.22	NE	41.1	3.88	J



LEGEND:

- SURFACE SOIL SAMPLE
- SOIL BORING
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA

mg/kg MILLIGRAMS PER KILOGRAM

NE NOT ESTABLISHED (RBSCs), NOT EVALUATED (BSCs)

\- NOT DETECTED

NOTES:

1. DATA INCLUDES ONLY ANALYTES OF METAL ABOVE BOTH THE RBSC AND BSC.
2. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
3. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
4. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
5. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
6. VALIDATION QUALIFIERS (VQ):
   J - THE ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS ESTIMATED.

FIGURE 4-9
DETECTED CONSTITUENTS AT THE FORMER SELLITE AREA IN SURFACE AND SUBSURFACE SOIL SAMPLES ABOVE RBSCs AND/OR BSCs (MAY, JUNE, AUGUST, NOVEMBER, AND DECEMBER 2011)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

SCALE: 0 60 120 FEET

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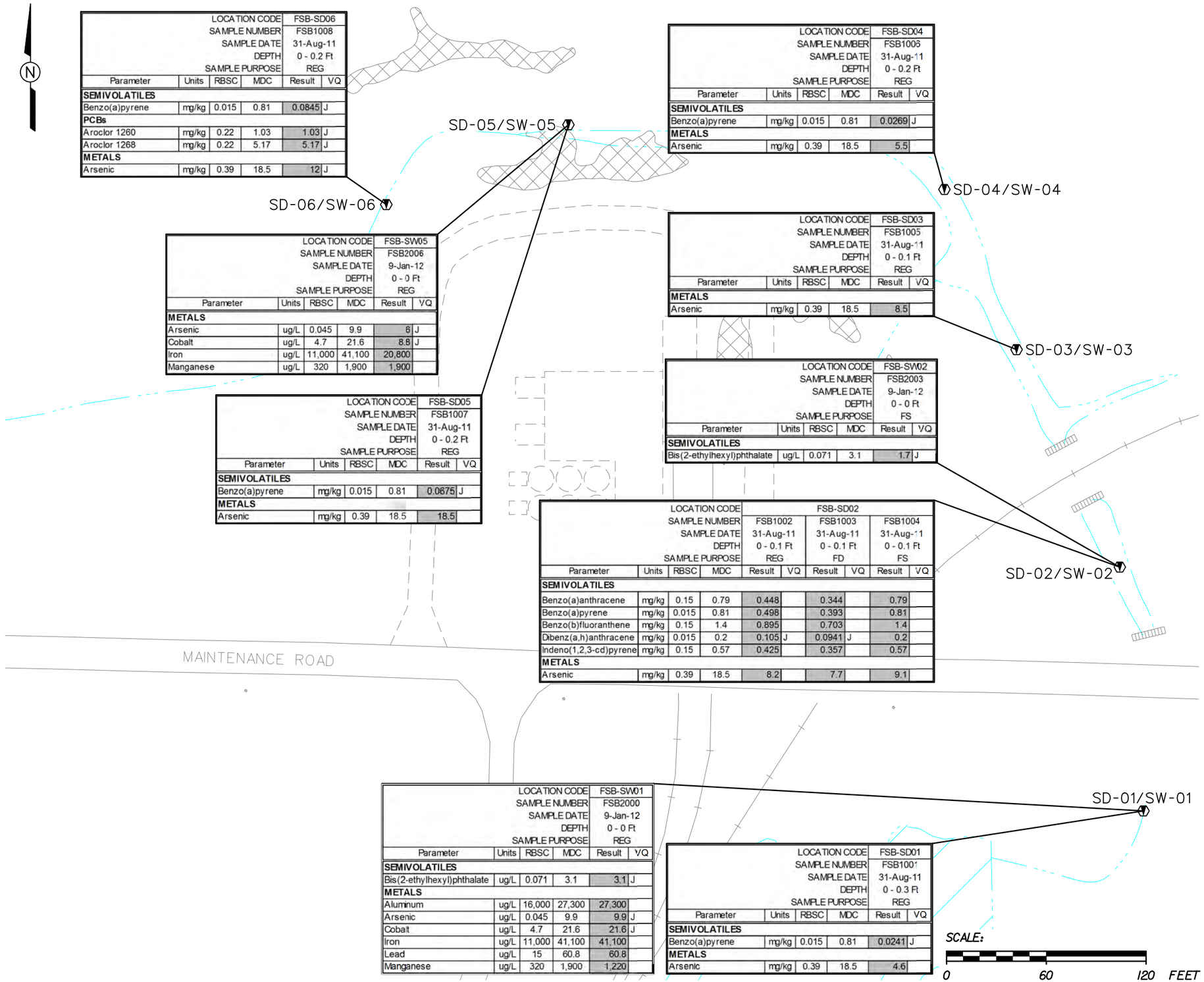

	LOCATION CODE	FSB-SD06			
	SAMPLE NUMBER	FSB1008			
	SAMPLE DATE	31-Aug-11			
	DEPTH	0 - 0.2 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
SEMIVOLATILES					
Benzo(a)pyrene	mg/kg	0.015	0.81	0.0845	J
PCBs					
Aroclor 1260	mg/kg	0.22	1.03	1.03	J
Aroclor 1268	mg/kg	0.22	5.17	5.17	J
METALS					
Arsenic	mg/kg	0.39	18.5	12	J

	LOCATION CODE	FSB-SD04			
	SAMPLE NUMBER	FSB1006			
	SAMPLE DATE	31-Aug-11			
	DEPTH	0 - 0.2 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
SEMIVOLATILES					
Benzo(a)pyrene	mg/kg	0.015	0.81	0.0269	J
METALS					
Arsenic	mg/kg	0.39	18.5	5.5	

	LOCATION CODE	FSB-SW05			
	SAMPLE NUMBER	FSB2006			
	SAMPLE DATE	9-Jan-12			
	DEPTH	0 - 0 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Arsenic	ug/L	0.045	9.9	6	J
Cobalt	ug/L	4.7	21.6	8.8	J
Iron	ug/L	11,000	41,100	20,800	
Manganese	ug/L	320	1,900	1,900	

	LOCATION CODE	FSB-SD03			
	SAMPLE NUMBER	FSB1005			
	SAMPLE DATE	31-Aug-11			
	DEPTH	0 - 0.1 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
METALS					
Arsenic	mg/kg	0.39	18.5	8.5	

	LOCATION CODE	FSB-SW02			
	SAMPLE NUMBER	FSB2003			
	SAMPLE DATE	9-Jan-12			
	DEPTH	0 - 0 Ft			
	SAMPLE PURPOSE	FS			
Parameter	Units	RBSC	MDC	Result	VQ
SEMIVOLATILES					
Bis(2-ethylhexyl)phthalate	ug/L	0.071	3.1	1.7	J

	LOCATION CODE	FSB-SD05			
	SAMPLE NUMBER	FSB1007			
	SAMPLE DATE	31-Aug-11			
	DEPTH	0 - 0.2 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
SEMIVOLATILES					
Benzo(a)pyrene	mg/kg	0.015	0.81	0.0675	J
METALS					
Arsenic	mg/kg	0.39	18.5	18.5	

LOCATION CODE	FSB-SD02								
SAMPLE NUMBER	FSB1002				FSB1003			FSB1004	
SAMPLE DATE	31-Aug-11				31-Aug-11			31-Aug-11	
DEPTH	0 - 0.1 Ft				0 - 0.1 Ft			0 - 0.1 Ft	
SAMPLE PURPOSE	REG				FD			FS	
Parameter	Units	RBSC	MDC	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES									
Benzo(a)anthracene	mg/kg	0.15	0.79	0.448		0.344		0.79	
Benzo(a)pyrene	mg/kg	0.015	0.81	0.498		0.393		0.81	
Benzo(b)fluoranthene	mg/kg	0.15	1.4	0.895		0.703		1.4	
Dibenz(a,h)anthracene	mg/kg	0.015	0.2	0.105	J	0.0941	J	0.2	
Indeno(1,2,3-cd)pyrene	mg/kg	0.15	0.57	0.425		0.357		0.57	
METALS									
Arsenic	mg/kg	0.39	18.5	8.2		7.7		9.1	

	LOCATION CODE	FSB-SW01			
	SAMPLE NUMBER	FSB2000			
	SAMPLE DATE	9-Jan-12			
	DEPTH	0 - 0 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
SEMIVOLATILES					
Bis(2-ethylhexyl)phthalate	ug/L	0.071	3.1	3.1	J
METALS					
Aluminum	ug/L	16,000	27,300	27,300	
Arsenic	ug/L	0.045	9.9	9.9	J
Cobalt	ug/L	4.7	21.6	21.6	J
Iron	ug/L	11,000	41,100	41,100	
Lead	ug/L	15	60.8	60.8	
Manganese	ug/L	320	1,900	1,220	

	LOCATION CODE	FSB-SD01			
	SAMPLE NUMBER	FSB1001			
	SAMPLE DATE	31-Aug-11			
	DEPTH	0 - 0.3 Ft			
	SAMPLE PURPOSE	REG			
Parameter	Units	RBSC	MDC	Result	VQ
SEMIVOLATILES					
Benzo(a)pyrene	mg/kg	0.015	0.81	0.0241	J
METALS					
Arsenic	mg/kg	0.39	18.5	4.6	

SCALE:

0 60 120 FEET

LEGEND:

- SURFACE WATER / SEDIMENT SAMPLE
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- ug/L MICROGRAMS PER LITER
- mg/kg MILLIGRAMS PER KILOGRAM

NOTES:

1. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
2. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
3. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
4. VALIDATION QUALIFIERS (VQ):
   J - THE ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS ESTIMATED.

FIGURE 4-10

DETECTED CONSTITUENTS AT THE FORMER SELLITE AREA IN SURFACE WATER (JANUARY 2012) AND SEDIMENT SAMPLES (AUGUST 2011) ABOVE RBSCs

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

CB&I Federal Services LLC

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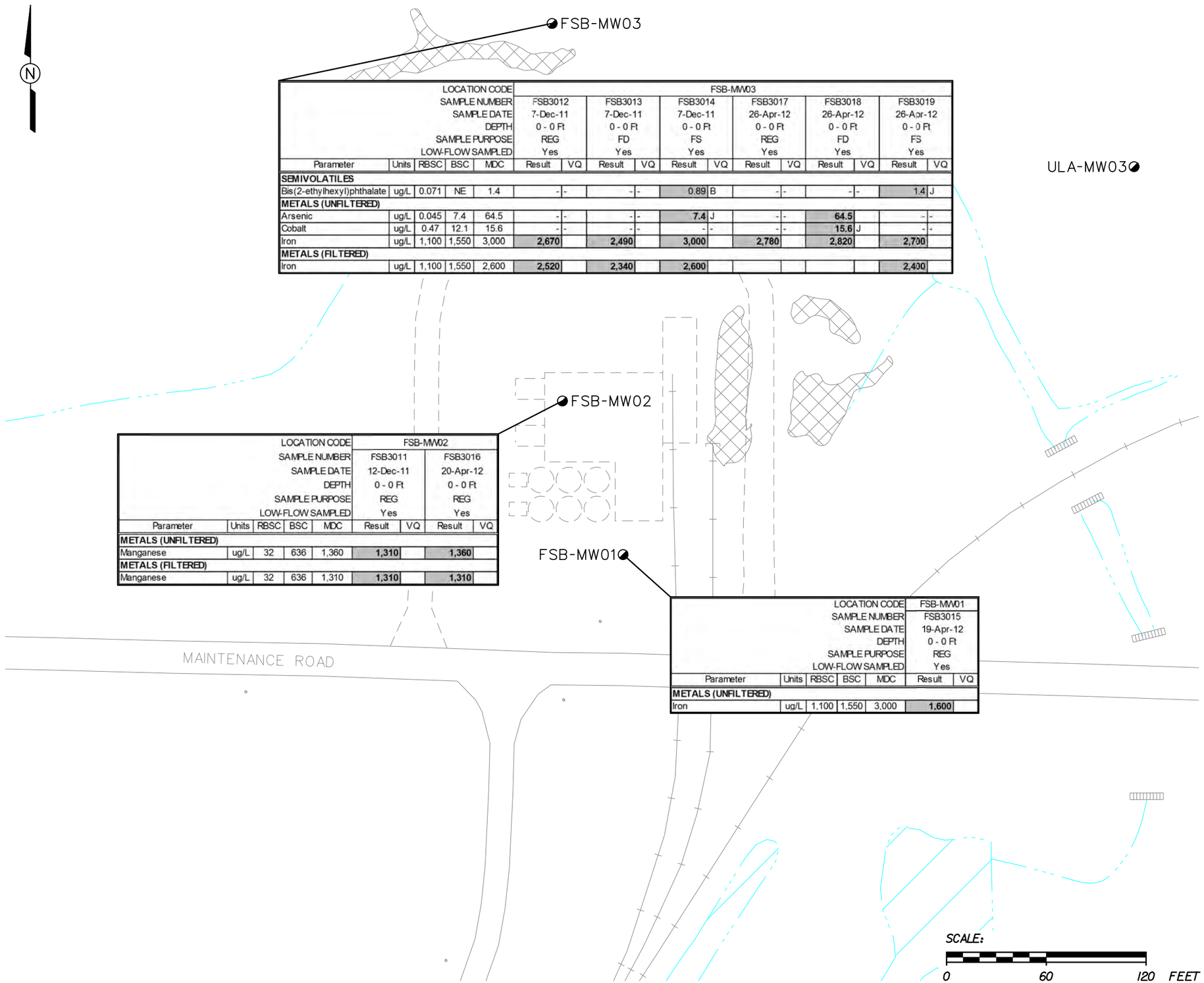

LOCATION CODE					FSB-MW03											
SAMPLE NUMBER					FSB3012		FSB3013		FSB3014		FSB3017		FSB3018		FSB3019	
SAMPLE DATE					7-Dec-11		7-Dec-11		7-Dec-11		26-Apr-12		26-Apr-12		26-Apr-12	
DEPTH					0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft		0 - 0 Ft	
SAMPLE PURPOSE					REG		FD		FS		REG		FD		FS	
LOW-FLOW SAMPLED					Yes		Yes		Yes		Yes		Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES																
Bis(2-ethylhexyl)phthalate	ug/L	0.071	NE	1.4	-	-	-	-	0.89	B	-	-	-	-	1.4	J
METALS (UNFILTERED)																
Arsenic	ug/L	0.045	7.4	64.5	-	-	-	-	**7.4**	J	-	-	**64.5**		-	-
Cobalt	ug/L	0.47	12.1	15.6	-	-	-	-	-	-	-	-	**15.6**	J	-	-
Iron	ug/L	1,100	1,550	3,000	**2,670**		**2,490**		**3,000**		**2,780**		**2,820**		**2,700**	
METALS (FILTERED)																
Iron	ug/L	1,100	1,550	2,600	**2,520**		**2,340**		**2,600**						**2,400**	

LOCATION CODE					FSB-MW02			
SAMPLE NUMBER					FSB3011		FSB3016	
SAMPLE DATE					12-Dec-11		20-Apr-12	
DEPTH					0 - 0 Ft		0 - 0 Ft	
SAMPLE PURPOSE					REG		REG	
LOW-FLOW SAMPLED					Yes		Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
METALS (UNFILTERED)								
Manganese	ug/L	32	636	1,360	**1,310**		**1,360**	
METALS (FILTERED)								
Manganese	ug/L	32	636	1,310	**1,310**		**1,310**	

LOCATION CODE					FSB-MW01	
SAMPLE NUMBER					FSB3015	
SAMPLE DATE					19-Apr-12	
DEPTH					0 - 0 Ft	
SAMPLE PURPOSE					REG	
LOW-FLOW SAMPLED					Yes	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
METALS (UNFILTERED)						
Iron	ug/L	1,100	1,550	3,000	**1,600**	

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- ug/L — MICROGRAMS PER LITER
- NE — NOT ESTABLISHED (RBSCs); NOT EVALUATED (BSCs)
- \- — NOT DETECTED

NOTES:

1. DATA INCLUDES ONLY ANALYTES OF METAL ABOVE BOTH THE RBSC AND BSC.
2. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
3. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
4. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
5. MDC IS MAXIMUM DETECTED CONCENTRATION FOR THE INVESTIGATION AREA ("B" QUALIFIED DATA NOT INCLUDED).
6. VALIDATION QUALIFIERS (VQ):
   - J - THE ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS ESTIMATED.
   - B- THE ANALYTE WAS DETECTED IN A LAB OR FIELD BLANK.

FIGURE 4-11

DETECTED CONSTITUENTS AT THE FORMER SELLITE AREA IN OVERBURDEN/SHALE GROUNDWATER SAMPLES ABOVE RBSCs AND BSCs (DECEMBER 2011 AND APRIL 2012)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

CB&I Federal Services LLC

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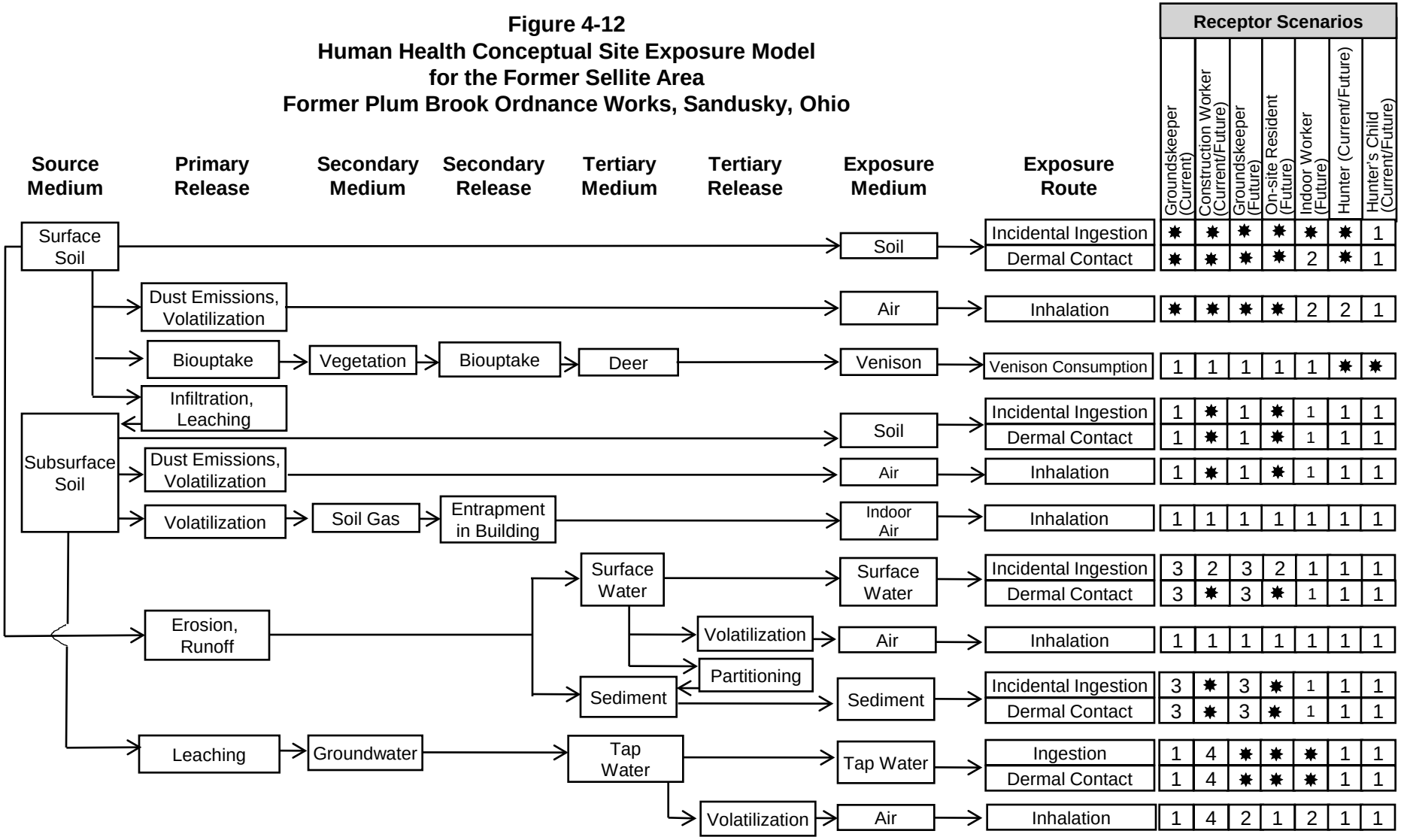
Figure 4-12
Human Health Conceptual Site Exposure Model
for the Former Sellite Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

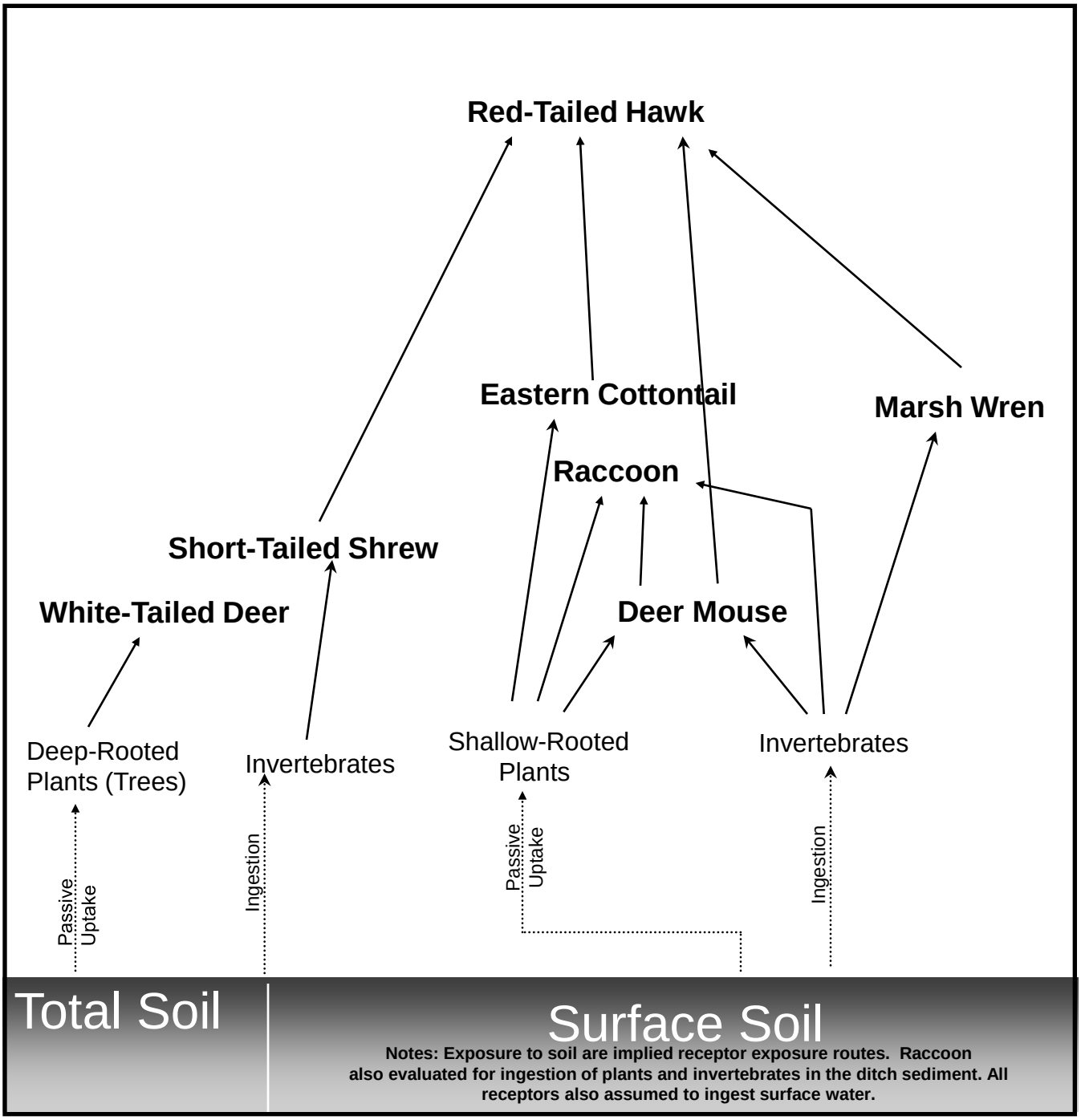


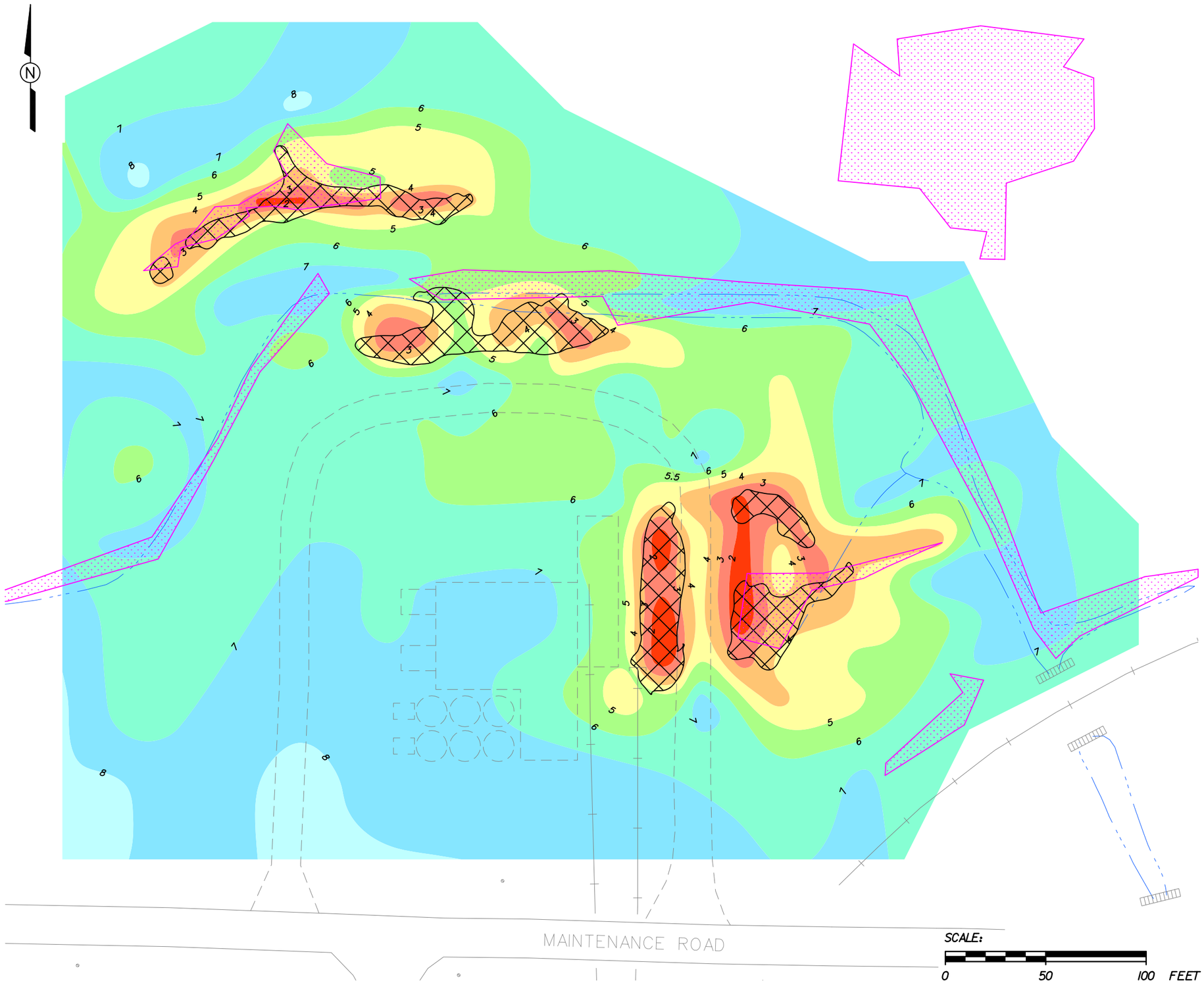
Exposure Route	Groundskeeper (Current)	Construction Worker (Current/Future)	Groundskeeper (Future)	On-site Resident (Future)	Indoor Worker (Future)	Hunter (Current/Future)	Hunter's Child (Current/Future)
Incidental Ingestion	✸	✸	✸	✸	✸	✸	1
Dermal Contact	✸	✸	✸	✸	2	✸	1
Inhalation	✸	✸	✸	✸	2	2	1
Venison Consumption	1	1	1	1	1	✸	✸
Incidental Ingestion	1	✸	1	✸	1	1	1
Dermal Contact	1	✸	1	✸	1	1	1
Inhalation	1	✸	1	✸	1	1	1
Inhalation	1	1	1	1	1	1	1
Incidental Ingestion	3	2	3	2	1	1	1
Dermal Contact	3	✸	3	✸	1	1	1
Inhalation	1	1	1	1	1	1	1
Incidental Ingestion	3	✸	3	✸	1	1	1
Dermal Contact	3	✸	3	✸	1	1	1
Ingestion	1	4	✸	✸	✸	1	1
Dermal Contact	1	4	✸	✸	✸	1	1
Inhalation	1	4	2	1	2	1	1

✸ = Complete exposure route quantified in the risk assessment.
1 = There is no plausible pathway for exposure to this medium.
2 = Although theoretically complete, this pathway is not quantified as explained in text.
3 = Contact with this medium, although plausible, is not part of this receptor's normal or expected activities; therefore contact would be sporadic and is not quantified.
4 = For current use there is no plausible exposure pathway. For future use, the pathway is potentially complete, but is not quantified as explained in the text.

Figure 4-13

Simplified Terrestrial Food Web Conceptual Site Model for the Former Sellite Area Former Plum Brook Ordnance Works, Sandusky, Ohio





LEGEND:

- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- BARREN AREA
- WETLAND AREA (ENVIROSCIENCE, 2012) (NOTE 1)

pH ISOCONTOUR KEY (S.U.):

- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9

NOTE:

1. WETLANDS AT PLUM BROOK HAVE BEEN FORMALLY DELINEATED BUT ARE CURRENTLY NOT JURISDICTIONAL. SEE TEXT FOR DETAILS.

FIGURE 4-14
SPATIAL RELATIONSHIP OF SOIL pH, BARREN AREAS, AND WETLANDS AT THE FORMER SELLITE AREA

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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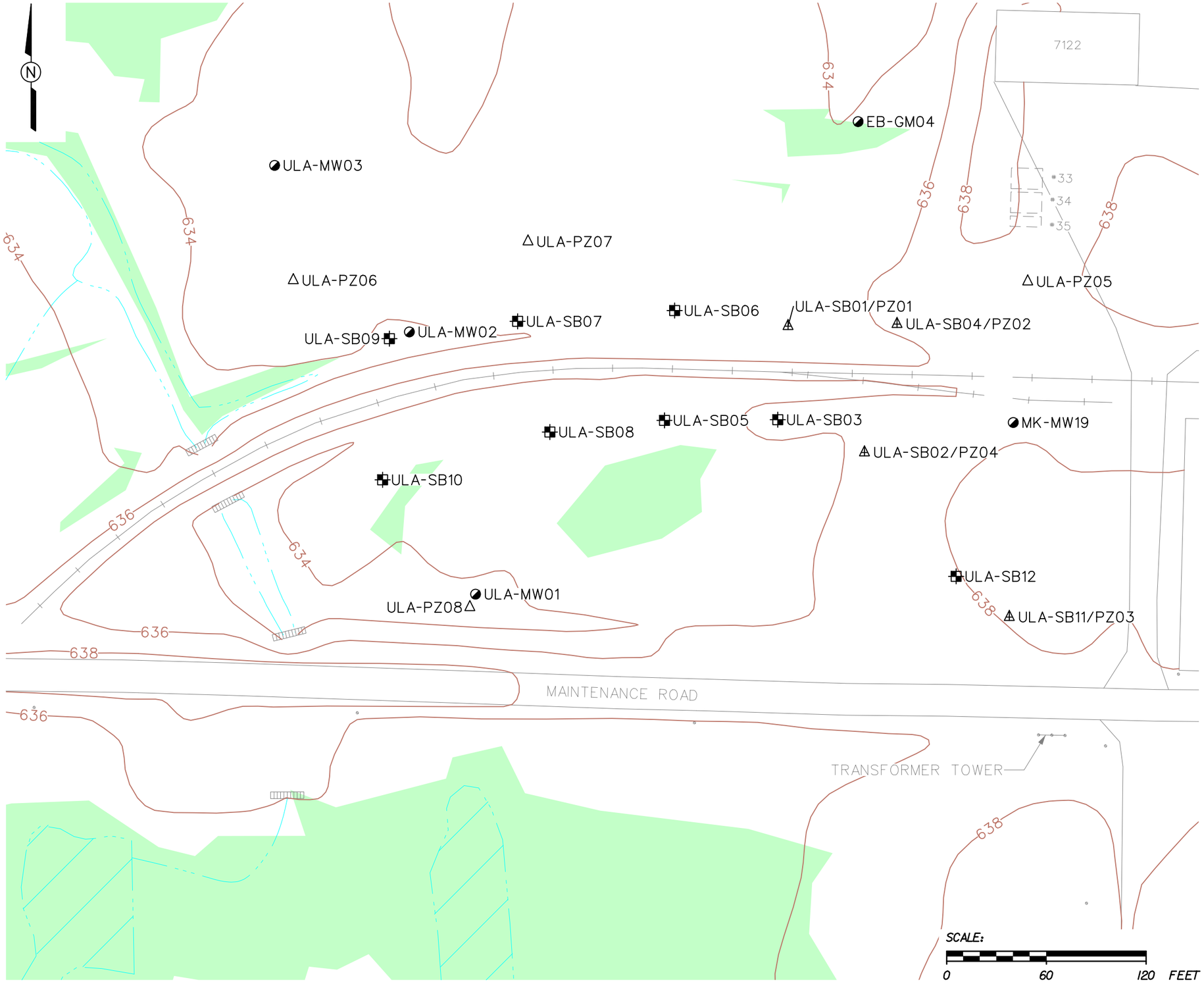

LEGEND:

- OVERBURDEN MONITORING WELL
- SOIL BORING
- SOIL BORING / PIEZOMETER
- PIEZOMETER
- POND
- CREEK, DITCH, CONVEYANCE
- WETLAND AREA (ENVIROSCIENCE, 2012) (NOTE 1)
- FORMER RAILROAD
- ROAD
- FORMER UNDERGROUND STORAGE TANK (NOTE 2)
- 634 TOPOGRAPHIC CONTOUR (2 FT. INTERVAL)

NOTES:

1. WETLANDS AT PLUM BROOK HAVE BEEN FORMALLY DELINEATED BUT ARE CURRENTLY NOT JURISDICTIONAL. SEE TEXT FOR DETAILS.
2. UNDERGROUND STORAGE TANKS #33, #34, AND #35 REMOVED IN 1989.

FIGURE 5-1

GENERAL SITE FEATURES OF THE UNLOADING AREA WITH SITE TOPOGRAPHY AND SAMPLING LOCATIONS

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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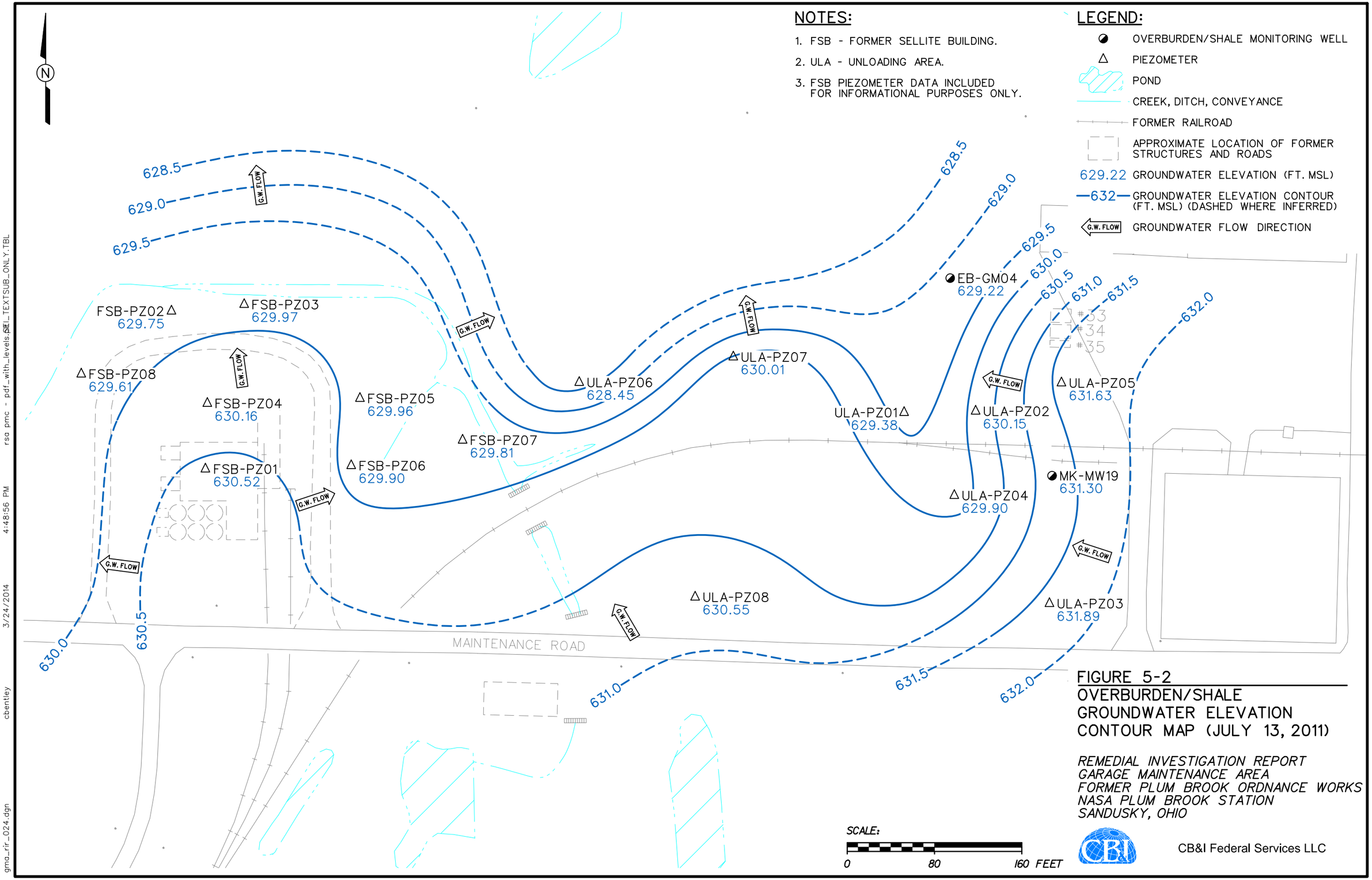

NOTES:

1. FSB - FORMER SELLITE BUILDING.
2. ULA - UNLOADING AREA.
3. FSB PIEZOMETER DATA INCLUDED FOR INFORMATIONAL PURPOSES ONLY.

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- PIEZOMETER
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- 629.22 GROUNDWATER ELEVATION (FT. MSL)
- —632— GROUNDWATER ELEVATION CONTOUR (FT. MSL) (DASHED WHERE INFERRED)
- G.W. FLOW GROUNDWATER FLOW DIRECTION

FIGURE 5-2
OVERBURDEN/SHALE GROUNDWATER ELEVATION CONTOUR MAP (JULY 13, 2011)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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NOTES:

1. FSB - FORMER SELLITE BUILDING.
2. ULA - UNLOADING AREA.
3. FSB WELL AND PIEZOMETER DATA INCLUDED FOR INFORMATIONAL PURPOSES ONLY.

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- PIEZOMETER
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- APPROXIMATE LOCATION OF FORMER STRUCTURES AND ROADS
- 631.66 GROUNDWATER ELEVATION (FT. MSL)
- —632— GROUNDWATER ELEVATION CONTOUR (FT. MSL) (DASHED WHERE INFERRED)
- G.W. FLOW GROUNDWATER FLOW DIRECTION

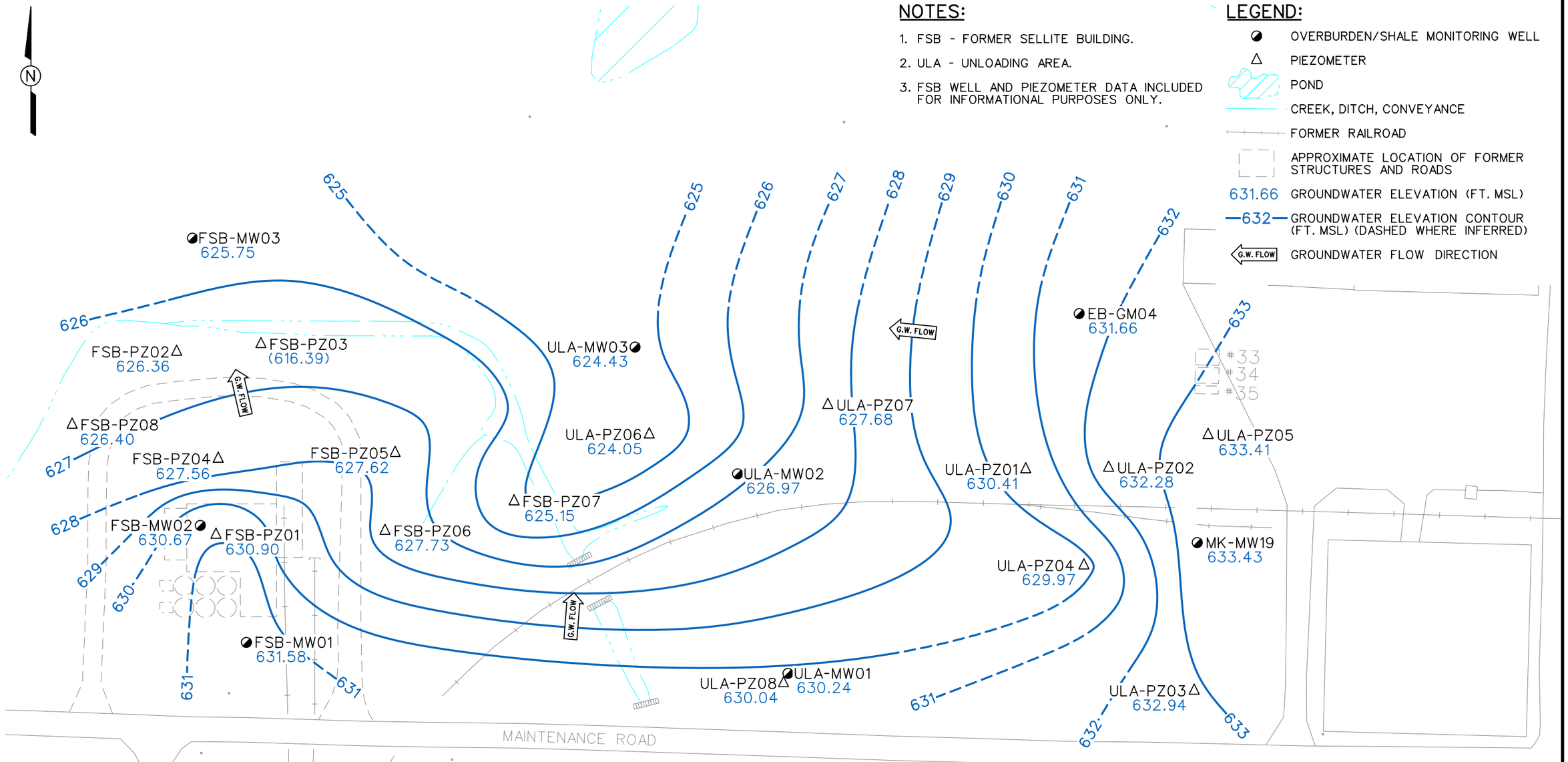

FIGURE 5-3
OVERBURDEN/SHALE GROUNDWATER ELEVATION CONTOUR MAP (OCTOBER 11, 2011)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
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SCALE:
0 80 160 FEET

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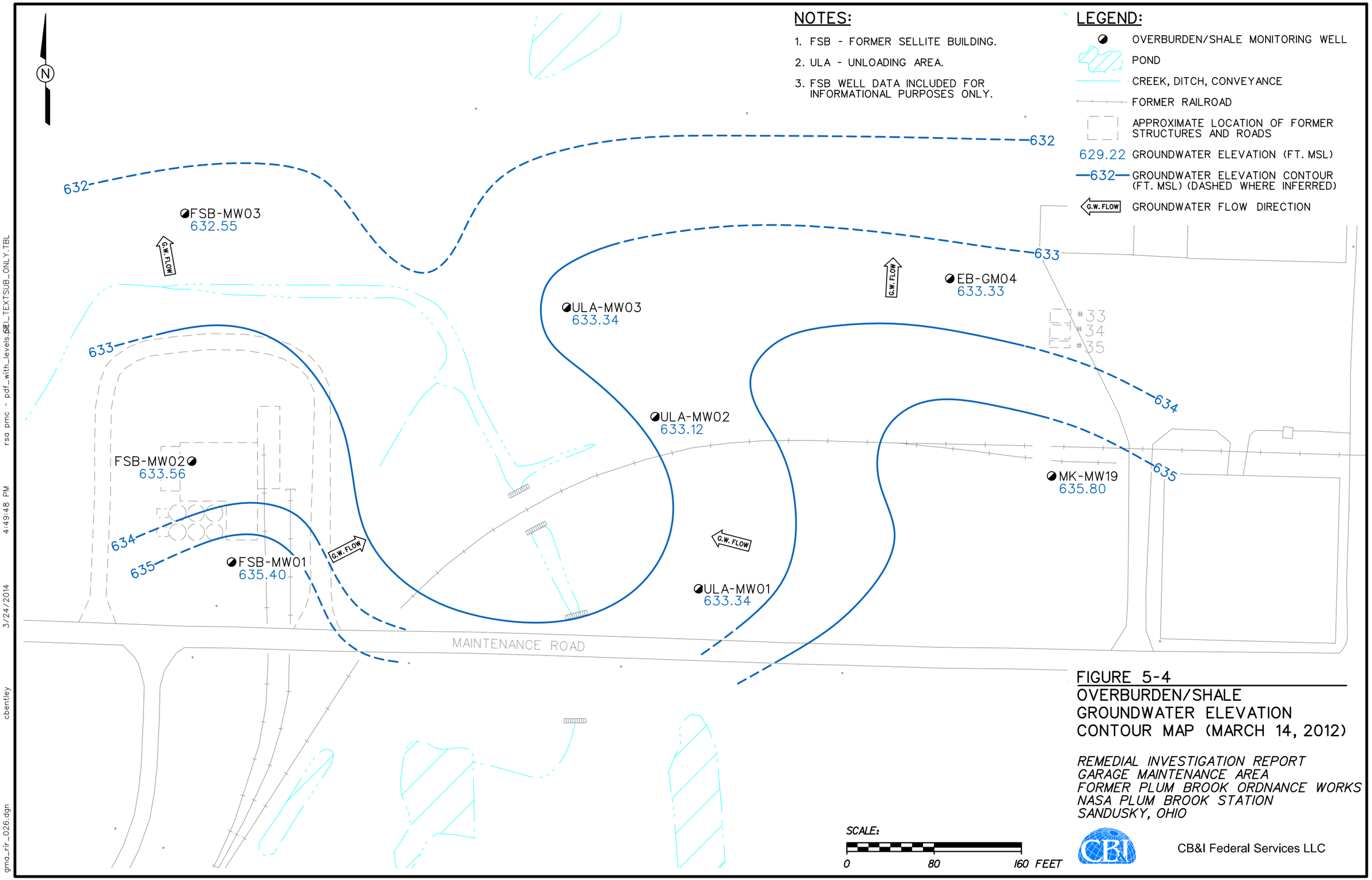

FIGURE 5-4
OVERBURDEN/SHALE GROUNDWATER ELEVATION CONTOUR MAP (MARCH 14, 2012)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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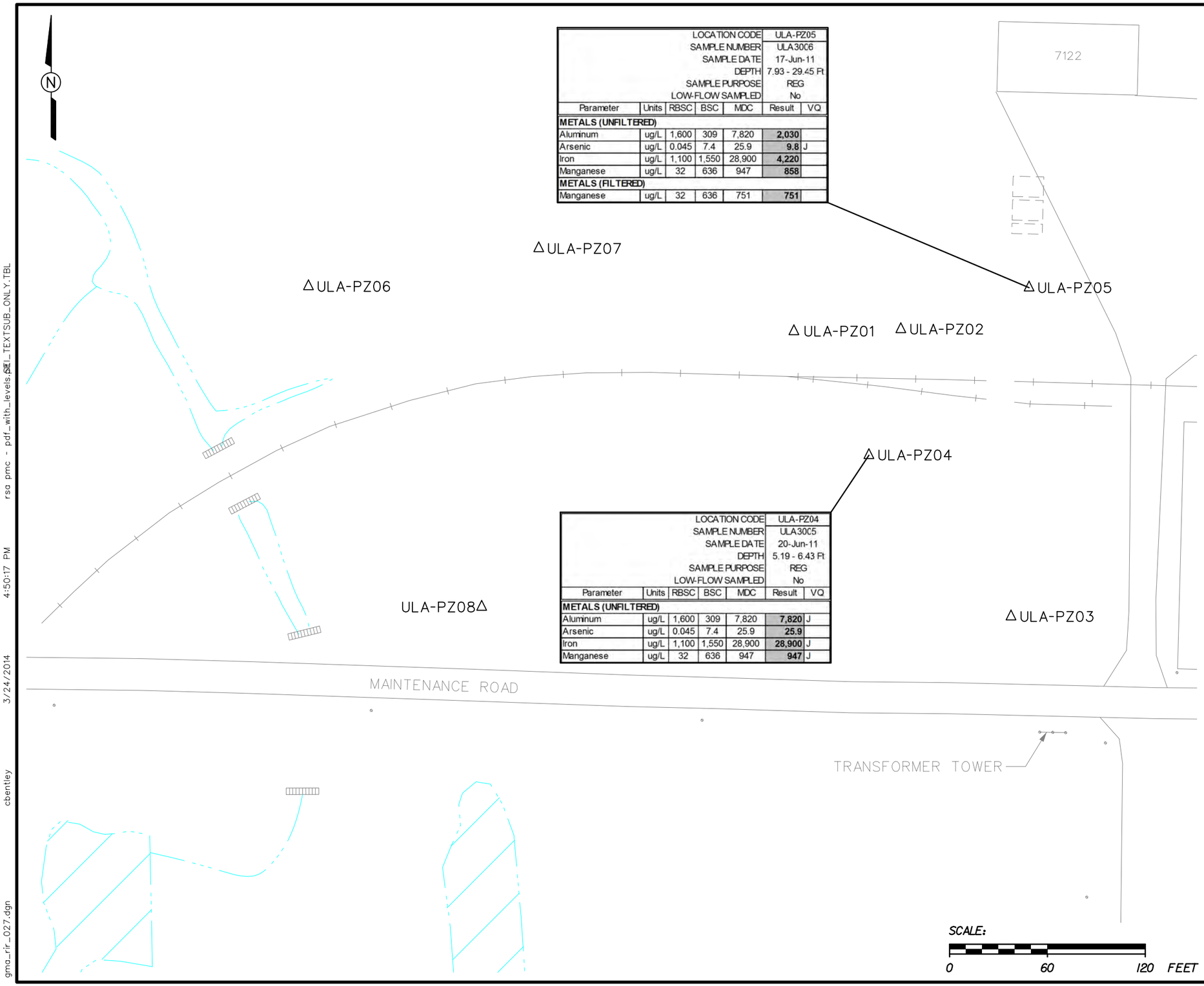

				LOCATION CODE	ULA-PZ05	
				SAMPLE NUMBER	ULA3006	
				SAMPLE DATE	17-Jun-11	
				DEPTH	7.93 - 29.45 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
METALS (UNFILTERED)						
Aluminum	ug/L	1,600	309	7,820	**2,030**	
Arsenic	ug/L	0.045	7.4	25.9	**9.8**	J
Iron	ug/L	1,100	1,550	28,900	**4,220**	
Manganese	ug/L	32	636	947	**858**	
METALS (FILTERED)						
Manganese	ug/L	32	636	751	**751**	

				LOCATION CODE	ULA-PZ04	
				SAMPLE NUMBER	ULA3005	
				SAMPLE DATE	20-Jun-11	
				DEPTH	5.19 - 6.43 Ft	
				SAMPLE PURPOSE	REG	
				LOW-FLOW SAMPLED	No	
Parameter	Units	RBSC	BSC	MDC	Result	VQ
METALS (UNFILTERED)						
Aluminum	ug/L	1,600	309	7,820	**7,820**	J
Arsenic	ug/L	0.045	7.4	25.9	**25.9**	
Iron	ug/L	1,100	1,550	28,900	**28,900**	J
Manganese	ug/L	32	636	947	**947**	J

LEGEND:

- △ PIEZOMETER
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FORMER UNDERGROUND STORAGE TANK
- ug/L MICROGRAMS PER LITER

NOTES:

1. DATA INCLUDES ONLY ANALYTES OF METAL ABOVE BOTH THE RBSC AND BSC.
2. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
3. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
4. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.
5. VALIDATION QUALIFIERS (VQ):
   J - THE ANALYTE WAS POSITIVELY IDENTIFIED; THE REPORTED VALUE IS ESTIMATED.

FIGURE 5-5
DETECTED CONSTITUENTS AT THE UNLOADING AREA IN TEMPORARY PIEZOMETER GROUNDWATER SAMPLES ABOVE RBSCs AND/OR BSCs (JUNE 2011)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
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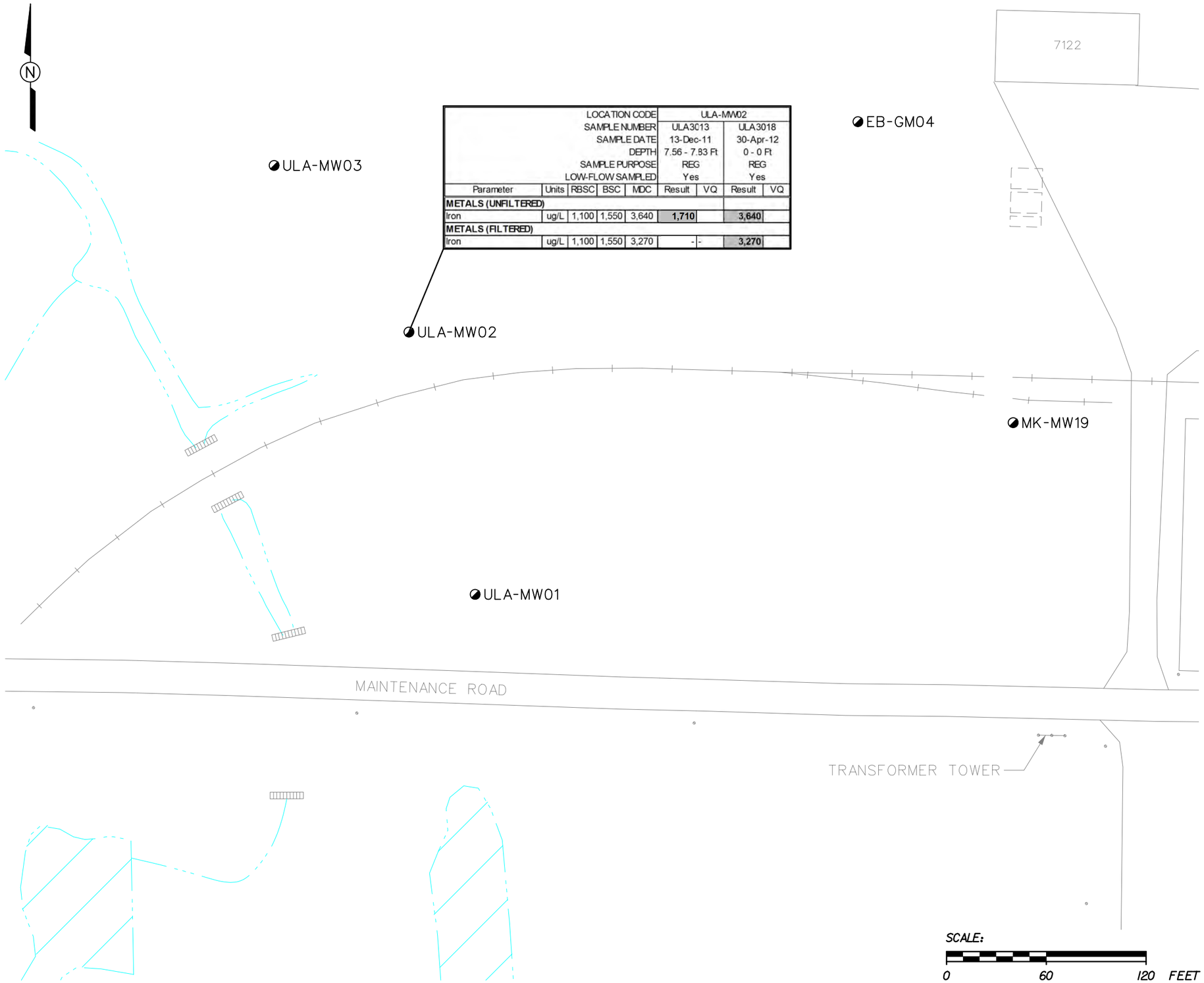

					LOCATION CODE		ULA-MW02	
					SAMPLE NUMBER		ULA3013	ULA3018
					SAMPLE DATE		13-Dec-11	30-Apr-12
					DEPTH		7.56 - 7.83 Ft	0 - 0 Ft
					SAMPLE PURPOSE		REG	REG
					LOW-FLOW SAMPLED		Yes	Yes
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ
METALS (UNFILTERED)								
Iron	ug/L	1,100	1,550	3,640	**1,710**		**3,640**	
METALS (FILTERED)								
Iron	ug/L	1,100	1,550	3,270	-	-	**3,270**	

LEGEND:

- OVERBURDEN/SHALE MONITORING WELL
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- FORMER UNDERGROUND STORAGE TANK
- ug/L MICROGRAMS PER LITER
- \- NOT DETECTED

NOTES:

1. DATA INCLUDES ONLY ANALYTES OF METAL ABOVE BOTH THE RBSC AND BSC.
2. SHADED CELL INDICATES VALUE IS GREATER THAN THE RISK-BASED SCREENING CONCENTRATION (RBSC).
3. BOLD TEXT INDICATES VALUE IS GREATER THAN THE BACKGROUND SCREENING CONCENTRATION (BSC).
4. RBSC VALUES REFLECT AN INCREMENTAL LIFETIME CANCER RISK (ILCR) OF 1E-6 OR A NONCANCER HAZARD QUOTIENT (HQ) OF 0.1. FOR CHEMICALS THAT EXHIBIT BOTH CANCER AND NONCANCER EFFECTS, WHICHEVER TYPE OF EFFECT IN A LOWER CONCENTRATION (USING AN ILCR OF 1E-6 AND AN HQ OF 0.1), THAT CONCENTRATION IS SELECTED AS THE RBSC.

FIGURE 5-6

DETECTED CONSTITUENTS AT THE UNLOADING AREA IN OVERBURDEN/SHALE GROUNDWATER SAMPLES ABOVE RBSCs AND/OR BSCs (DECEMBER 2011 AND APRIL 2012)

REMEDIAL INVESTIGATION REPORT
GARAGE MAINTENANCE AREA
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
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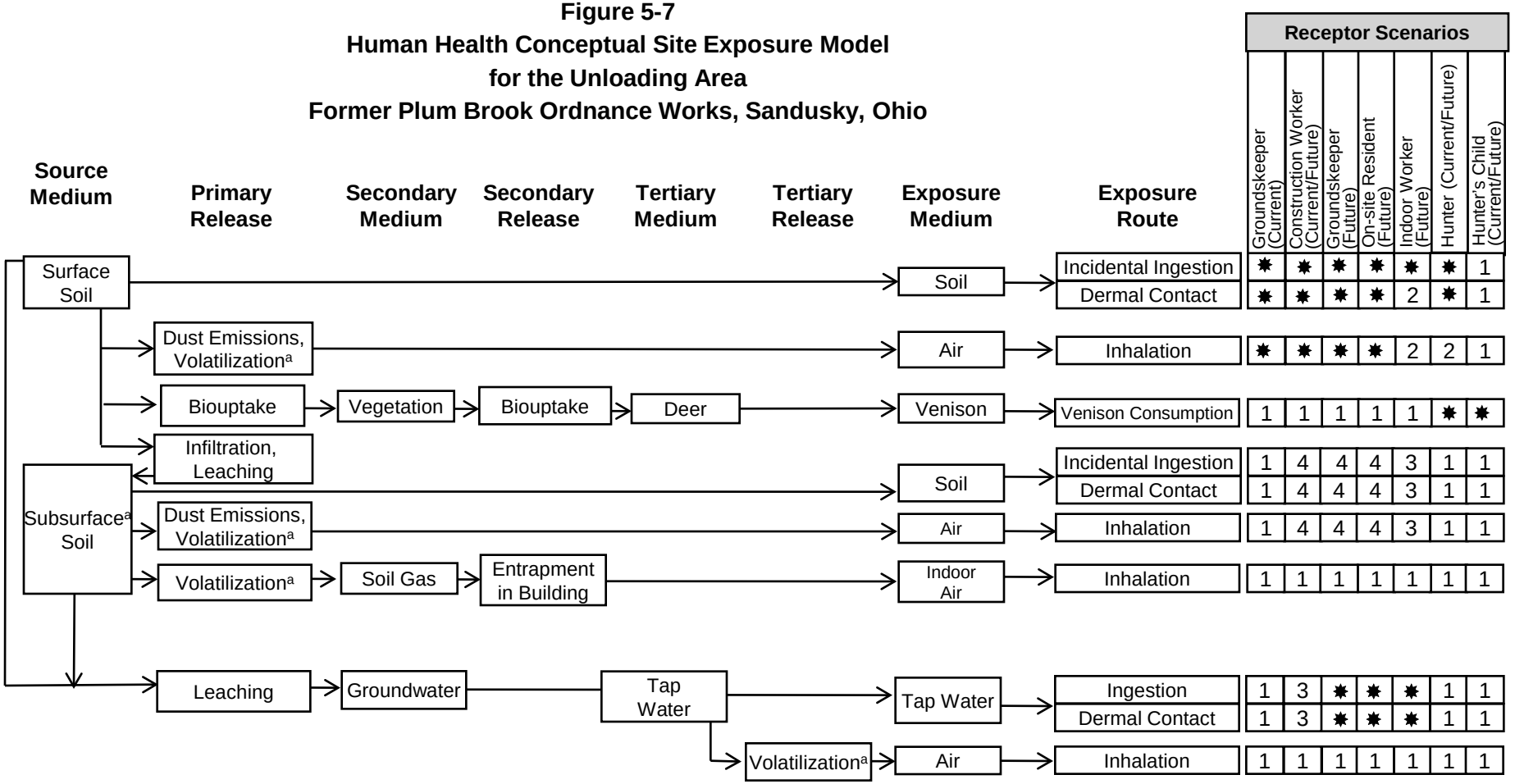
Figure 5-7
Human Health Conceptual Site Exposure Model
for the Unloading Area
Former Plum Brook Ordnance Works, Sandusky, Ohio



[a] No volatile COPCs were identified in soil or groundwater at the site and no COPCs were identified in subsurface soil.
✸ = Complete exposure route quantified in the risk assessment.
1 = There is no plausible pathway for exposure to this medium.
2 = Although theoretically complete, this pathway is not quantified as explained in text.
3 = For current use there is no plausible exposure pathway. For future use, the pathway is potentially complete, but is not quantified as explained in the text.
4 = No COPCs were identified in subsurface soil. Exposures to combined surface and subsurface soil (total soil) are evaluated using surface soil concentrations as explained in the text.

APPENDICES A THROUGH J

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